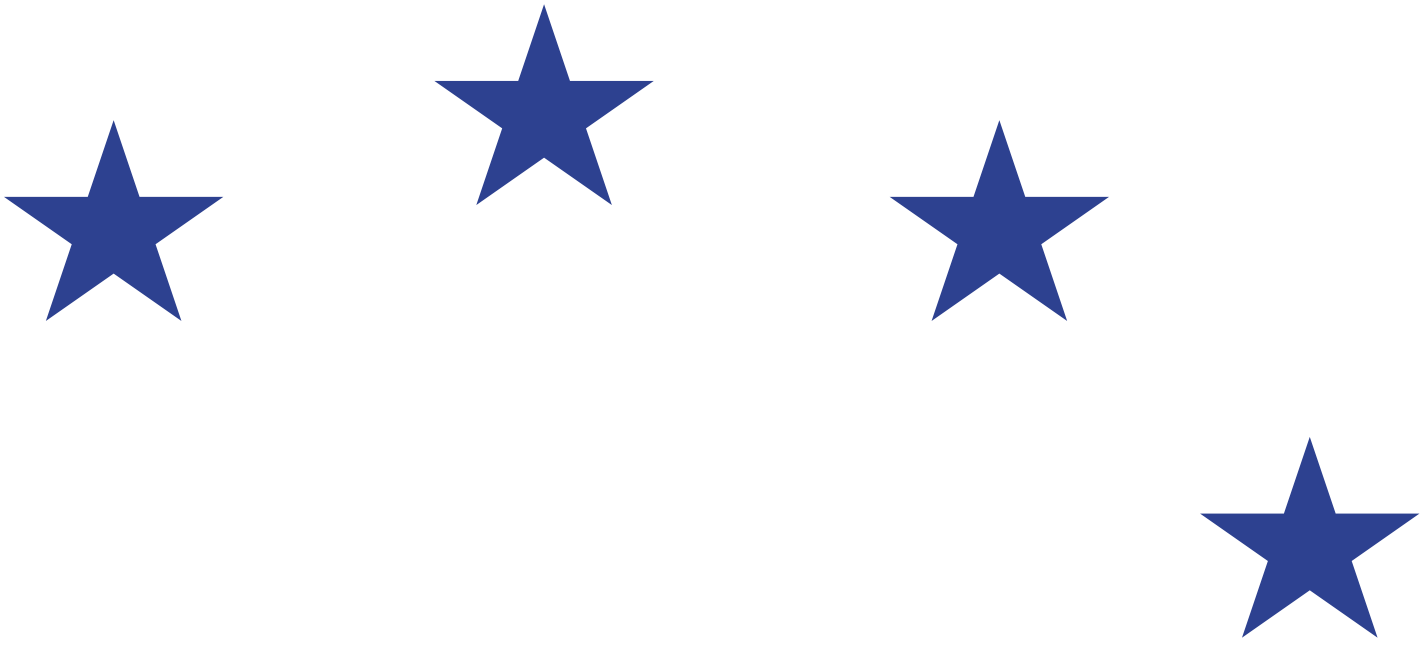
esma European Securities and Markets Authority

TRV

ESMA Report on Trends, Risks and Vulnerabilities No. 2, 2020



2 September 2020

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 The reporting period for this Report is 1 January 2020 to 30 June 2020, unless otherwise indicated. Legal reference for this Report: Regulation (EU) No. 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/77/EC, Article 32 'Assessment of market developments, including stress tests', '1. The Authority shall monitor and assess market developments in the area of its competence and, where necessary, inform the European Supervisory Authority (European Banking Authority), and the European Supervisory Authority (European Insurance and Occupational Pensions Authority), the European Systemic Risk Board, and the European Parliament, the Council and the Commission about the relevant micro-prudential trends, potential risks and vulnerabilities. The Authority shall include in its assessments an analysis of the markets in which financial market participants operate and an assessment of the impact of potential market developments on such financial market participants.' The information contained in this publication, including text, charts and data, exclusively serves analytical purposes. It does not provide forecasts or investment advice, nor does it prejudice, preclude or influence in any way past, existing or future regulatory or supervisory obligations by market participants.

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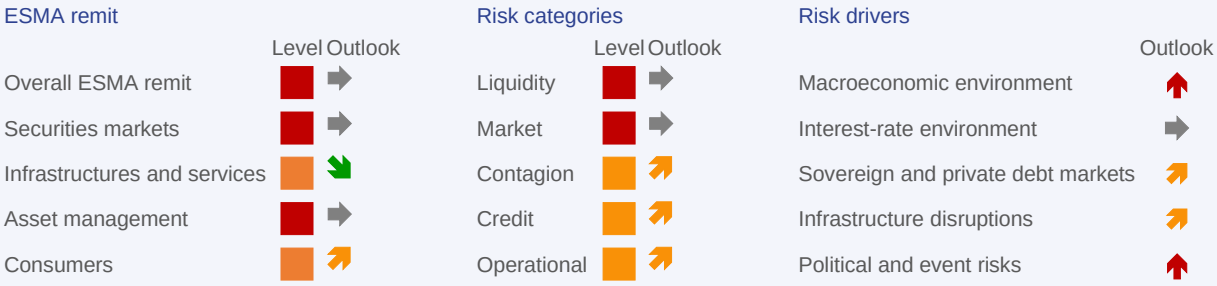
Risk summary

The COVID-19 pandemic, in combination with the valuation risks we had highlighted in ESMA's previous risk assessments, led to massive equity market corrections in 1Q20. We provided an updated Risk Dashboard on 2 April to inform about the new risk landscape. Since this risk update, markets have seen a remarkable rebound, not least in the light of notable public policy interventions in the EU and elsewhere. However, as the market environment remains fragile, we maintain our risk assessment: going forward, we see a prolonged period of risk to institutional and retail investors of further – possibly significant – market corrections and see very high risks across the whole of the ESMA remit. The extent to which these risks will further materialise will critically depend on two drivers: the economic impact of the pandemic, and any occurrence of additional external events in an already fragile global environment. The impact on EU corporates and their credit quality, and on credit institutions, are of particular concern, as are growing corporate and public indebtedness, and the sustainability of the recent market rebound.



Note: Assessment of the main risks by risk segments for markets under ESMA's remit since the last assessment, and outlook for the forthcoming quarter. Assessment of the main risks by risk categories and sources for markets under ESMA's remit since the last assessment, and outlook for the forthcoming quarter. Risk assessment based on the categorisation of the European Supervisory Authorities (ESA) Joint Committee. Colours indicate current risk intensity. Coding: green=potential risk, yellow=elevated risk, orange=high risk, red=very high risk. Upward-pointing arrows indicate an increase in risk intensity, downward-pointing arrows a decrease and horizontal arrows no change. Change is measured with respect to the previous quarter; the outlook refers to the forthcoming quarter. ESMA risk assessment based on quantitative indicators and analyst judgement.

Market environment: As a result of the COVID-19 pandemic, financial markets have been hit by an external shock of unprecedented size. During the initial stage of the crisis in 1Q20, markets experienced one of the fastest declines in recent history, including surges in volatility and liquidity contractions. Massive policy responses – containment, fiscal, monetary and regulatory – in the EU and elsewhere aimed to mitigate the economic impact of the pandemic. While markets have seen a remarkable rebound in 2Q20, the resilience of the recovery critically depends on the economic impact of the pandemic. In particular, the effect on EU corporates and their credit quality, and on credit institutions are of particular concern, as is growing corporate and public indebtedness. Beyond the risks related to second waves of infections, any occurrence of additional external events, such as trade tensions between the US and China, could further destabilise fragile market conditions.

Securities markets: In 1Q20, EU equity markets plunged amid liquidity shortages and upticks in extreme volatility triggered by rising infections across Europe against the backdrop of a deteriorating global economic outlook. Corporate bond spreads surged as a result of signs of rapid credit risk repricing, as flight-to-safety strategies took off. Government bond spreads widened, reflecting the damage of the virus and the associated containment measures implemented by sovereign countries. Markets have seen a remarkable rebound, albeit with differentiation across economic sectors since end-March, not least in light of massive public policy interventions in the EU and elsewhere. The potential decoupling of financial market performance and underlying economic activity raises the question of the sustainability of the market rebound looking forward.

Infrastructures and services: Market infrastructures faced heightened activity during the sell-off, as volumes and volatility soared. Trading venues coped with increased trading volumes amid a higher share of lit trading, as investors sought certainty of execution during the time of liquidity stress. Central Counterparties (CCPs) proved resilient throughout the period, despite the surge in clearing activity coupled with the sharp rise in initial and variation margins. Similarly, clearing members met heightened liquidity demands despite some margin breaches that were covered by excess margins. Credit Rating Agencies (CRAs) responded to the sharp economic deterioration by downgrading affected issuers, particularly non-financials. The risks of "fallen angels" remain high as a result, and securitised products (e.g. Collateralised Loan Obligations (CLOs)) may be affected, too, going forward.

Asset management: In the wake of the initial impact of the COVID-19 outbreak on markets, the EU investment fund industry faced a significant deterioration in liquidity in some segments of the fixed income markets combined with large-scale investment outflows from investors. Redemptions from bond funds reached record highs in March, resulting in outflows of 4% of their net asset value (NAV) in 1Q20. Some asset managers decided to suspend the redemption of their funds, mainly because of valuation uncertainty but in some cases also because of outflows. Between the second half of March and May around 200 EU and UK funds (out of 60,000 funds) had to suspend redemptions temporarily. Some corporate bond exchange traded funds (ETFs) traded with unusually large discounts compared with the reference basket, reflecting liquidity issues in underlying assets in March and April. Some money market funds (MMFs) were particularly affected end-March owing to their exposure to the USD money market, especially low volatility net asset value MMFs. Since early April, the liquidity profile of funds has improved across fund types, with a surge in inflows and a general improvement in performance.

Consumers: The strong negative impact of the COVID-19 pandemic on both the real economy and financial markets has affected retail and institutional investors. Investor confidence fell sharply from March 2020 onwards owing to the pandemic, and the performance of typical retail investor instruments, such as EU UCITS funds, declined to historical lows. Despite improvements in 2Q20, annual performance remained close to zero at the end of the reporting period . Complaints in relation to financial instruments remained steady.

Market-based finance: The COVID-19 turmoil has also had a strong impact on primary markets. During the period of acute market stress, primary issuance practically came to a standstill for equity and bonds. In the equity space, only incumbent firms were able to tap markets through follow-on issuance in March. Bond issuance rebounded from early April onwards, first in the investment-grade segment, followed in May by lower-rated issuers. However, small and medium-sized enterprises (SMEs) remain at risk of facing financing gaps.

Sustainable finance: Environmental, Social and Governance (ESG)-oriented assets such as benchmark equity indices and funds have outperformed their non-ESG peers again in the first half of 2020 (1H20). Investor appetite for ESG funds remained high with net inflows in 1H20 compared with large net outflows for the rest of the equity fund industry. The green bond market continued to expand even as some agency and supranational issuers shifted their focus to social bonds to tackle the socio-economic consequences of COVID-19. Green bond liquidity is improving despite a deterioration in corporate bid-ask spreads in March and April, in line with broader bond market developments.

Financial innovation: COVID-19 lockdowns are expected to accelerate digitalisation of financial services. While positive from an efficiency perspective, this may accentuate risks, such as cyber risk, high market concentrations among data service providers and fragilities in the FinTech sector. Crypto assets were not spared from the COVID-19 turmoil. So-called “global stablecoins” continue to be under close scrutiny by central banks and regulators.

Risk analysis

Model risk in CLOs: The benefits of securitisation depend on its ability to effectively engineer and limit credit risk. This article explores the approaches to modelling CLO credit risk adopted by the three main CRAs. It discusses the differences and some limitations in approaches and how these might potentially affect credit rating accuracy. Finally, it sets the discussion in the context of some of the recent developments in the leveraged loan and CLO markets, including those stemming from COVID-19. Together, these make clear the importance of sensitivity analysis to identify model and credit rating limitations and how the transparency of these is key to informing investors’ reliance on ratings.

Interconnectedness and spillovers in the EU fund industry: The COVID-19 turmoil has highlighted the risks of market-wide stress, not least for investment funds. This article assesses the connectedness among EU fixed-income funds. Our empirical results suggest high spillover effects, indicating that funds exposed to less liquid asset classes are more likely to be affected by shocks originating in other markets than funds invested in more liquid assets. Alternative funds are found to be the main transmitters of shocks, while high-yield and corporate-bond funds were net shock receivers during the COVID-19 market stress.

MiFID II research unbundling – first evidence: This article analyses the impact on EU sell-side research of the MiFID II research unbundling provisions that require portfolio managers to pay for the research they obtain. In the past, concerns have been raised, based primarily on survey data, that the new rules could have detrimental effects on the availability and quality of company research in the EU. In order to provide a more detailed, data-based contribution to inform this discussion, we examine a sample of 8,000 EU companies between 2006 and 2019, and do not find material evidence of harmful effects from

these rules. The introduction of MiFID II has not led to a significant difference in the number of analysts producing Earnings per Share (EPS) estimates (“research intensity”). Recent increases in the number of firms no longer being covered by research analysts (“research coverage”) appear to be a continuation of a long-term trend. The quality of research has been steadily improving in recent years. SMEs do not appear to be particularly affected in terms of research intensity, research coverage, and research quality. The descriptive findings in this article are consistent with the emerging data-based academic literature on the impact of the MiFID II research unbundling provisions and are complemented by a forthcoming ESMA econometric study. Further assessment of the impact of the MiFID II research unbundling provisions on subsets of the EU market for research, such as the impact on sponsored research, could be interesting avenues for further study.

Costs and performance of closet index funds: “Closet indexing” refers to the situation in which asset managers claim to manage their funds in an active manner while in fact tracking or staying close to a benchmark index. Panel regressions using annual fund-level data for the period 2010 to 2018 suggest that investors face lower expected returns from closet indexers than from a genuinely actively managed fund portfolio. At the same time, potential closet indexers are only marginally cheaper than genuinely active funds. Overall, the net performance of potential closet indexers is worse than the net performance of genuinely active funds, as the marginally lower fees of potential closet indexers are outweighed by reduced performance.

Market monitoring

Market environment

Summary

As a result of the COVID-19 pandemic, financial markets have been hit by an external shock of unprecedented size. During the initial stage of the crisis in 1Q20, markets experienced one of the fastest declines in recent history, including surges in volatility and liquidity contractions. Massive policy responses – containment, fiscal, monetary and regulatory – in the EU and elsewhere aimed to mitigate the economic impact of the pandemic. While markets have seen a remarkable rebound in 2Q20, the resilience of the recovery critically depends on the economic impact of the pandemic. In particular, the effect on EU corporates and their credit quality, and on credit institutions are of particular concern, as is growing corporate and public indebtedness. Beyond the risks related to a second wave of infections, any occurrence of additional external events, such as trade tensions between the US and China, could further destabilise fragile market conditions.

As a result of the **COVID-19 pandemic**, EU and global financial markets have been hit by an external shock of unprecedented size. For more than one month, the EU was the epicentre of the global pandemic, and drastic containment measures have been undertaken by Member State governments to limit the spreading of the virus. By the end of the reporting period of this TRV, the pandemic had been retreating in Europe, having caused more than 2.6mn infections and in excess of 196,000 fatalities[1]. Globally, as of the end of June, there were more than 10mn infections and more than 500,000 deaths, with new cases rising in the US and Latin America. In that context, risks persist owing to the inability of certain countries to tame the outbreak and the possibility of a second wave of infections as economies are continuing to reopen.

While neither financial nor economic in nature, the pandemic has engulfed economies and financial markets around the world in a crisis. Over the reporting period of this TRV, the **impact in the EU's financial markets** can be summarised in three different stages: the liquidity and volatility period (mid-February to end-March), the rebound (early to end-April) and the differentiation stage (starting early May), with divergence in performance across markets. Textbox T.2 provides an account of how the pandemic has affected financial markets in the EU.

Importantly, the immediate market reaction to the outbreak in February and March was driven by market uncertainty over the magnitude of the pandemic and its economic impact against a background of limited information and experience with that type of external shock, as well as erratic newsflow. The outcome was a strong **short-run liquidity and volatility shock in 1Q20** in key market segments, testing the resilience of market infrastructures and financial institutions. As this initial shock has waned, the **medium-term and long-term implications of mounting credit and solvency risks come to the forefront**, as investors start differentiating between issuers and asset classes amid ongoing deterioration of economic fundamentals.

Some of the economic effects have been as unprecedented as the pandemic itself. Indicators of **economic activity contracted sharply** across sectors and countries, with some countries experiencing the sharpest drop in GDP since the Second World War (T.10). Since March, GDP growth forecasts have been continuously revised down amid very high uncertainty. In April, the IMF forecast a decline in global GDP of 3% for 2020, and -7.5% for the euro area (EA), revised down to -10.2 in June. Early July the European Commission lowered its forecast of EU GDP growth to -8.7% for 2020 (against -7.5% in May), followed by a rebound of 6.1% for 2021 (T.11). In June, the OECD revised down its forecasts for the euro area to -9.1% for 2020, with a 6.5% rebound in 2021.

To limit the economic impact, governments initiated massive **support programmes**, at the

[1] Since July, the number of infections has picked up again in Europe.

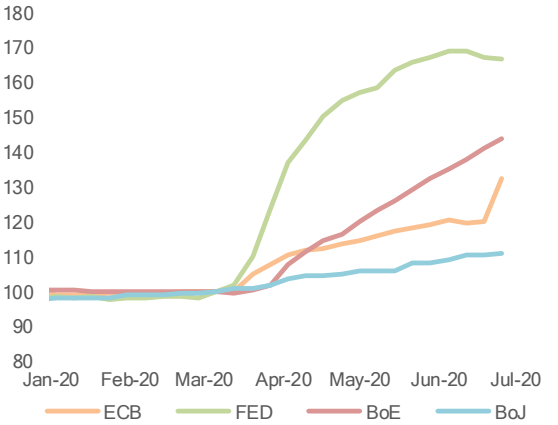
time of writing totalling USD 7.6tr in fiscal commitments among the G20 economies (11% of GDP) and already outsizing the expenditures made in response to the Global Financial Crisis of 2007-2008[2]. In addition, EU leaders agreed in July on a EUR 750bn recovery fund to support the economic recovery. The package includes EUR 390bn in grants to be given to countries most affected by COVID-19, along with EUR 360bn in loans.

As a result, fiscal balances and **public indebtedness** are in the process of deteriorating significantly. First IMF estimates[3] predict a surge in global gross government debt to 130% of GDP in 2020 for advanced economies, up from 105% before the pandemic, and to 105% in the euro area compared with 84% previously (T.15). As a consequence in the euro area, stress in the sovereign market increased, with spreads widening substantially in the initial stage of the crisis before receding to some extent from mid-April onwards (T.14).

Central banks provided support to banks by injecting liquidity and supported markets by announcing large-scale purchases of corporate and government bonds, resulting in another sizeable increase of their balance sheets (T.1). Between end-February and end-June, the combined balance sheets of the ECB, FED, BoE and BoJ expanded by more than EUR 4.8trn, including EUR 1.6trn for the ECB and EUR 2.5trn for the FED.

Emerging Markets (EMs) were also severely affected in March and April as they experienced massive **capital outflows** in March (around USD 83bn according to the IIF). Flows have improved since then, with USD32bn in inflows in June. However, EMs remain at risk of 'sudden stops', especially in Latin American countries where the number of new COVID-19 infections keeps rising.

T.1
Central banks' balance sheets
Swift expansion of central bank assets



Note: Total assets of central banks in local currency, rebased at 100=1/1/2020
Sources: Refinitiv Datastream, ESMA.

Commodities markets were hard hit during the first phase of the crisis, with oil prices collapsing and turning briefly negative for the West Texas Intermediate (WTI). Gold initially surged as investors flew to safety and then plummeted as the 'dash for cash' took hold.

Meanwhile, other risks in the environment of financial markets persist. In particular, **cyber risk** remains a key threat to financial stability. The number of cyber-attacks surged during the COVID-19 crisis, with cyber criminals targeting primarily the health and financial sectors. In addition, the outbreak has prompted a surge in phishing and fraud, with cyber criminals impersonating health officials, as well as government and financial institutions.[4]

Going forward, **the economic and political backdrop of financial markets remains extraordinarily fragile**. In the short term, risks from external shocks to financial markets, such as a second wave of COVID-19 infections, setbacks on the way to finalising Brexit, or geo-political conflicts are high and real. In the long run, the COVID-19 health crisis has the potential to trigger structural shifts, e.g. on global trade patterns, economic productivity and growth potential, and lead to unsustainable private and public debt levels, which may have a long-lasting impact on financial market sentiment.

[2] https://www.csis.org/analysis/breaking-down-g20-covid-19-fiscal-response-june-2020-update.

[3] IMF World Economic Outlook Update, June 2020,.

[4] FS-ISAC, "High risk domains with COVID-19 and financial theme", April 2020.

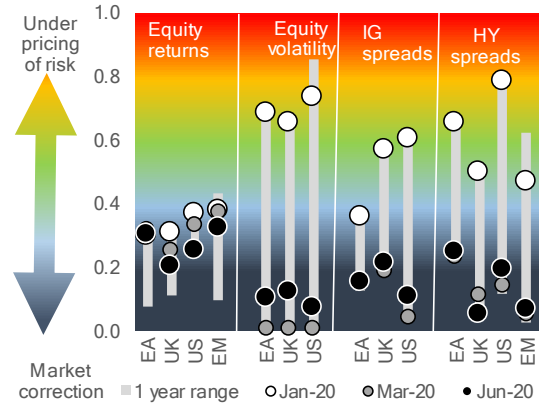
T.2
COVID-19 impact on financial markets

COVID-19 external shock in three stages

During the initial stage of the crisis (mid-February to March), the rise in infections across the globe and the entry into force of lockdown measures in many European countries triggered a global sell-off across asset classes, including traditional safe assets such as government bonds and gold. Financial markets fell at one of the fastest paces in modern history: Major indices lost close to 40% in 20 days (T.4), while volatility surged to the highest levels observed since the Global Financial Crisis (T.5). The swift decline in market valuation was visible across asset classes, from equities to investment grade (IG) and high yield (HY) corporate bonds (T.3).

T.3
Market overview

Sharp market correction in March



Note: Percentiles of monthly equity returns and volatilty and bond spreads computed over 1990-2019. Equity returns are computed as average of past 12 months returns divided by volatility over the last 12 months.
Sources: Refinitiv Datastream, ESMA.

The sell-off was partly related to investors' flight to liquidity ('dash for cash'). Liquidity demand from investors was clearly visible in very large redemptions from funds, including funds exposed to less liquid asset classes such as (HY bonds and EM bonds (T.6). Large redemptions also occurred in Investment Grade bond funds as well as in low volatility net asset value (LVNAV) money market funds (MMFs), especially in USD. For funds, stress on the liability side was also coupled with stress on the asset side, as liquidity deteriorated quickly across all asset classes, from US Treasury bonds to short-term funding markets (cross-currency basis swaps and commercial paper). The deterioration in liquidity was clearly visible in the massive premium and discounts between ETFs tracking corporate bonds indices and the underlying basket of securities (T.7).

The decline in liquidity resulted from the massive selling pressure from investors, amid a fall in liquidity supplied by traditional market makers. High levels of volatility made institutions unwilling or unable to provide liquidity support, resulting in sharp price falls and further volatility.

The rapid sales of assets by investors had a direct impact on infrastructures, with a surge in trading volumes, which amid low liquidity caused circuit breakers on equities and ETFs to be triggered at an unprecedented pace (T.8). At the same time, settlement fails jumped, as market participants were unable to timely deliver the securities in exchange for cash (T.9). The increase in fails was related to higher settlement activity and increased collateral movements, including margin calls and substitutions. Higher activity also led to longer settlement chains, whereby the failure to deliver a security resulted in multiple fails across the chain. Central Securities Depositories (CSDs) and participants also faced operational challenges as most of their workforce worked remotely. Staff had to cope with processing an increased volume of transactions while business continuity plans were activated.

During the turmoil, the associated rise in volatility led to sharp increases in variation margin collections by CCPs, reflecting large changes in mark-to-market value on derivatives positions. At the same time, initial margins gradually increased to take into account extraordinary levels of volatility which depleted excess margins.

The pace and the extent of the decline can be explained by stretched valuations before the outbreak (with equity markets reaching new highs on 19 February), and procyclical effects of volatility and liquidity. The historically low levels of volatility enabled investors such as investment funds to increase their positions within their risk limits. In times of stress, volatility and liquidity can be self-reinforcing[5]. As volatility surges, the risk limits become binding, leading to an unwinding of positions by investors and a reduction in market making activity owing to higher risks. Given deteriorating levels of liquidity, the sales led to further price declines and an increase in volatility, further deterring market makers from supplying liquidity.

During the second phase of the crisis (end-March to end-April), markets rebounded swiftly on the back of policy actions. Given the unprecedented shocks to financial markets and the real economy, policymakers quickly took several steps to support financial stability. Fiscal authorities announced a range of measures, including fiscal stimulus, loan guarantees and tax holidays. Central banks provided support to banks by injecting liquidity and supported markets by announcing large-scale purchases of corporate and government bonds, resulting in another sizeable increase of their balance sheets.

Equity markets bounced back, followed by fixed income markets, amid a fall in volatility and some improvement in liquidity. Outflows from funds slowed and were then followed by inflows, as investors' risk appetite increased. By the end of April around half of the fund outflows had been reversed.

In the third phase of the crisis (starting in May), credit and solvency risk came to the forefront, as investors started to differentiate between issuers and asset classes amid ongoing deterioration of economic fundamentals.

In that context, concerns around credit risk started to materialise. Credit rating downgrades have surged since early March (T.12), at the fastest pace since 2007, although the pace has slowed since April. Rising corporate indebtedness, fuelled by the search for yield and benign financing conditions, has made issuers more vulnerable to the sharp fall in revenues that occurred during the crisis. Within the IG universe, BBB-issuers, which account for 40% of rated corporates are particularly vulnerable (T.13), as a downgrade to HY could trigger forced sales by investors.[6]

Against the background of these events, regulators have monitored closely any threats to financial stability and have taken measures to promote stability, investor protection and market integrity.

— ESMA has issued recommendations to financial market participants on business continuity planning, market disclosure, financial reporting and fund risk management, and has launched initiatives to address the effects of the COVID-19 pandemic in areas including the Benchmarks Regulation, corporate disclosure issues, Credit Rating Agencies supervision, bilateral

5 IMF Global Financial Stability Report, April 2020.

6 ESMA, "EU fund risk exposures to potential bond downgrades", TRV No.1, 2020.

margining requirements, fund management periodic reporting, MiFID II/MiFIR, as well as short selling[7].

- At EU systemic level, the ESRB provides an overview of policy measures in response to the COVID-19 pandemic and is working on possible implications of the crisis in areas such as market illiquidity and implications for asset managers and insurers, the impact of large-scale downgrades of corporate bonds on markets and entities across the financial system, and liquidity risks arising from margin calls.[8]
- IOSCO as the organisation of securities regulators at international level is addressing areas of market-based finance that are most exposed to heightened volatility, constrained liquidity and the potential for procyclicality, including examining investment funds, and margin and other risk management aspects of central clearing for financial derivatives and other securities.[9]
- The Financial Stability Board (FSB), representing a broad and diverse membership of national authorities, international standard setters and international bodies, is actively cooperating to maintain financial stability during market stress related to COVID-19. The focus of the FSB work lies in sharing information, assessing financial risks and vulnerabilities, and coordinating policy responses.[10]

7 https://www.esma.europa.eu/about-esma/covid-19

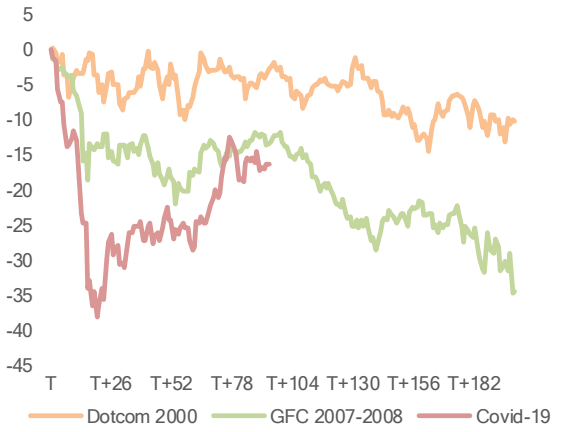
8 ESRB COVID-19 webpage

9 https://www.iosco.org/news/pdf/IOSCONEWS562.pdf

10 https://www.fsb.org/work-of-the-fsb/addressing-financial-stability-risks-of-covid-19/

Key indicators

T.4
Equity performance comparison
Quickest fall of Eurostoxx50 on record

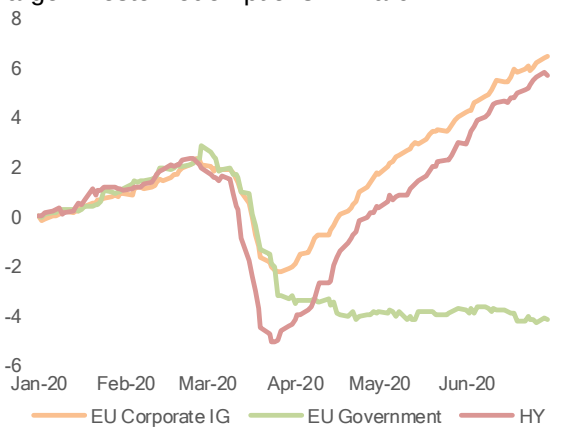


Note: Change in equity prices (Eurostoxx50) in %. Start dates: Dotcom (3/3/2000), GFC (1/1/2008), Covid-19 (19/02/2020).
Sources: Refinitiv Datastream, ESMA.

T.5
Market volatilities
Peak volatility as high as in 2008

Note: Implied volatility of S&P500 (VIX) and Eurostoxx50 (VSTOXX), in %.
Sources: Refinitiv Datastrem, ESMA.

T.6
Fund flows
Large investor redemptions in March

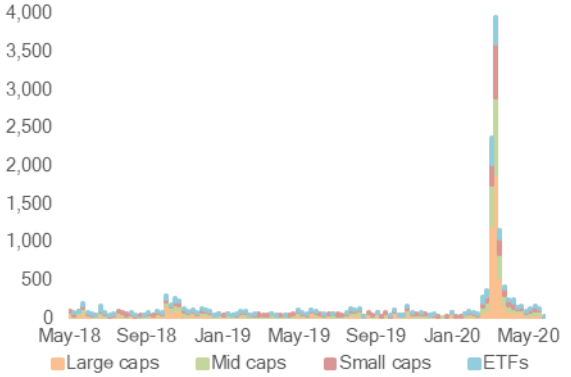


Note: Cumulated flows into UCITS, in % of NAV.
Sources: Morningstar, ESMA.

T.7
ETF premium and discounts
Dislocations in corporate bond markets in March

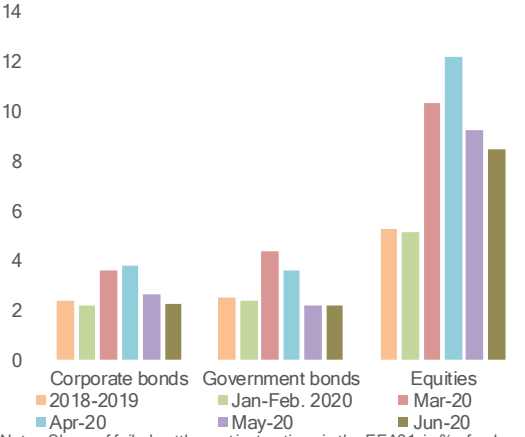
Note: EU ETFs premium/discount, in %. Deviations from zero indicate that the price of the ETF is different from the price of the underlying basket of securities.
Sources: Morningstar, ESMA

T.8
Circuit breakers
Surge in trading halts across instruments



Note: Number of daily circuit-breaker trigger events by type of financial instrument and by market cap registered on 34 EEA31 trading venues for all constituents of the STOXX Europe Large/Mid/Small 200 and a large sample of ETFs tracking these indices or some of their subindices. Results displayed as weekly aggregates.
Sources: Morningstar Real-Time Data, ESMA.

T.9
Settlement fails
Sharp rise in fails for equities



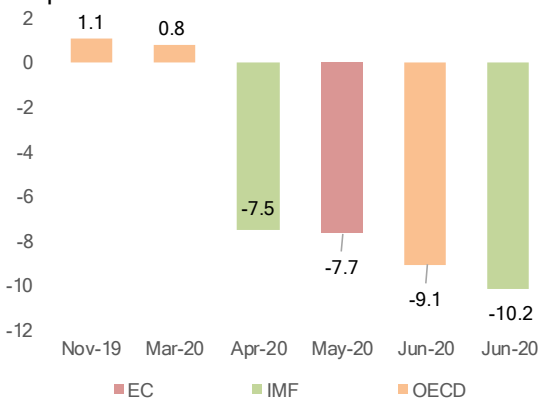
Note: Share of failed settlement instructions in the EEA31, in % of value .
Sources: National Competent Authorities, ESMA.

Key indicators

T.10
Real GDP
Activity collapsed in 1Q20

Note: Quarter on quarter growth of GDP. Expected values based on Reuters polls. Data for 2020Q1.
Sources: Refintiv Eikon, ESMA.

T.11
GDP forecast
Sharp recession for the euro area in 2020



Note: Euro area real GDP growth forecast for 2020, in %. OECD data for November, March and June, IMF for April and European Commission for May.
Sources: European Commission, IMF, OECD, ESMA.

T.12
Rating actions
Wave of downgrades

Note: Number of corporate EU27+UK issuers (financial, insurance and non-financial) with at least one bond upgraded or downgraded from 5 largest EU-registered CRAs (Fitch, Moody's, S&P, DBRS, Scope)
Sources: ESMA, RADAR

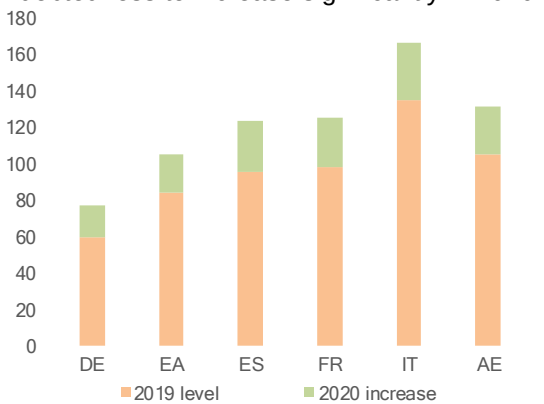
T.13
Corporate ratings on outstanding bonds
Large share of BBB issuers

Note: Corporate non financial ISINs rated by the Big 5 (CRAs (Fitch, Moody's, S&P, DBRS, Scope) by category value.
Sources: RADAR, ESMA

T.14
EA sovereign spreads
Peak in March, receding after

Note: 10Y spreads to German bonds, in basis points
Sources:Refinitive Eikon, ESMA

T.15
EA public debt
Indebtedness to increase significantly in 2020



Note: General government gross debt, in % of GDP. Actual data for 2019, forecast for 2020. AE: Advanced Economies.
Sources: IMF, ESMA.

Market trends and risks

Securities markets

Trends

In 1Q20, EU equity markets plunged amid liquidity shortages and upticks in extreme volatility triggered by rising infections across Europe against the backdrop of a deteriorating global economic outlook. Corporate bond spreads surged as a result of signs of rapid credit risk repricing, as flight-to-safety strategies took off. Government bond spreads widened, reflecting the damage of the virus and the associated containment measures implemented by sovereign countries. Markets have seen a remarkable rebound, albeit with differentiation across economic sectors since end-March, not least in light of massive public policy interventions in the EU and elsewhere. The potential decoupling of financial market performance and underlying economic activity raises the question of the sustainability of the market rebound looking forward.

Risk status

Risk level 

Outlook 

Risk drivers

- COVID-19 pandemic
- Asset revaluation and risk re-assessment
- Geopolitical risk
- Corporate sector indebtedness and deteriorating credit quality
- Sovereign risk

Equities: massive price corrections in March

After a slight rise in early 2020, equity markets reached new peaks mid-February before the outbreak. During the liquidity and volatility crisis, **equity markets** tanked (T.26), as high uncertainty amid stretched valuation led investors to liquidate their positions. The Stoxx 600 index recorded a peak-to-trough fall of -35.5%. This was accompanied by extreme weekly and daily market movements with a one-week fall of around -10% in the last week of February and a one-day fall of -11.5% on 13 March.

During the first phase of the crisis, the heavy decline in equity prices was accompanied by extremely high levels of **volatility**. Volatility levels were higher than levels observed during the Global Financial Crisis (GFC) in 2008. The VSTOXX reached an intraday high of 90% on 18 March, continuing to trade around levels that were still very elevated of around 50% after. This compares with levels of around 15-20% until mid-February. The surge in volatility was closely related to new information linked to the severity of the pandemic, as proxied by the fatality rate and the stringency of lockdown measures (Box T.16).

T.16
Market volatility and COVID-19
Elevated levels of volatility linked to the severity of the pandemic

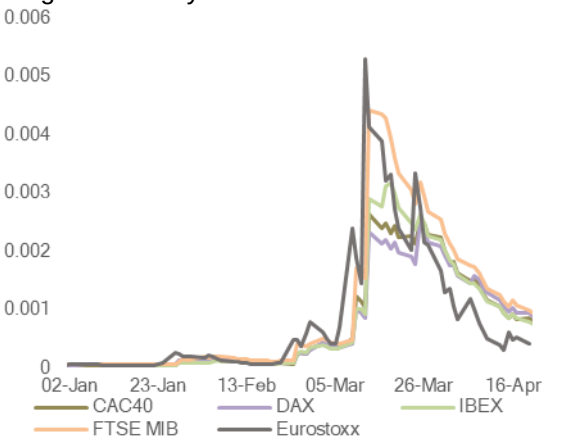
We investigate the relationship between the severity of the COVID-19 pandemic and the surge in volatility in March. Rather than the case count, we direct our attention to the number of deaths, which seems to significantly increase just a few days before the collapse in financial markets.

We focus on Germany, Spain, France and Italy and model stock market volatility in those four countries using a GARCH (1,1) process (T.17). The model predicts a sharp jump on 18 March and a prolonged period of higher volatility (but lower than the peak) in the following days. The estimation also shows that the FTSE MIB index was more volatile followed by the IBEX, CAC40 and DAX.

We then estimate a panel regression model to investigate the relationship between the severity of the disease and changes in volatility compared with early January. The severity of the disease is measured by the logarithm of total deaths and the case fatality rate (CFR), calculated as the ratio between confirmed deaths and the sum of total deaths and total recovered, which is viewed as a more accurate proxy to measure

death rate.[11] To account for lockdown restrictions we include the stringency index, which measures the strictness of national government policies (0 not strict, 100 very strict)[12]. We lag this variable by the disease incubation period (approximately 5 days) since restrictions get stricter as deaths increase. We then control for the weekend effect on the assumption that markets are more volatile at the start of the week. For this reason, we introduce a dummy which equals 1 on Mondays. Finally, since the ECB intervention has played an important role in supporting market turbulence, we use changes in short term interbank rates to control for it. We lag all variables by one day.

T.17
Equity volatility
Surge in volatility in March



Note: Estimate of stock market volatility on selected EU27 stock market indices using GARCH(1,1) process.
Sources: Refinitiv Eikon, ESMA

Results show that, more than the death count, higher levels of CFR are positively correlated with spikes in volatility (T.18). Since the CFR takes into account the number of recovered patients, it implies that positive news, such as a daily decrease in total deaths or a daily increase in recovered patients, can have a calming effect on financial markets. The coefficient on the stringency index is positive, reflecting that tighter measures are associated with higher levels of volatility.

T.18
Panel regression results[13]
Positive relationship between CFR and volatility

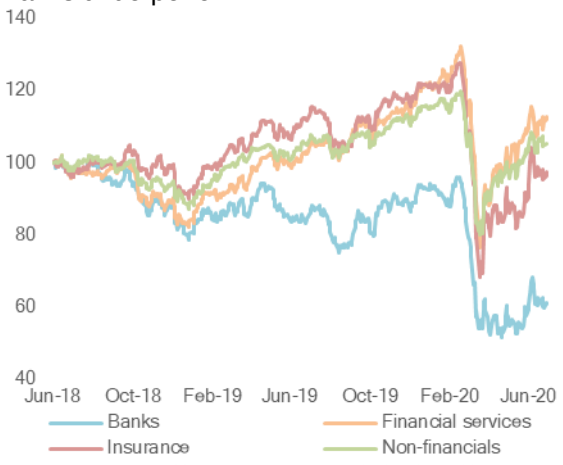
	Vol	Vol	Vol	Vol
Deaths (log)	0.293***	0.229***	0.139	0.114
	(0)	(0)	(0.115)	(0.204)
CFR		2.200***	2.207***	2.196***
		(0)	(0)	(0)
Days since first case			-0.037***	-0.035***
			(0.022)	(0.029)
Stringency index			0.023***	0.024***
			(0.001)	(0.001)
Monday			0.036	0.050
			(0.747)	(0.651)
Short-term rate				-14.682
				0.196
R^2	0.703	0.789	0.836	0.840

Note: Estimates of the panel regression.
Sources: Refinitiv Datastream, ESMA.

Selling pressure from investors, resulted in a sharp deterioration in **market liquidity,** evidenced by higher bid-ask spreads (T.27).

The initial drop in equity prices was indiscriminate across sectors (T.19). Despite the Single Supervisory Mechanism (SSM) providing temporary capital and operational relief and the ECB providing liquidity support, **bank shares** fell more than 40% in March (T.19). This trend reflected investor concerns about the liquidity situation of banks and uncertainty about a potential increase in the share of non-performing loans weighing on banks' balance sheets.

T.19
Sectoral indices performance
Banks underperform



Note: STOXX Europe 600 sectoral return indices. 01/05/2018=100.
Sources: Refinitiv Datastream, ESMA.

As investor sentiment and equity market performance turned negative, **short selling activity** increased from late February. To address trading conditions in EU financial markets, a number of Member States (Austria,

[11] See Ghani, A. C., Donnelly, C. A., Cox, D. R., Griffin, J., Fraser, C., Lam, T., Ho, L., R., Anderson, Hedley, A. and Leung, G., (2005), "Methods for estimating the case fatality ratio for a novel, emerging infectious disease", American Journal of Epidemiology, Vol. 162(5), pp. 479-486.

[12] See: Hale, T., Petherick, A., Phillips, T., & Webster, S., (2020), "Variation in government responses to COVID-19". Blavatnik School of Government Working Paper Series No. 31, University of Oxford. Index available at: www.bsg.ox.ac.uk/covidtracker

[13] For further reference on methodology, see Engle, R., "Measuring the Financial Impact of COVID-19", 2020.

Italy, France, Greece, Belgium, Spain) introduced short selling bans, which were lifted in mid-May as market conditions improved (see Box T.33 in the infrastructure section for more detail on short selling).

Since end-March, equity markets have rapidly recovered with the monthly performance in April being at or close to an historic high, and a further increase being observed in May. Markets overall stabilised in June at levels that are yet 15% below the initial baseline, and liquidity improved as volatility declined. In 2Q20, European equity markets showed their best quarterly performance since 2015 with a rise of 20%. During the recovery, there have been signs of **differentiation** across sectors. As of end-June, EU airlines and banking sector indices are still 36% and 30% respectively below their early January levels, against 11% for the EU aggregate index.

The recovery took place in the context of a further deteriorating macroeconomic environment and a deep and globally synchronized recession. The potential decoupling of financial market performance from underlying economic activity raises a question about the sustainability of the market rebound going forward (T.20).

Towards the end of the reporting period, securities markets saw the share price of Wirecard, a blue-chip listed company and major international payment services provider, collapse to less than 1% of its peak value in 2018. The company filed for insolvency on 25 June. The circumstances are under investigation.

T.20
Market valuation
Decoupling of market valuations from economic performance

The strong rebound in asset prices since early April contrasts with the sharp deterioration of the macroeconomic outlook for 2020, raising concerns about potential overvaluation across asset classes, countries and sectors. While current levels of price earnings ratios are in line with long-term averages (T.21), the severity of the COVID-19 crisis and the associated recession might not be entirely reflected in current asset prices.

In that context, current valuation levels can be analysed across several dimensions.

From a **short-term** perspective, valuations might be supported by the ample injections of liquidity by central banks. Following the 'dash for cash' that occurred in March, and the implementation of support programmes by central banks, cash-rich investors reinvested their funds in equity and credit markets, leading to the rise in valuations. In addition, historically, rebounds in asset prices have preceded the recovery in economic activity.

From a **long-term** perspective, expectations of a quick economic recovery and a period of low rates for a long period support equity prices, as the fall in current earnings is more than compensated by future discounted cash flows.

From a **sectoral** perspective, the rise in asset prices in some sectors such as technology or health can be explained by expectations that the crisis will favour the business models of these sectors over those of other sectors such as travel, and tourism which are expected to underperform. For those more vulnerable sectors, public support to these industries might explain the partial recovery in asset prices.

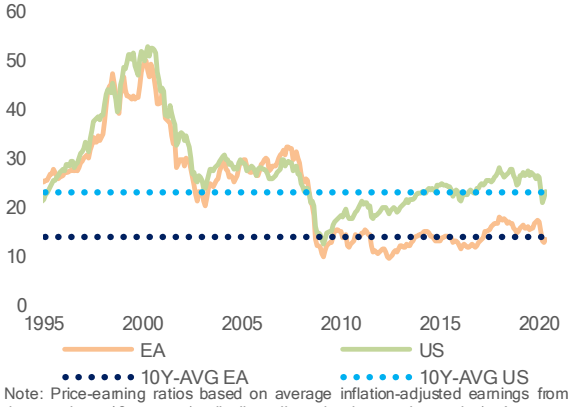
The differentiation also applies at country level, with some economies better positioned than others regarding these changes of business models.

However, each of these perspectives can give rise to risks of significant market corrections. From a **short-term** perspective, for example, current upbeat expectations by many market participants rest on a continued highly supportive monetary environment. The May 2013 taper tantrum episode showed how sensitive such expectations can negatively affect the behaviour of investors.

From a **long-term** perspective, the crisis could lead to permanent effects on economic activity, owing to lasting unemployment or structural changes in the economy, which might have an impact on future earnings. The increase in private and public sector debt could also give rise to solvency and sustainability issues, which might not be factored into valuations.

Overall, fragile market conditions and high uncertainty around the economic outlook and potential lasting effects of the COVID-19 crisis warrant close monitoring of market developments to avoid a disorderly market correction.

T.21
Equity valuation
Price earning ratios close to historical average

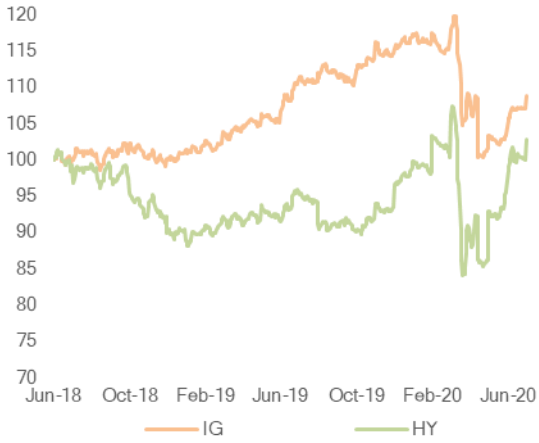


Note: Price-earning ratios based on average inflation-adjusted earnings from the previous 10 years (cyclically adjusted price-earning ratios). Averages computed from the most recent data point up to 10 years before.
Sources: Refinitiv Datastream, ESMA.

Fixed income: elevated credit risk

Fixed income markets mirrored developments in equity markets. During the first phase of the crisis, yields spiked, and spreads increased for corporates (T.30) and most EA sovereigns (T.28). The price decline occurred amid low liquidity in bond markets: the bid-ask spread on corporate bonds increased by almost 20 basis points in March (T.29), with the Amihud coefficient following the same direction, partly reflecting forced sales from investors. Some leveraged investors were forced to sell their assets in order to raise cash to meet margin calls on their repo and derivatives positions, exerting downward pressure on prices, including IG bonds[14]. Both IG and HY bonds went through the largest ever decline in market value by 10 and 15 percentage points respectively (T.22). Since April, corporate bond markets have recovered, with an increase in prices in the secondary market (+ 3% for IG and +22% for HY bonds) and the reopening of primary markets. April saw a sharp increase in IG issuance, and in May and June, HY issuers were also able to tap the markets (see also the market-based finance section).

T.22
Market value of global IG and HY corporate bond indices
Large decline, then rebound for IG and HY bonds



Note: Change in market value of BoAML global IG and HY corporate bond inidcessince01/06/2018,=100.
Sources:Refinitiv Datastream, ESMA

Money markets were also affected by a rise in yields, especially for instruments with a maturity higher than one week, creating challenges for MMFs, as detailed in the asset management section, and leading to higher Euribor rates (see infrastructure section). As investors demand for liquidity surged in March, activity in the **repo market** increased. Higher activity was driven in part by flight to safety, with flows out of risky assets into short-term secured markets, as well as collateral transformation to raise cash to meet investors' redemptions or margin calls.[15] The increase in demand for repo put pressure on supply, as some banks were unwilling to expand their balance sheet. The constraints on supply stem not only from seasonal factors (banks usually wind down their repo operations at the end of the quarter) but also potentially from substitution effects as banks increased their lending to corporate clients, as the commercial paper market dried up.

During the second and third phases of the crisis, spreads tightened, and liquidity improved on the back of policy support from central banks, and an improvement in investor sentiment.

In **sovereign bond markets**, euro area spreads stabilised at lower levels than the peaks reached mid-March, following the announcement of the ECB emergency plan. As a response to the market turmoil, on March 18, the ECB announced a EUR 750bn Pandemic Emergency Purchase Program (PEPP). The rescue plan envisages a range of purchases until the end of 2020, that include all the asset categories eligible under the existing asset purchase programme. As lockdown restrictions were announced, national governments felt the pressure of extra spending to finance the crisis, hence increasing public debt. Since April, sovereign spreads have declined but remain slightly above their pre-crisis levels in the euro area, with significant heterogeneity, reflecting the differences in levels of public debt.

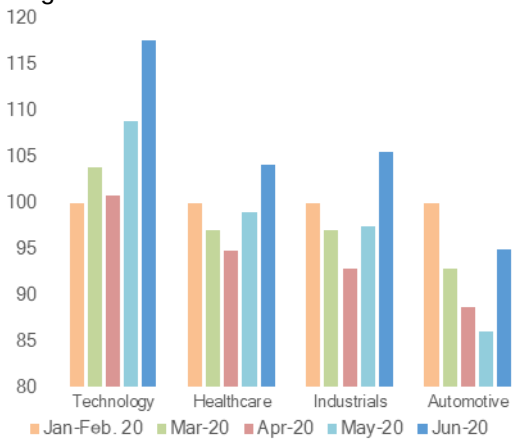
In **corporate bond markets**, spreads declined but remained well above pre-crisis levels, owing to heightened credit risk. Lockdowns resulted in a large fall in revenues for corporates and further liquidity pressure. Higher spreads also reflect underlying vulnerabilities related to high corporate leverage, which has built-up over the last few years. Non-financial corporates (NFCs) remain fragile as liquidity conditions are still tight. Furthermore, the recovery pointed towards a

[14] BIS Bulletin No 2, Leverage and margin spirals in fixed income markets during the COVID-19 crisis, 02 April 2020

[15] See "The European repo market and the COVID-19 crisis", ICMA, April 2020

differentiation across sectors and asset classes in April and May. Across non-financials, the automotive sector had the largest decline, followed by the energy sector. In contrast, technologies and healthcare seem to have suffered less from the crisis (T.23). In June, most sectors recovered, except for the automotive sector, which still lagged 5 basis points (bps) behind the others.

T.23
Market value of Euro corporate bond indices by sector
Large differentiation across sectors



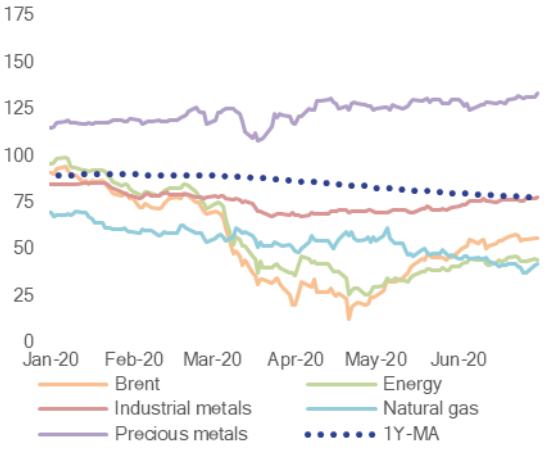
Note: Change in monthly average of market value of BoAML Euro corporate indices by sector. Jan-Feb 20 = 100.
Sources: Refinitiv Datastream, ESMA.

In April, the ECB announced a package of temporary collateral easing measures, including allowing bonds recently downgraded from IG to HY ('fallen angels') to remain eligible as collateral for liquidity providing operations, as long as their rating remains equal or above BB. The intervention was aimed at supporting the provision of bank lending, especially by easing the conditions under which credit claims are accepted as collateral.

Commodities: oil price collapse in April

Commodity markets have experienced large price swings in March and April. Initially gold surged as a result of the flight to safety but the 'dash for cash' also led investors to reduce their positions in traditional safe assets such as sovereign bonds and gold. The price of energy collapsed as the generalized slowdown in economic activity led to subdued demand (T.24).

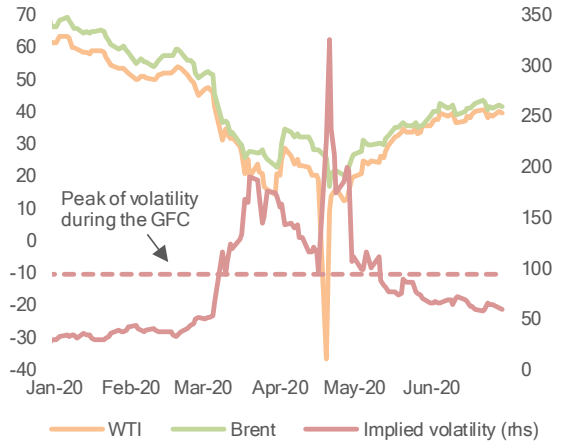
T.24
Commodity prices
Sharp decline for energy



Note: S&P GSCI commodity indices and Brent price. 01/06/2018=100. 1Y-MA=one-year moving average computed using S&P GSCI.
Sources: Refinitiv Datastream, ESMA.

Oil markets experienced substantial pressure as supply can only adjust very gradually to lower demand. The price of Brent declined by 85% between 19 February and 12 April amid the highest levels of volatility on record (T.25). In addition, investors with long positions on the May WTI future contract rushed to close their positions to avoid taking physical delivery of oil at Cushing, Oklahoma, given the shortage of storage place in the terminal. Investors had to sell their positions at a negative price (paying the buyer), with WTI touching a historical low of minus USD37 on 20 April 2020. Since then, oil prices have recovered amid lower volatility.

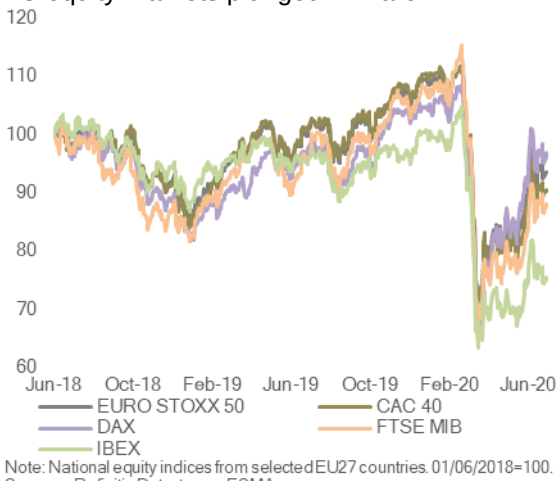
T.25
Oil prices
WTI price turned deeply negative in mid-April



Note: Price of Crude oil in USD, and CBOE implied volatility, in %.
Sources: Refinitiv Datastream, ESMA.

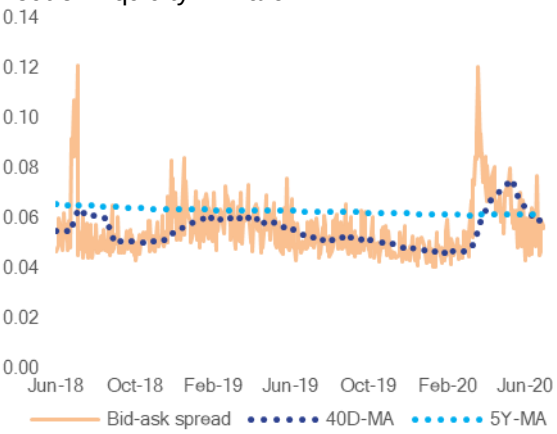
Key indicators

T.26
National equity indices from selected EU27 countries
EU equity markets plunged in March



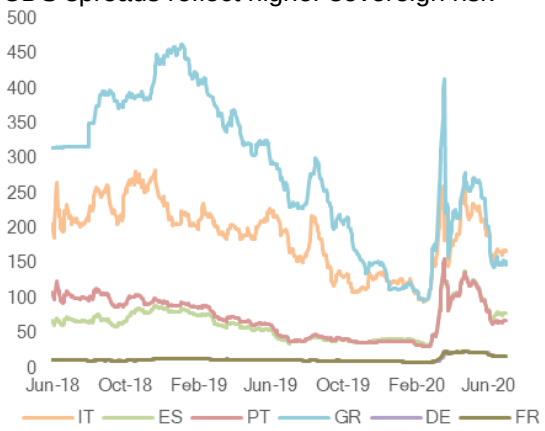
Note: National equity indices from selected EU27 countries. 01/06/2018=100.
Sources: Refinitiv Datastream, ESMA.

T.27
Equity market liquidity
Bout of illiquidity in March



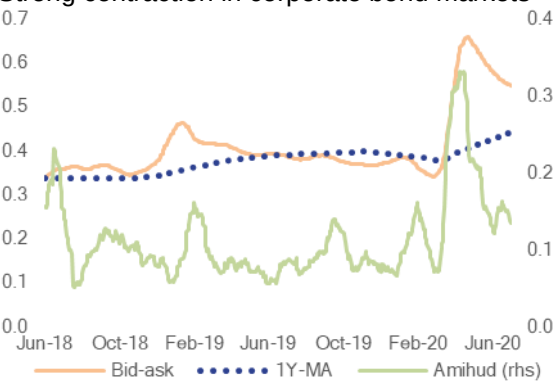
Note: Liquidity measure as median of the bid-ask price percentage difference for the current EU28 constituents of STOXX Europe Large 200, in %.
Sources: Refinitiv Datastream, ESMA.

T.28
EU CDS spreads
CDS spreads reflect higher sovereign risk



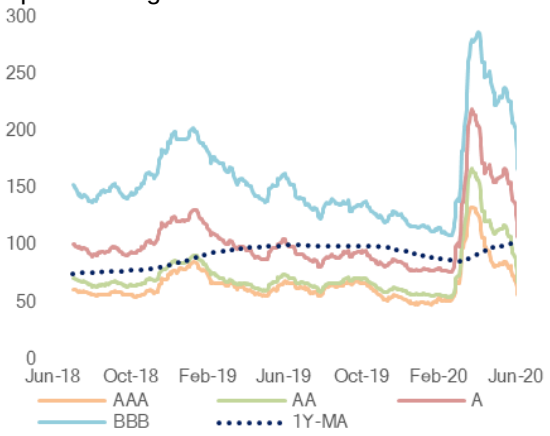
Note: 5Y CDS spreads of selected EU27 countries. in bps.
Sources: Refinitv Eikon, ESMA.

T.29
Corporate bond market liquidity
Strong contraction in corporate bond markets



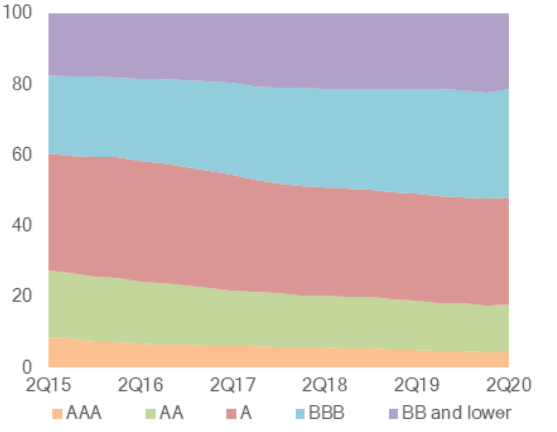
Note: Markit iBoxx EUR Corporate bond index bid-ask spread, in %, computed as a one-month moving average of the iBoxx components in the current composition. 1Y-MA=one-year moving average of the bid-ask spread. Amihud liquidity coefficient index between 0 and 1. Highest value indicates less liquidity.
Sources: IHS Markit, ESMA.

T.30
EA corporate bond spreads
Spreads surged in March



Note: ICE BofAML EA corporate bond option-adjusted spreads by rating, in bps. 1Y-MA=one-year moving average of all indices.
Sources: Refinitiv Datastream, ESMA.

T.31
Long-term corporate debt outstanding
BBB and lower debt share accounts for 50%



Note: Outstanding amount of corporate bonds in the EEA30 by rating category, in % of the total.
Sources: Refinitiv EIKON, ESMA.

Market trends and risks

Infrastructures and services

Trends

Market infrastructures faced heightened activity during the sell-off, as volumes and volatility soared. Trading venues coped with increased trading volumes amid a higher share of lit trading, as investors sought certainty of execution during the time of liquidity stress. Central Counterparties (CCPs) proved resilient throughout the period, despite the surge in clearing activity coupled with the sharp rise in initial and variation margins. Similarly, clearing members met heightened liquidity demands despite some margin breaches that were covered by excess margins. Credit Rating Agencies (CRAs) responded to the sharp economic deterioration by downgrading affected issuers, particularly non-financials. The risks of "fallen angels" remain high as a result, and securitised products (e.g. Collateralised Loan Obligations – CLOs) may be affected too going forward.

Risk status

Risk level 

Outlook 

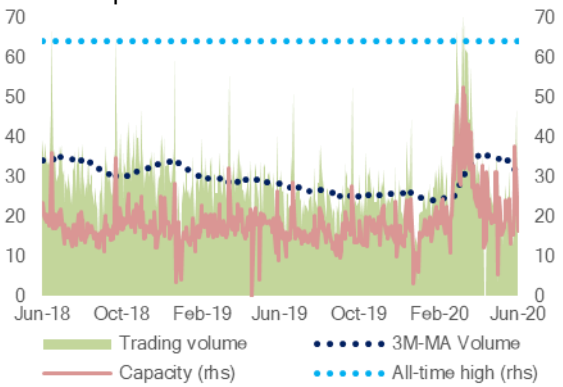
Risk drivers

- Operational risk and risk of infrastructure disruptions, especially in a COVID-19 context
- Geopolitical and event risks, especially trade tensions and Brexit amid the COVID-19 outbreak

Trading venues: massive increase in volumes

During the large sell-off from end-February, EU **trading volumes** in equity and equity-like instruments sharply increased with volumes reaching historical highs. Daily volumes reached a daily maximum of around EUR 70bn on 12 March (T.32), compared with a long-term average of EUR 32bn. Growth in trading activity occurred for all types of equity trading. In line with overall equity trading volumes, OTC volumes rose by more than a third in 1Q20, with the share of OTC trading remaining broadly stable at around 25% (T.48). Taking a longer-term perspective, OTC trading declined substantially from 33% in March 2019 to 25% in March 2020, before going back to average levels in 2Q20. As markets recovered, trading volumes declined again from April onwards to levels slightly above those observed before the crisis.

T.32
Trading of equity and equity-like instruments
Volumes peak in March



Note: Daily and 3M-MA of trading volumes on 34 EEA31 trading venues for all constituents of the STOXX Europe Large/Mid/Small 200 and a large sample of ETFs tracking these indices or some of their subindices, in EUR bn. Capacity computed as the average across trading venues of the ratio of daily trading volume over maximum volume observed since 31/03/2016, in %.
Sources: Morningstar Real-Time Data, ESMA.

The share of **lit markets equity trading** increased from a total of 45% in January to a total of 48% in March, following the trend observed during 2019. Trading in lit markets declined to 46% in April and May, stabilising at levels that were three percentage points (pps) higher than those during the previous year. The share of systematic internalisers declined to around 16% of total trading. The increase in lit trading is

related to investors needs for immediacy and certainty of execution during stress periods.[16] Dark pool trading remained at relatively low levels, accounting for 9% of total volumes.

In this context, trading venues proved to be broadly resilient, despite the surge in trading activity, message traffic and market movements. **Circuit breakers** were widely and efficiently used, and trading capacity was tested by volumes reaching all-time highs, with few operational issues.

The weekly number of **circuit breaker** trigger events reached record levels of around 2,400 and 4,000 in the second and third week of March respectively. This compares, for example, with previous peaks of daily circuit breaker triggers of around 1,500 around the Brexit referendum in the week of 20 June 2016. In April, the occurrences stabilised to an average of 200 per week and declined afterwards to a level close to the long-term average of around 150 per week (T.8). Across sectors, an average of 35% of trigger events occurred for banks, while 28% occurred for industrials (T.41).

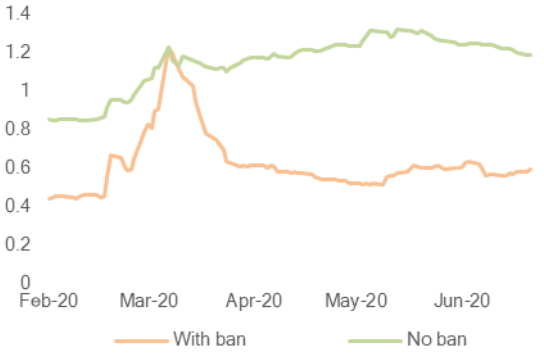
However, on 14 April, trading venues using the XETRA system experienced an outage for several hours. The outage was caused by an internal technical error and affected several trading venues for equities across the EU, as well as the Eurex trading platform for derivatives.[17] The impact on other EU venues was primarily owing to the technical interconnection between EU platforms, since many use the Eurex trading system. The inability of exchange trading for derivatives caused some liquidity issues in the underlying cash markets, as market participants were not able to hedge their positions between the cash and derivative markets. For some sovereign bonds, trading activity plummeted on the cash trading platform (MTS) during the outage.[18] Nevertheless, the incident had limited consequences for EU markets overall as it occurred while volatility had already declined to relatively low levels. On 1 July, XETRA experienced another outage for three hours. Both outages were related to issues with a third-party software that is part of the trading system. As during the first outage, several electronic trading systems in the EU using XETRA system, were affected. Trading of securities concerned by the problem resumed after the issue was solved.

In a context of heightened volatility and severe price declines, several National Competent Authorities (NCAs) introduced **short-selling bans** to maintain investor confidence in the orderly functioning of financial markets (Box T.33).

T.33
Short-selling bans on shares listed on EU regulated markets
Bans smooth net-short selling positions

Short selling can be a widespread phenomenon during market downturns, reflecting investors' pessimism over the value of a security. Short sellers sell borrowed securities with the expectation of buying them back at a lower price.

T.34
Net short-selling positions
Gradual normalisation after introduction of bans



Note: Net short selling positions on blue-chip shares reported by NCAs under Article 5 of SSR as % of total market value of shares listed on a EU Regulated Market. Average by countries with ban and without ban. Applied market value for reference as of 10-Feb-20. The chart covers net short positions on shares above 0.2% reporting threshold until 16 March, while it is based on the 0.1% reporting threshold from that date onwards.
Sources: FIRDS, NCAs, Refinitiv EIKON, ESMA

In the context of the COVID crisis, short-selling activity increased from end-February in equity markets. In addition, the increase points to both a larger number of investors holding a large net short position and an increase in the number of publicly disclosed positions per investor. High levels of volatility strongly contracted market confidence in the EU, with increased short-selling activity potentially contributing to amplified price swings and losses across financial markets. In this

[16] See "Liquidity landscape: Post COVID-19", Liquidinet, March 30, 2020

[17] For details on the 14 April outage, see "Eurex Exchange Readiness Newsflash | Refresher Newsflash: Incident Handling"

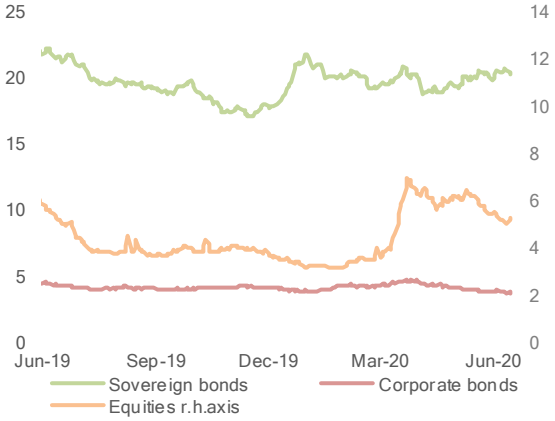
[18] Similarly, in 2015, an outage in Eurex resulted in very low trading activity on the Italian sovereign bond market on MTS. See Panzarino, O., Potente, F. and Puorro, A. (2016), "BTP futures and cash relationships: a high frequency data analysis" , Bank of Italy Working Paper No. 1083

context and to support transparency, ESMA on 16 March lowered the reporting threshold of net short positions on shares to 0.1%, which was extended in June for three months.[19] Around the same time several Member States also imposed short-term or long-term short-selling bans (AT, BE, FR, GR, IT, ES which were lifted mid-May as market conditions improved (T.34).

Throughout the crisis, net short selling positions in countries with bans more than doubled, compared with countries without bans which experienced a smaller increase (+40%). Following the entry into force of the ban decisions, short-selling activity gradually declined, receding to lower, but higher than pre-crisis, levels from April onwards. In countries where bans were not implemented, net short selling positions reported to NCAs were on average higher but broadly stable. After mid-May, short-selling levels slightly increased overall.

An increase in securities lending is also an indicator of short-selling as it includes securities that are borrowed to sell. The utilisation rate measures security lent over those available.[20] Since the end of February, the utilisation rate jumped sharply from 4% to almost 7% for equities, signalling increased demand (T.35). Following the ban, the equity utilisation rate began to gradually fall to lower, but still volatile, levels.

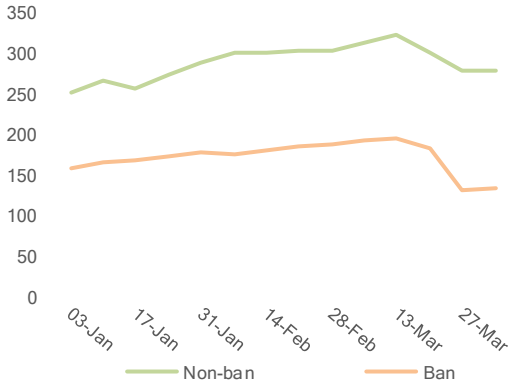
T.35
Securities utilisation rate
Equities lent jump then gradually decline



Note: Utilisation rate in percent, the ratio of the market value of securities lent over the market value of securities available for lending.
Sources: FIS Astec Analytics Short Lending Data, Quandl.

Another way to open a short selling position is to buy a put option on a given stock. T.36 shows the gross notional outstanding of put options bought by European Economic Area (EEA) counterparties around the time of the short selling measures. It shows that single stock put options bought by EEA participants generally declined with the introduction of the short-selling ban. Furthermore, the impact of the short selling measures was statistically stronger in the countries that imposed a ban.

T.36
Single equity put options bought by EEA counterparties.
Significant reduction for countries with a ban



Note: Equity put options bought by EEA counerparties, in gross notional, EUR bn. Country of instrument is the country of its Relevant Competant Authority (RCA). Ban countries include countries that imposed a short selling ban (AT, BE, ES, FR, GR, IT).
Sources: TR, ESMA.

CCPs: initial and variation margins surge

In the first stage of the crisis, the period of high volatility resulted in increased activity for EU financial infrastructures as well as significant stress for risk management practices. The massive increase in volatility translated into an increase in margins through a number of channels. The key drivers were increased volumes (A.84-A86 – interest-rate derivative (IRD) and Credit Derivative (CD) cleared volumes) and volatility leading to increased variation margins, reflecting mechanically large mark-to-market gains and losses for derivatives counterparties. A second order effect was that margin models were adapted to the period of heightened volatility (through parameter updates or by including new observations in the lookback sample of Value-at-Risk models), after a large number of margin breaches were observed[21]. This is visible in chart T.37 which shows that Initial Margins (IMs) required, as reported by EU28 CCPs to Trade Repositories, increased gradually from mid-February.

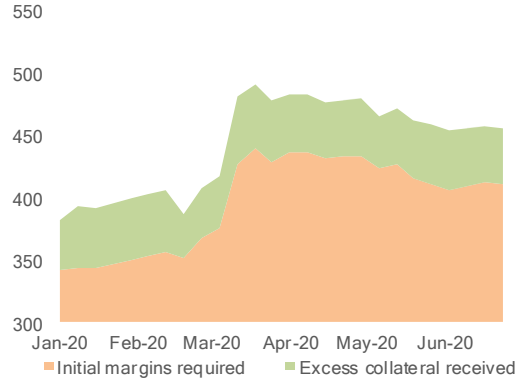
[19] See the March statement and the June update. for the renewal of the ESMA decision.

[20] The utilisation rate is a reliable proxy to measure short selling. It is the ratio between of the value of securities lent to the value of all securities available in the market. Utilisation is generally intended as a measure of demand against the supply of instrument to borrow, indicating portfolio and exposure rebalancing over time.

[21] Margin breaches occur each time the actual margin coverage held against an account falls below the mark-to-market value of the position of the account owner, based on the results of daily back-testing.

The elevated occurrence of margin breaches in March happened across markets, starting with equities and equity derivatives, and moving to sovereign debt and other fixed income instruments as well as commodity derivatives. A significant number of intra-day margin calls were observed, and CCPs generally increased the initial margin parameters gradually to cope with the increase in volatility, while limiting procyclicality.

T.37
Collateral received by EU28 CCPs
Gradual increase in margins

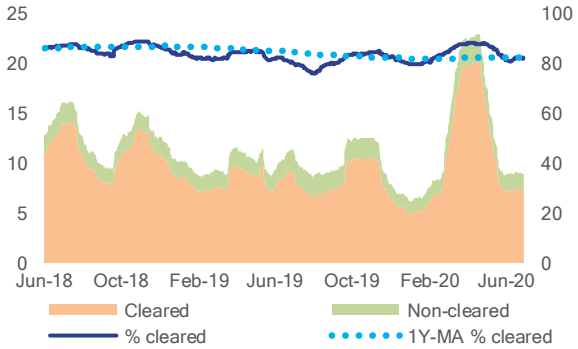


Note: Outstanding amounts of initial margins required and excess collateral received by EU28 CCPs for derivatives (data for CC&G missing). in EUR bn. Data points for 22, 29 May and 12 June missing (extrapolated on the chart) due to incompleteness in data for these dates.
Sources: TRs, ESMA.

Widespread intraday-margin call and overall increases in margins collected by CCPs can put additional liquidity demands on clearing members and their clients during times of liquidity shortage in other market segments. However, liquidity in the EU central clearing framework was never put under critical stress, as illustrated by the development of excess collateral received by EU CCPs (T.37), which never reached critical lows at an aggregate level over the period of the crisis. Excess collateral started to decrease slightly from end-January, i.e. before the gradual increase in initial margins, which points to excess collateral serving as a cushion limiting procyclicality of margins. Later on, when volatility returned to lower levels, initial margins remained at a higher level while excess collateral built up, again showing signs of controlled liquidity provision from clearing members. Overall, the central clearing system proved resilient in the EU. Outside EU-regulated CCPs, only one clearing member default occurred at a US CCP and one at a commodity clearinghouse in Poland which is not registered as an EU CCP.

Clearing volumes increased in March and April amid the surge in overall trading volumes. Clearing rates rose to 88% on average in April for CDS indices (T.38), up from 80% in January. The rise in cleared rates might be related to the liquidity and volatility crisis; however it does not seem to reflect only a flight-to-liquidity episode as volumes in cleared single names (less liquid than indices, and usually left out in times of flight-to-liquidity) followed a similar trend to cleared CDS indices (T.39). Activity declined in May and June, as market conditions improved, together with clearing rates coming back to their medium-term average level.

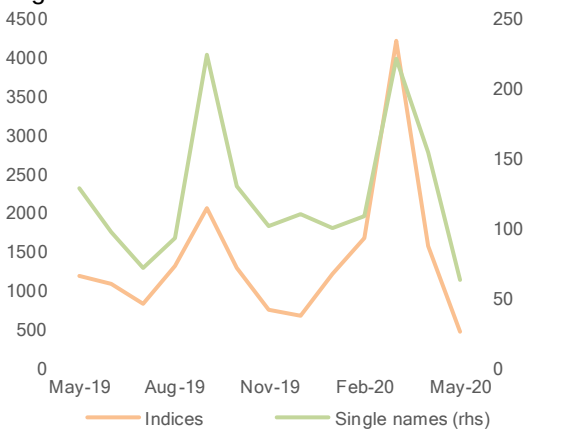
T.38
CDS index volumes and clearing rates
Volumes doubling, clearing rates up



Note: Daily trading volumes for the main EUR CDS indices including Itraxx Europe, Itraxx Europe Crossover, Itraxx Europe Senior Financials. 40-day moving average notional, USD bn. ISDA SwapsInfo data are based on publicly available data from DTCC Trade Repository LLC and Bloomberg Swap Data Repository.
Sources: ISDA SwapsInfo, ESMA.

High activity during the market turmoil points to central clearing being perceived as safer by investors than non-centrally cleared trades. IRD clearing rates in EU28 denominated currencies also increased, although to a lower extent (T.50).

T.39
Single names vs. index CDS cleared volumes
Aligned trends

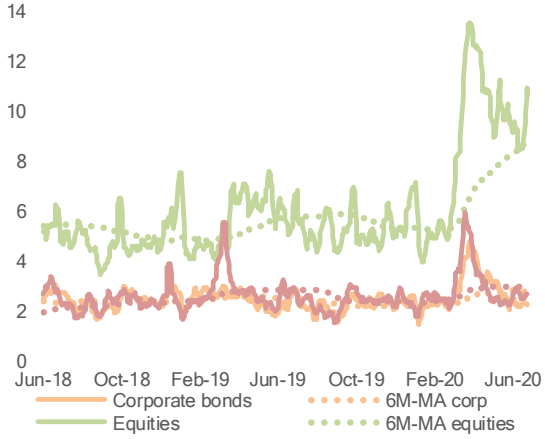


Note: Monthly volumes of cleared Single name CDS and cleared CDS indices, in EUR bn.
Sources: Clarus Financial Technology, ESMA.

CSDs: settlement fails at all-time highs

The level of settlement fails surged during the second half of March reaching levels unseen since the beginning of the reporting in 2014. Fails climbed to around 14% for equities and close to 6% for government and corporate bonds (T.40). The high level of fails is related to operational and structural issues. First, high market volatility triggered a high velocity in the exchange of assets, reflecting increased collateral movements (margin calls and substitutions) and consequently heavily increased settlement instructions volumes and overall turnover (T.49). High activity also led to longer settlement chains, whereby the failure to deliver a security resulted in multiple fails across the chain. In that context, the sharp increase in settlement activity led to operational issues for market participants and CSDs, owing to remote work and third-party outsourcing to countries in lockdown.

T.40
Settlement fails
All-time highs end-March across asset classes



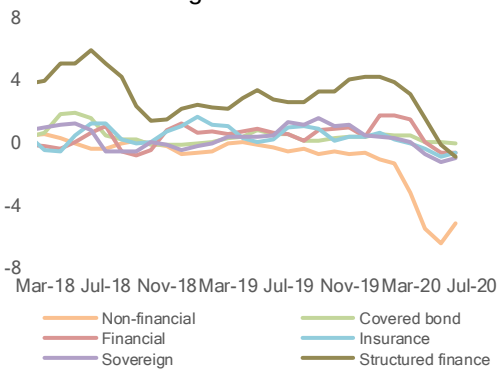
Note: Share of failed settlement instructions in the EEA31, in % of value, one-week moving averages.
Sources: National Competent Authorities, ESMA.

Most settlement fails were related to operational challenges for market participants in delivering securities rather than a lack of cash. Structural issues around ETFs also played a role, as there is no harmonized process for the issuance of ETF shares, which usually settle at T+3, which is one day longer than the traditional settlement cycle. Nevertheless, most settlement fails where resolved between one and five days after the intended settlement date. Since April, settlement fail levels have decreased across instruments, together with volatility and settlement activity. While fails for corporate and sovereign bonds have converged to their long-term average settlement fails for equities, remain above their historical norms.

CRAs: sharp jump in corporate downgrades

The sharp increase in credit risk from the COVID-19 crisis is clearly visible in the evolution of credit ratings from March onwards. **Ratings drift dropped** across all issuers, but particularly for non-financials, structured finance and financials (T.41). Ratings drift later stabilised and began to rise for non-financials, reflecting the slowing pace of downgrades following the surge in March.

T.41
Ratings drift by asset class
Fall in credit ratings across classes

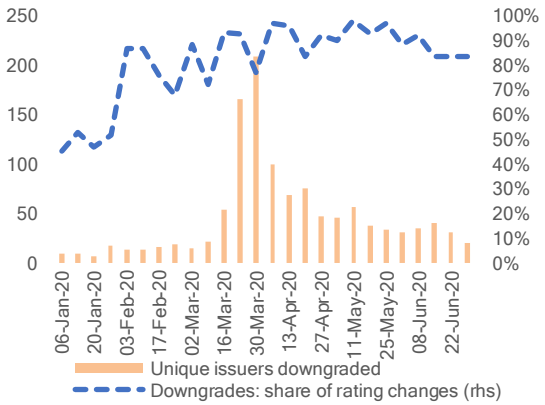


Note: 3-month moving average of net rating changes in outstanding ratings from all credit rating agencies, excluding CERVED and ICAP, by asset class, computed as the percentage of upgrades minus the percentage of downgrades. EU-27+UK ratings.
Sources: RADAR, ESMA.

Measures to slow COVID-19 severely weakened prospects for businesses in numerous sectors, and **corporate issuers' ratings** were correspondingly hit. In March the number of issuers with at least one bond downgraded per week increased more than ten-fold, well in excess of long-term averages. Among these issuers, NFCs were most affected, followed by financial institutions and then insurers (T.41).

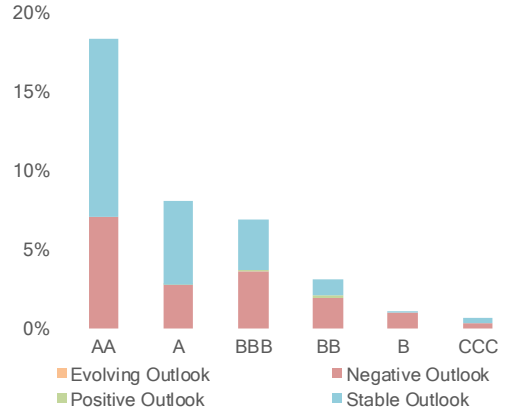
Downgrades have also grown as a share of rating changes, from about 40% at the beginning of the year to over 80% by the end of 1Q20 and through 2Q20 (T.48). Following the surge in downgrades in March and April, the flow of corporate downgrades gradually slowed (T.12, T.42).

T.42
Corporate issuer downgrades
Sharp jump in downgrades in March



Note: Number of EU27+UK corporate issuers with at least one bond downgraded, and ratio dowgraded corporate issues over upgrades and downgrades (rhs)
Sources:ESMA, RADAR

T.43
Ratings outlook by rating
Corporate ratings' outlook negatively skewed



Note: Corporate non financial instruments (ISINs) with outlook rated by the largest five CRAs (Fitch, Moody's, S&P, Scope and DBRS) by category value over the total ratings per category value, as of July 13 2020.
Sources: RADAR, ESMA.

While most downgrades were concentrated among HY issuers, some IG issuers were also downgraded. These downgrades include **fallen angels** (downgrades from IG (rated BBB or higher) to non-IG (rated below BBB)). Given the steady growth in BBB-rated debt a significant proportion of IG corporate debt is currently rated BBB (T.13, T.31). The risk of fallen angels thus continues and remains significant. As of end-June, the amount of fallen angels year to date totalled around EUR 270bn globally. This risk is also captured in the ratings outlook for corporate instruments, which shows a strong negative skew across ratings. Fallen angel risk is evident when looking at ratings outlook with nearly 5% of all BBB corporate instrument ratings having a negative outlook as of May 2020 (T.43). Among BBB-rated corporate instruments with outlooks, about 59% are negative, 40% stable, and only 1% positive.

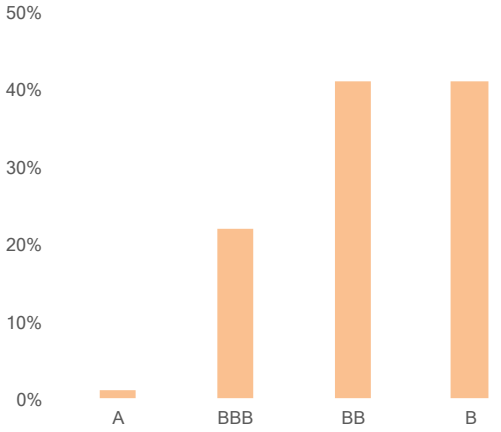
For other asset classes, downgrades have been more muted than for corporates, although ratings drift has also fallen.. Some of this reflects not only the more limited or indirect effect of COVID-19 on other asset classes but also the well-established lag in credit ratings relative to other market indicators.

Some structured finance products are likely to experience downgrades as the credit quality in the collateral underlying these products deteriorates. There were early indications in April that **Collateralised Loan Obligations** (CLOs) in particular, which are backed by leveraged loans, may experience downgrades (T.44). Subsequent evidence indicated that about half of EU CLO tranches placed on negative watch in April were later downgraded.[22] As with other corporates, there has been a wave of downgrades in leveraged loans, which may by deteriorating collateral value and/or breaching overcollateralisation tests lead to downgrades on the more junior tranches. Senior tranches appear less at risk (T.44). CLOs may also face more substantive downgrades if leveraged loan downgrades are more correlated across sectors than originally anticipated – given the dependency of the CLO ratings model on default correlation among loans[23].

[22] See BoA Global Research, "European CLO Weekly: Negative 1H20 returns despite strong recovery", 20 July 2020

[23] For further discussion, see the Risk article, " Model risk in CLOs' on pp. 60-73, and the TRV 2-2019 article 'Leveraged loans, CLOs – trends and risks'.

T.44
CLO tranches on negative outlook
Junior and mezzanine tranches at risk

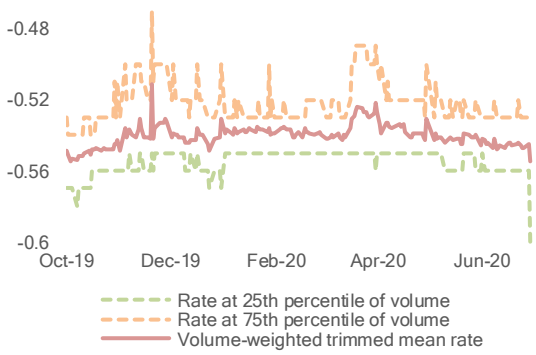


Note: Share of CLO tranches put on negative outlook for A and negatve watch for all ratings below A) as of April 22 2020.
Sources: Barclays, ESMA.

Benchmarks: transition towards risk-free rates

The new overnight **reference risk-free rate** euro short-term rate €STR (previously ESTER) was first published on 2 October 2019. During the COVID-19 crisis, the rate increased with a more general peak in volatility occurring from mid-March to early-April. During the period of high overall market volatility, dispersion also surged, as rates at 25% and 75% of the volumes diverged during this time span, thus showing signs of more volatile fixing (T.45).

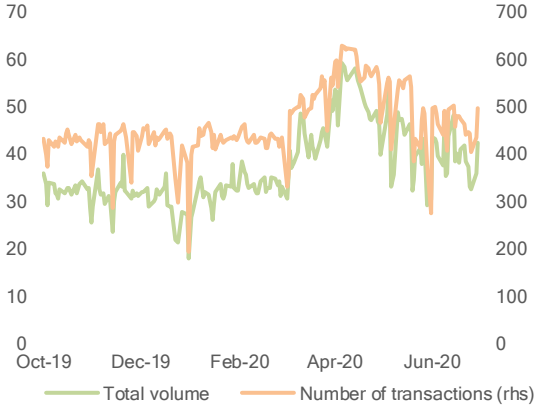
T.45
€STR rates
Widening dispersion of rates used for fixing



Note: Rates at the 25th and 75th percentiles of total volumes as well as the trimmed one, after removing the top and bottom 25% and calculating the mean of the remaining 50% of the volume-weighted distribution of rates.
Sources: ECB ESMA

Nevertheless, this was most probably owing to volatility on the underlying market rather than lower liquidity, as €STR volumes and the number of transactions used for calculation doubled during the second half of March (T.46). Activity normalised in May and June, with volumes reverting back to pre-crisis levels.

T.46
€STR volume and transactions
Increased volumes in March and April



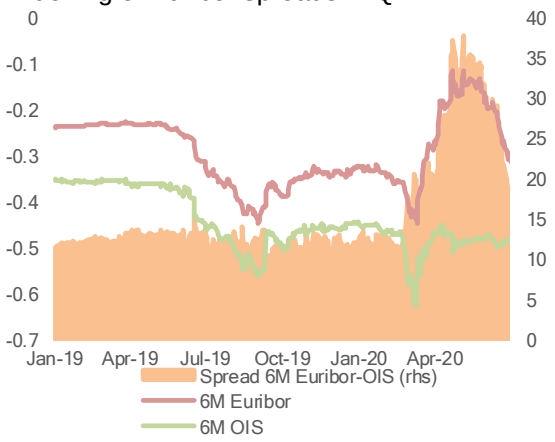
Note: Total nominal value of transactions before trimming, in EUR bn. Number of transactions before trimming.

In March, as market participants on unsecured euro money markets were unwilling to lend at longer maturities, issuers had to accept higher rates for longer tenors. As those transactions are used as inputs by panel members to provide contributions to Euribor fixings, Euribor rates edged up, although Overnight Index Swaps (OIS) of similar maturities declined (T.47). The rise in Euribor-OIS spreads thus reflected more liquidity problems on the underlying markets used for the fixing rather than increases in credit or counterparty risks.

Relatedly, the Intercontinental Exchange (ICE) Swap rate (formerly ISDA FIX), a benchmark rate reflecting swap rates underlying swaptions or other structured products failed to be published in March and April for some tenors and currencies, in particular EUR and USD. The ICE swap rate is based on interdealer central limit order book data from three Swap Execution Facilities (SEF). Amid COVID-19 related market swings, dealers preferred bilateral trades to the SEFs used to fix the rates, which thus affected the ICE Swap rate

fixing[24]. The publication of all EUR fixings resumed in May and the publication of USD swaps resumed in June.

T.47
Euribor rates
Widening of Euribor spreads in Q1



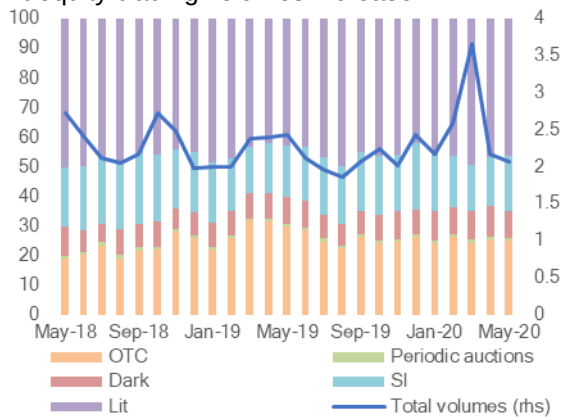
Note: 6M Euribor and EONIA Overnight Index Swap fixings, in % and spread in bps.
Sources: Refinitiv Datastream, ESMA.

End-March, some **bond index benchmark providers** took the unusual step of postponing their month-end index rebalancing to the end of April. The action was taken in relation to investors' worries that the rebalancing would lead to forced sales of excluded bonds ('fallen angels') amid low liquidity. As analysed previously, forced sales of fallen angels from passive funds can have a sizeable impact on the HY bond market.

[24] For more details see "Swap benchmark vanishes as traders flee firm price venues", Risk.net, 20 March 2020.

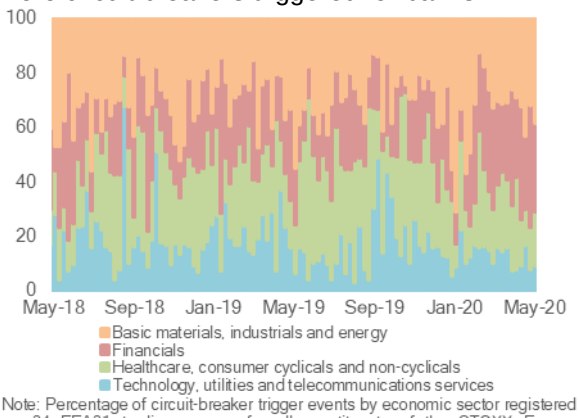
Key indicators

T.48
Equity-trading volumes
Lit equity-trading volumes increase



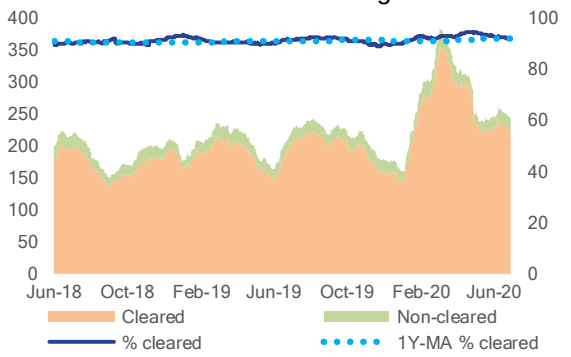
Note: : Type of equity trading in the EU as a percentage of total volumes. Total equity trading volumes in EUR trillion (right axis)
Sources: FIRDS, FITRS, ESMA

T.49
Circuit breakers by economic sector
More circuit breakers triggered for banks



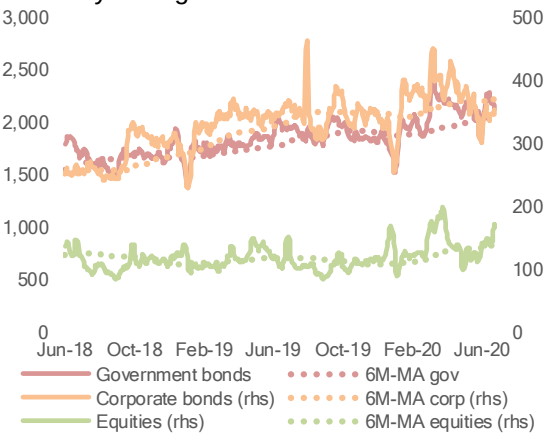
Note: Percentage of circuit-breaker trigger events by economic sector registered on 34 EEA31 trading venues for all constituents of the STOXX Europe Large/Mid/Small 200 and a large sample of ETFs tracking these indices or some of their subindices. Results displayed as weekly aggregates.
Sources: Morningstar Real-Time Data, ESMA.

T.50
IRD trading volumes and clearing rates
Increase in volumes and clearing rates



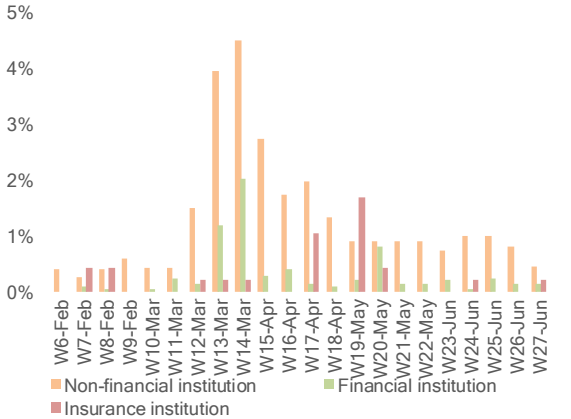
Note: Daily trading volumes for EU28-currency-denominated IRD products (EUR, HUF, PLN, GBP). Products include IRS, basis swaps, FRA, inflation swaps, OIS. 40-day moving average notional, USD bn. ISDA SwapsInfo data are based on publicly available data from DTCC Trade Repository LLC and Bloomberg Swap Data Repository.

T.51
Settlement activity
At multi-year highs



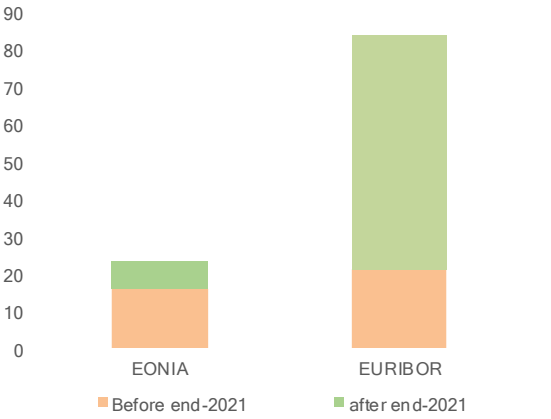
Note: Total value of settled transactions in the EEA31 as reported by NCAs, in EUR bn, one-week moving averages.
Sources: National Competent Authorities, ESMA.

T.52
Share of issuers with at least one bond downgraded
Surge in downgrades across corporates



Note: Percentage of issuers with at least one bond downgraded over the total of outstanding issuers of that institution rated by the big 5 CRAs (Fitch, Moody's, S&P, DBRS, Scope).
Sources: ESMA, RADAR

T.53
IRS linked to EONIA and Euribor by maturity
Extensive reference to Euribor and EONIA



Note: Gorss notional amount of IRS outstanding referencing EONIA, EONIA SWAP rate and EURIBOR, by maturities. as of 27 March 2020, EUR tn.

Market trends and risks

Asset management

Trends

In the wake of the initial impact of the COVID-19 outbreak on markets, the EU investment fund industry faced a significant deterioration in liquidity in some segments of the fixed income markets combined with large-scale investment outflows from investors. Redemptions from bond funds reached record highs in March, resulting in outflows of 4% of their net asset value (NAV) in 1Q20. Some asset managers decided to suspend the redemption of their funds, mainly because of valuation uncertainty but in some cases also because of outflows. Between the second half of March and May around 200 EU and UK funds (out of 60,000 funds) had to suspend redemptions temporarily. Some corporate bond exchange traded funds (ETFs) traded with unusually large discounts compared with the reference basket, reflecting liquidity issues in underlying assets in March and April. Some money market funds (MMFs) were particularly affected end-March owing to their exposure to the USD money market, especially low volatility net asset value MMFs. Since early April, the liquidity profile of funds has improved across fund types, with a surge in inflows and a general improvement in performance.

Risk status

Risk level 

Outlook 

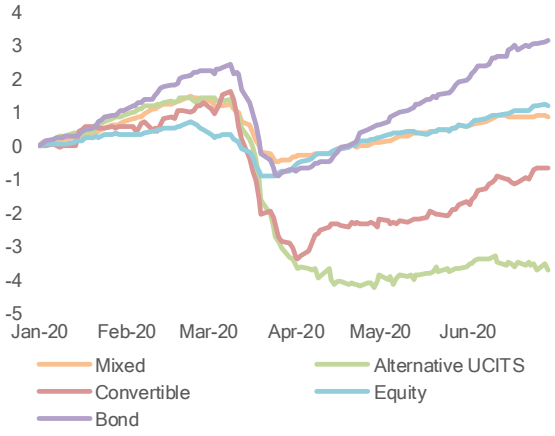
Risk drivers

- Liquidity stress related to COVID-19, valuation uncertainty
- Risk sentiment remains fragile
- Funds exposed to liquidity mismatch remain vulnerable

Fund flows: liquidity stress for bond funds in March

In 1Q20, the **EU investment fund industry** faced a significant deterioration of liquidity in some segments of the fixed income markets combined with large-scale investment outflows from investors. The COVID-19 outbreak and the prospects of a severe economic downturn triggered significant risk aversion and a surging demand for cash. Flow patterns reflected this general preference for safer and more liquid assets amid global uncertainty. Outflows from equity funds were more muted than for bond funds. Bond fund outflows reached record highs in 1Q20, representing more than 4% of the sector NAV (T.70), followed by equity (-2%) and mixed funds (-2%). Over 1H20, cumulative flows were close to zero, with the high inflows observed in April and May compensating for the March outflows across most bond funds (T.54). In contrast, the recovery has been limited for smaller segments of the fund sector like alternative UCITS (-5% of NAV) and convertible bond funds (-1%) (T.54).

T.54
Fund flows
Sharp outflows followed by inflows since April

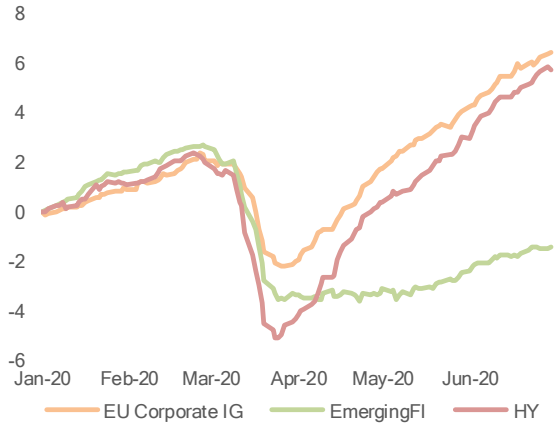


Note: Cumulative flows into UCITS, in % of NAV
Sources:Morningstar, ESMA.

In March, redemption demands were particularly challenging for funds that invest in less liquid assets, such as **corporate HY bonds and EM bonds**, which faced cumulative redemptions of 5% and 4% respectively in a deteriorating liquidity environment (T.55). During the second and third

phases of the crisis, corporate bond funds recorded high inflows as risk sentiment improved, while the recovery for EM bond funds has been more muted.

T.55
Fund flows
Large outflows in March for EM and HY funds



Note: Cumulated flows into UCITS, in % of NAV.
Sources: Morningstar, ESMA.

The severe liquidity stress faced by investment funds during the liquidity crisis was broadly similar to the assumptions used in ESMA's stress simulation performed in 2019 (Box T.56). In addition, outflows occurred across fund categories, pointing to a high degree of contagion among funds.[25]

T.56
Fund liquidity stresses
Market shock reached stress scenario levels

The acute stress faced by bond funds in March 2020 can serve as benchmark against which the redemption shocks used in ESMA stress simulation (STRESI) can be compared.[26]

The size of the redemption shocks during the phase of acute stress was similar to the shocks used in STRESI: HY funds faced 7.4% of outflows, compared with 8.2% in STRESI (T.57). Total outflows amounted to around EUR 120bn against EUR 142bn in STRESI.

T.57
Redemption shocks
Comparison of fund outflows

	STRESI		Observed	
	Flows in %	Flows in EUR bn	Flows in %	Flows in EUR bn
HY	8.2%	14	7.4%	17
EM	6.7%	15	7.1%	30
Euro FI	6.8%	50	2.3%	30
Global FI	6.6%	28	1.1%	7
Mixed	3.6%	34	2.2%	33
Total	5.7%	142	2.2%	118

Note: Comparison between the assumptions and the results in the STRESI report and observations between 20 February and 24 March 2020.
Sources: Morningstar Direct, ESMA.

Using the observed fund outflows, we estimate the price impact of sales from funds based on STRESI assumptions regarding market liquidity (T.58). The overall price decline observed during the period is in line with the estimated price impact used STRESI, although the observed change in prices also includes non-fund-related factors (such as sales from other investors and an increase in credit risk).

T.58
Price impact
Market impact comparable to ESMA stress simulation

	Price impact in bps	
Asset class	STRESI	Observed
HY bonds	402	533
IG bonds	199	169
EM bonds	318	265

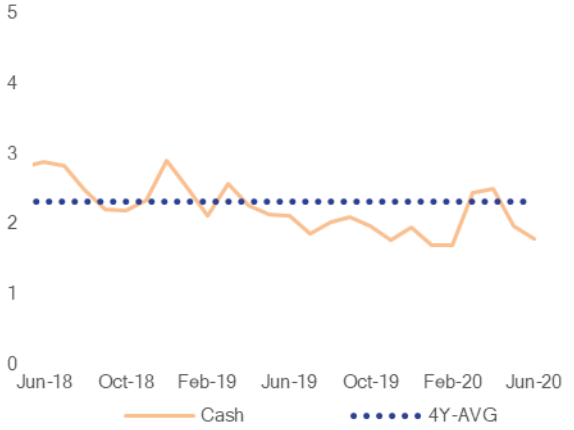
Note: Comparison between the assumptions and the results in the STRESI report and observations between 20 February and 24 March 2020.
Sources: Morningstar Direct, ESMA.

Funds investing in less liquid asset classes generally hold part of their portfolio in liquid assets, including cash, and diversify their exposures to issuers in order to mitigate liquidity risk, even in a stressed environment. Corporate bond funds increased their **cash holdings** in March and April to cope with high expected redemptions. As markets normalised, cash holdings reverted to pre-crisis lower levels (T.59).

[25] See also the risk article "interconnectedness and spillovers in the EU fund industry" p.74-80.

[26] ESMA, "Stress simulation for investment funds", Economic Report, September, 2019.

T.59
Corporate bond fund cash holdings
Changes in cash holdings during the turmoil



Note: Cash held by EU corporate bond funds, in % of portfolio holdings (%). Short positions can have a negative value.
Sources: Refinitiv Lipper, ESMA.

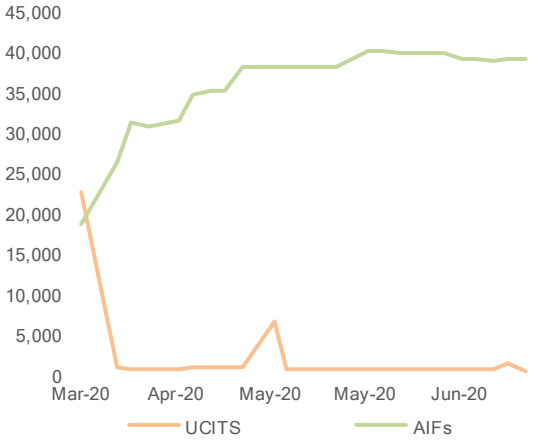
As liquidity plummeted during the market turmoil in March and April, some asset classes were subject to high valuation uncertainty. In that context, some fund managers decided to suspend redemptions when it was necessary to protect investors (Box T.60). Owing to fund share valuation uncertainty, there was a risk of unfairly penalising remaining (redeeming) investors, by redeeming shares above (below) their fair price. The suspension of redemption is one of the **Liquidity Management Tools** (LMTs) employed by asset managers to handle outflows or asset valuation issues. In light of the deterioration in market liquidity and rising redemption requests, asset managers used tools such as gates, suspension of redemption and swing pricing although there is significant variation in the availability of those tools across EU jurisdictions. Outside the EU, investment funds in the US and Asia also experienced sharp outflows and, in some cases, had to use LMTs during the turmoil in March and April.

T.60
Liquidity management tools
Suspensions of redemptions

Faced with liquidity pressures on the liability side as well as valuation uncertainty on the asset side, some fund managers made use of LMTs to protect investors. In particular, a range of funds suspended redemptions from investors (T.61).

For UCITS, after a surge in suspensions end March (around EUR 22bn), mainly for bond funds exposed to corporate bonds, the size and number of suspended funds declined to around EUR 0.4bn end-June. In contrast, the NAV of suspended Alternative Investment Funds (AIFs) increased to EUR 40bn end-June, mainly because of real estate funds that suspended redemptions. Overall, most of the suspensions during the reporting period were linked to valuation uncertainty in corporate bonds, OTC derivatives and real estate markets, rather than difficulties in meeting investors' outflows.

T.61
UCITS and AIFs
Increase in suspensions for AIFs

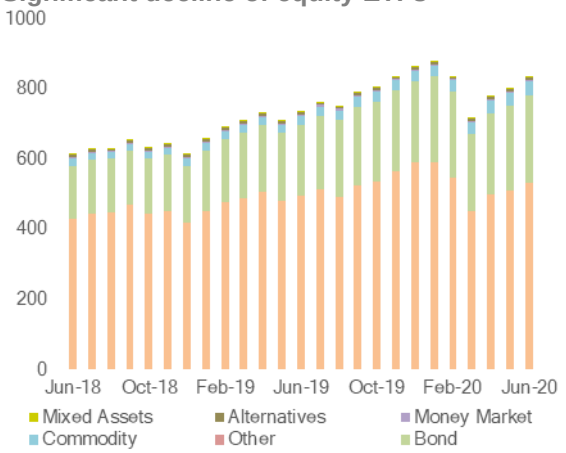


Note: Net asset value of UCITS and AIFs with suspension of redemptions, in EUR Mn.
Sources: National Competent Authorities, ESMA.

ETFs: frictions in the arbitrage mechanism

ETF assets under management (AuM) declined by 14% in March because of a combination of outflows and negative valuation effects. Over the reporting period, AuM declined by 11% down to EUR 780bn mainly driven by equity ETFs (-15%). Nevertheless, equity ETFs still represent 64% of the sector, followed by bond ETFs (T.62).

T.62
ETF NAV by asset type
Significant decline of equity ETFs

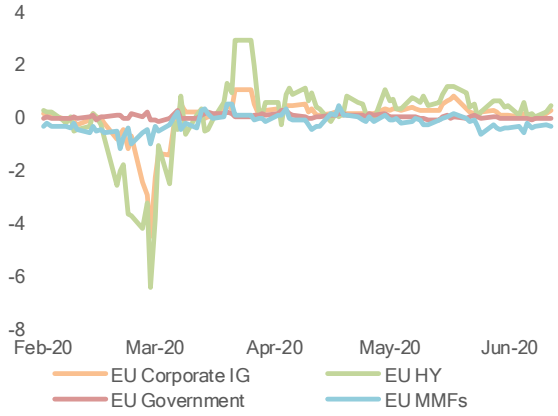


Note: NAV of EU ETFs by asset type, EUR bn.
Sources: Refinitiv Lipper, ESMA.

The liquidity stress also affected fixed income ETFs in March, as some **corporate bond ETFs** traded with a large discount compared with the

underlying assets (T.63). In such cases, the selling pressures on the ETF shares were not reflected in the underlying market and ETF share prices dropped by more than the value of the underlying assets, resulting in a discount.

T.63
ETFs discount and premium
Large divergence in March for corporate ETFs



Note: EU ETFs premium/discount, in %. Deviations from zero indicate that the price of the ETF is different from the price of the underlying basket of securities.
Sources: Morningstar, ESMA

This points to a potential dysfunction of the ETFs arbitrage mechanism, with the illiquidity of the underlying assets causing friction in the arbitrage process. On the one hand, it can be considered a discontinuation of price discovery. On the other hand, this could also indicate that ETFs were able to price assets in a worsening liquidity environment, with ETF prices reflecting market dynamics more quickly than the prices of the underlying assets. Since April, as volatility has abated and market liquidity has improved, ETFs premium and discounts have converged back to zero, and inflows have increased.

MMFs: severe liquidity challenges end-March

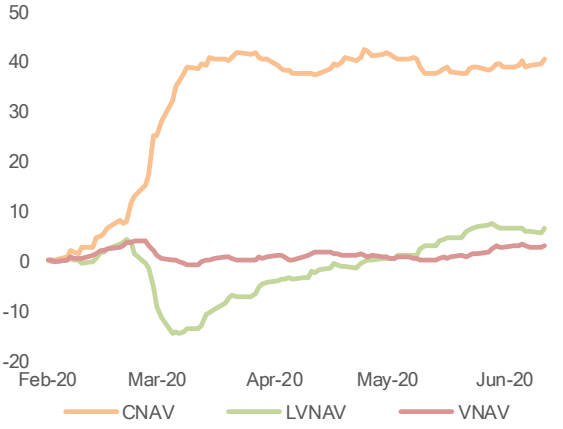
Some segments of the **EU short-term MMF industry** faced liquidity challenges during the period of acute stress in March 2020, in particular LVNAV MMFs (T.64), while other types of MMFs such as constant net asset value (CNAV) and variable net asset value (VNAV) MMFs saw high inflows (CNAVs) or limited outflows overall (VNAVs), although individual VNAV funds may have been subject to large outflows.

LVNAVs are short-term MMFs that invest mainly in private securities (commercial paper or certificate of deposits) and use mainly amortised cost accounting. LVNAVs are subject to daily and weekly liquidity requirements (10% and 30% of their assets respectively). When their mark-to-market NAV deviates more than 20 bps from the constant NAV, LVNAVs have to convert to VNAVs. Within the LVNAV sector, **USD MMFs** account for the largest share of the EU LVNAV universe (T.65). Such funds are seen as MMFs that are similar to US Prime MMFs, and are used by US corporate subsidiaries located in the EU to park their cash.

In contrast, VNAV funds (which use mark-to-market valuation and are subject to lower daily and weekly liquidity requirements than other MMFs) are predominantly denominated in EUR. VNAVs include short-term MMFs and standard MMFs. Standard MMFs have less investment constraints than LVNAVs and can hold securities with longer maturities.

Finally, CNAVs must invest 99.5% of their assets into government debt instruments, reverse repos collateralised with government debt, and cash. CNAVs use amortised cost valuation and are subject to daily and weekly requirements similar to LVNAVs (10% and 30% respectively). Given the period of prolonged low rates in the euro area, almost all CNAVs are in USD.

T.64
MMF flows
Large redemptions from LVNAV MMFs in March

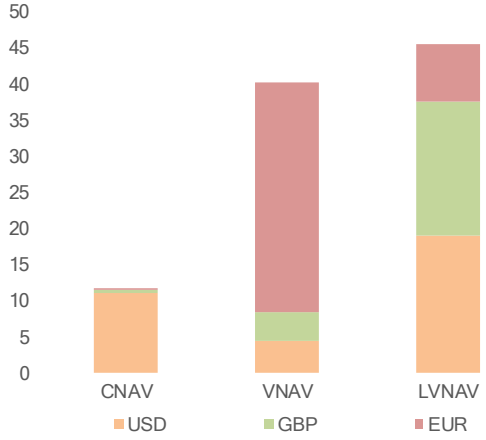


Note: Cumulative flow into EU MMFs, % of NAV.
Sources: Morningstar, Refinitiv Lipper, Crane, ESMA.

LVNAV MMFs liquidity challenges were related to a combination of factors. On the liability side, investors redeemed their MMF shares as part of the 'dash for cash', while on the asset side, liquidity deteriorated quickly in money markets, particularly in the commercial paper market in the EU and the US. In particular, bank issuers who usually buy back their paper from MMFs when

needed were unwilling to make markets, increasing liquidity pressures on MMFs.

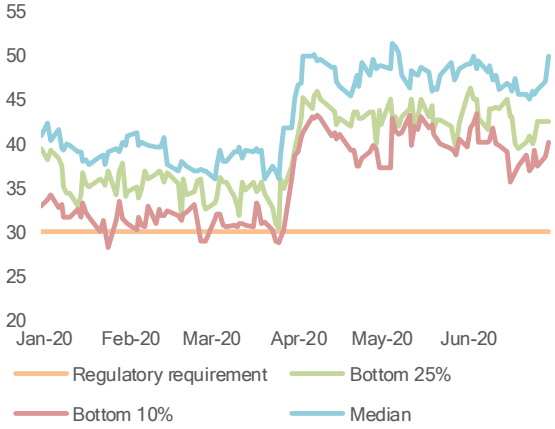
T.65
MMF by type and currency
LVNAV most exposed to US market



Note: EU MMFs by type and currency, in % of total NAV as of June 2020.
Sources: Refinitiv Lipper, ESMA.

The stress was visible in the fall in USD LVNAV weekly liquid assets end-March (T.66), and in large deviations between the mark-to-market NAV and the constant NAV for some funds, as MMFs had to sell instruments with a discount to raise cash to meet redemptions. As investors fled LVNAVs, MMFs that invest only in government securities (CNAVs) recorded very high inflows, as part of investor rebalancing.

T.66
EU USD LVNAV weekly liquid assets
Sharp drop end-March

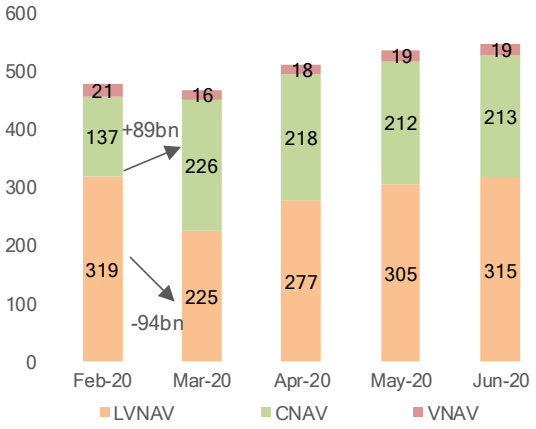


Note: Weekly liquid assets of USD LVNAVs, based on a sample of 20 MMFs with a NAV of USD 330bn.
Sources: Crane, ESMA.

As a result, the share of **USD CNAV** within EU USD MMFs increased to 48% from 29% in March, while LVNAV receded from 67% to 48% (T.67). Similar developments were observed in the US, with a large rebalancing between Prime MMFs and Treasury & Government MMFs. Some Prime MMFs received direct support from their sponsor to address their liquidity challenges.

In that context, the Federal Reserve launched a series of measures to support US MMFs, through lending facilities for dealers purchasing assets from MMFs (Money Market Mutual Fund Liquidity Facility), and outright purchases of money market instruments (Commercial Paper Funding Facility). [27] In the euro area, the ECB put in place a purchase programme of commercial paper issued in EUR by NFCs. However, EU USD MMFs were eligible neither for the Fed facilities, nor for the ECB Commercial Paper programme.

T.67
EU USD MMFs
Surge in CNAVs assets while LVNAVs drop

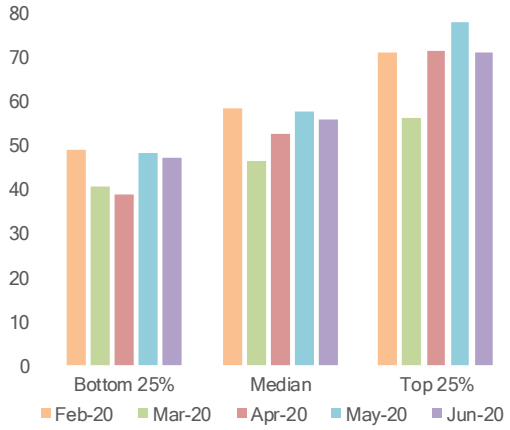


Note: Net assets of EU USD MMF Assets, in USD bn.
Sources: Crane, ESMA.

As USD LVNAVs faced severe outflows in March, they rebalanced their portfolios by selling assets and reducing the maturity of their holdings. While the overall composition of their portfolio by asset classes remained stable (commercial paper and certificates of deposit accounted for 40% and 30% respectively in February and March), MMFs reduced significantly the maturity of their holdings, with the weighted average life declining by more than 10 days (T.68).

[27] BIS Bulletin No 14, US dollar funding markets during the COVID-19 crisis - the money market fund turmoil, 12 May 2020

T.68
EU USD LVNAV MMFs
Decline in maturity of holdings in March



Note: Weighted Average Life (WAL) of USD LVNAVs, in days.
Sources: Crane, ESMA.

The sales of assets in an illiquid market resulted in significant deviation of the mark-to-market NAV from the constant NAV. By regulation, the market value of LVNAV should not deviate more than 20 bps from their constant NAV, or they will have to convert to VNAV. This rule is aimed at limiting the risk of first-mover advantage, when the first investor to redeem expects to have shares repaid at a book price superior to the fair value. However, it may also put pressure on managers who are willing to avoid such conversion, if they think that it could trigger further redemptions. In addition, more than 95% of USD LVNAVs receive MMF ratings from CRAs (Box T.69), and the move to VNAV would have resulted in downgrades.

Overall, no EU MMFs had to introduce redemption fees or gates or suspend redemptions during the market turmoil.

T.69
Money market funds
MMF ratings

A large share of the MMF industry is rated by CRAs. MMF ratings assess the ability of a fund to preserve capital and maintain liquidity for investors, and are therefore very different from credit ratings, which assess the creditworthiness of the issuer.

MMF ratings are mainly used by institutional investors, when their investment mandate might restrict investing only in AAA MMFs. Around 80% of US institutional MMFs are rated and around 95% of EU MMFs covered by Crane data are rated (accounting for around 60% of the EU MMF universe). Almost all rated MMFs are AAA.

Methodologies used by CRAs for their MMF ratings, include diversification, maturity and credit quality requirements. In most cases, AAA MMFs cannot invest in issuers with short-term ratings below a certain threshold.

In addition, changes in pricing policies or the use of liquidity management tools would trigger downgrades from AAA. For LVNAVs, changes of valuation from amortised cost to mark-to-market would lead to a downgrade by some CRAs for AAA MMFs.

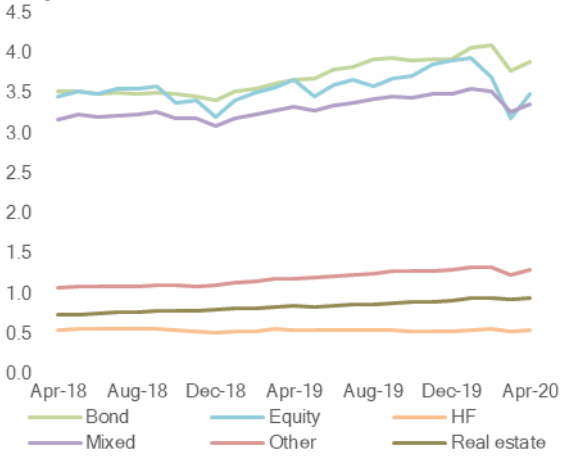
For all AAA-rated MMFs, the use of redemption fees or gates would trigger a downgrade.

Stress among MMFs can have an impact on the wider financial system, given the strong degree of interconnectedness that is typical for MMFs. MMFs are often used by institutional investors and corporates as a cash management tool similar to deposits and a suspension in one MMF may trigger redemptions in other MMF. In addition, suspensions might have wider consequences on the banking sector using money markets for its short-term financing and could also cause reputational damage to MMFs in the long run.

Following policy actions, and a global reduction in risk aversion among investors, outflows from LVNAVs stabilized in early April and were then followed by subscriptions (T.64). LVNAVs recorded high inflows, and year-to-date cumulated inflows turned positive in May. LVNAVs experienced a general improvement in their liquidity profile and increased the maturity of their holdings (T.68).

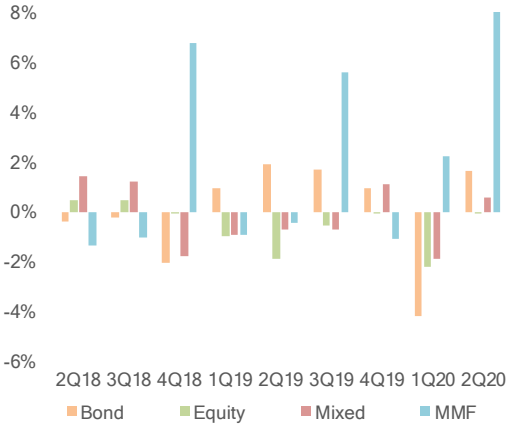
Key indicators

T.70
Asset by market segment
Large decline in March



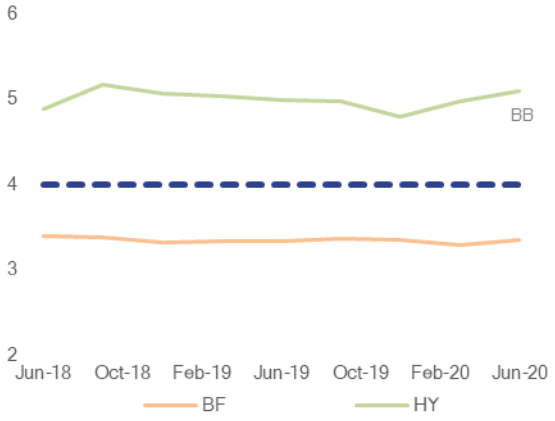
Note: AuM of EA funds by fund type, EUR tn. HF=Hedge funds.
Sources: ECB, ESMA.

T.71
Fund flows by fund type
Significant outflows in 1Q20



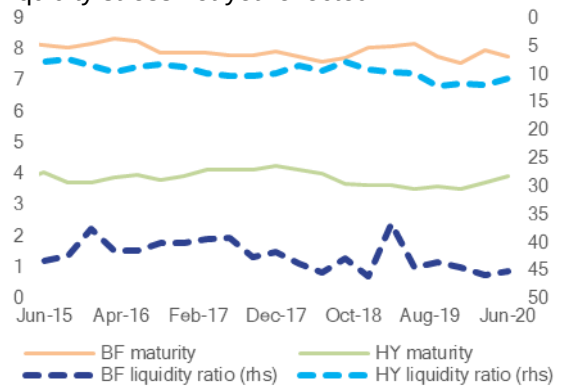
Note: EU-domiciled funds' quarterly flows, in % of NAV.
Sources: Refinitv Lipper, ESMA.

T.72
Credit risk
Risk still stable for IG and HY bond funds



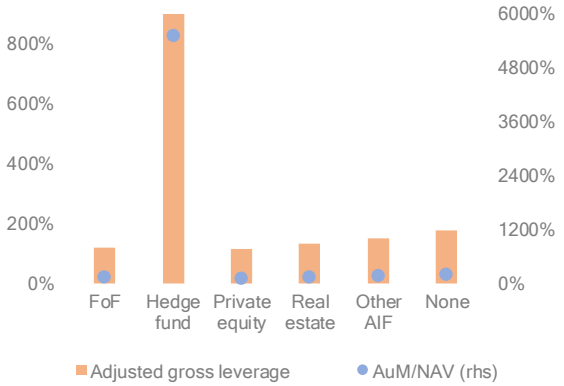
Note: Average credit quality (S&P ratings; 1= AAA; 4= BBB; 10 = D).
Sources: Thomson Reuters Lipper, ESMA.

T.73
Maturity and liquidity risk profile
Liquidity stress not yet reflected



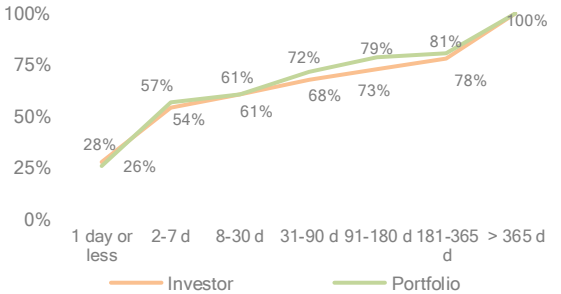
Note: Effective average maturity of fund assets in years; ESMA liquidity ratio (rhs, in reverse order).
Sources: Thomson Reuters Lipper, ESMA.

T.74
AIF "leverage"
Leverage concentrated in hedge funds



Note: Adjusted gross leverage of AIFs managed and/or marketed by authorised EU AIFMs, end of 2018, in % of NAV. Adjusted gross leverage does not include IRDs. FoF= Fund of funds, None=No predominant type. Data for 25 EEA countries.
Sources: AIFMD database, National competent authorities, ESMA.

T.75
AIF liquidity profile
No significant liquidity mismatches



Note: Portfolio and investor liquidity profiles of AIFs managed and/or marketed by authorised EU AIFMs, end of 2018. Portfolio profile determined by percentage of the funds' portfolios capable of being liquidated within each specified period, investor liquidity profile depend on shortest period within each fund could be withdrawn or investors could receive redemption payments. EU and non-EU AIFs by authorised EU AIFMs marketed, respectively, w/ and w/o passport. d= Days. Data for 25 EEA countries.
Sources: AIFMD database, National Competent Authorities, ESMA.

Market trends and risk

Consumers

Trends

The strong negative impact of the COVID-19 pandemic on both the real economy and financial markets has affected retail and institutional investors. Investor confidence fell sharply from March 2020 onwards owing to the pandemic, and the performance of typical retail investor instruments, such as EU UCITS funds, declined to historical lows. Despite improvements in 2Q20, annual performance remained close to zero at the end of the reporting period . Complaints in relation to financial instruments remained steady.

Risk status		Risk drivers
Risk level		– Short-term: drop in investment performance owing to COVID-19 market impacts
Outlook		– Longer term: low participation in long-term investments, linked to a lack of financial literacy and limited transparency around some products

COVID-19 hit consumers and retail investors

Household resources have been significantly hit by the economic impact of the COVID-19 pandemic with a 4% decline in the value of household assets, while liabilities remained stable, resulting in a sharp decline in the **asset to liabilities ratio** in 1Q20 (-3%).

Consumer confidence in current market conditions fell massively to historical lows in 1H20. Thus, the dynamics of **investor sentiment** for both retail and institutional investors mirrored the significant negative impact of the crisis and the increasing uncertainty of financial and real economic prospects. Retail investor expectations over a 10 year horizon were less strongly affected, although they remained below those of institutional investors. Sentiment indicators regarding the future significantly dropped at the end of 1Q20 for institutional and retail investors (T.79); however they started to rebound in April, and reached a five-year high for retail investors in June.

The distribution of **household financial assets** (A.154) remained focused on traditional saving channels as households continued to channel savings towards bank deposits. Direct investment in the financial markets or in riskier assets, such as equities, remained contained at an aggregate level. However, the sharp drop in valuations and the surge in volatility following the pandemic corresponded to increases in stock buying and volume traded for retail investors in the period between February and the beginning of March (e.g. FR, BE), with significant differences in behaviour according to the age group or frequency of investment. [28]

Net flows into deposits by households reached their highest share of disposable income in ten years, reaching 5.8% in 1Q20. Households net purchase of equity and funds shares increased to 1.6% of disposable income in 1Q20, while households reduced their exposures to debt securities. (A.156).

The **distribution of products to consumers** varies geographically. Reasons for this heterogeneity may include differences in consumer preferences, industry and regulatory differences, different cost treatments, and

[28] AMF, "Retail investor behaviour during the COVID-19 crisis", April 2020, and Financial Services and Markets Authority, "Belgians trade up to five times as many shares during the coronavirus crisis", May 2020..

variability in investor risk aversion, trust and financial literacy.

Retail funds: sharp drop in net flows and performance

Performance for retail investors declined significantly in 1Q20 but slightly improved in 2Q20. Annual average gross returns on a stylised retail investor portfolio dropped to -0.5% in March 2020 from 1.1% in December 2019 (T.80), to reach an annual performance close to zero in June.

Focusing on **retail investment funds,** UCITS funds continue to represent the largest segment in the EU. At the end of 1H20, the value of retail assets invested in these products amounted to around EUR 4tn, 90% of which was concentrated in equity, bond and mixed funds,. This followed the sharp drop in 1Q20 to EUR 3.4tn, which was related to the overall decline in valuations during the market turmoil.

Gross annual performance for EU UCITS dropped to -5.9% in 1Q20 (from +15.9% in 4Q19) and then recovered in 2Q20 (+1.5%) but remained at very low levels (T.81). Dispersion across member states strongly declined in 1Q20, given that the source of the shock was exogenous and affected financial and economic performance across countries (A.163). Negative performance was also notable for funds identified as potential closet indexing funds (Box T.76).[29]

EU equity UCITS annual gross performance reached +1.3% in 2Q20, after -11.7% in 1Q20 (compared with +25.9% in 4Q19). For bond and mixed funds performance remained negative. For bonds, annual gross performance was just below zero in 2Q20 following -3.8% in 1Q20 and +6.7% in 4Q19. Mixed UCITS annual gross performance, also remained negative, despite an increase from -6.9% in 1Q20 to -1.1% in 2Q20. The net performance of funds and thus the net value of investor portfolios were largely driven by market developments, as cost levels are much more stable than returns.[30]

Negative fund performance and investor confidence at historically low levels in 1Q20 had an impact on **fund flows**. For retail investors, UCITS focusing on bonds registered the strongest drop in flows, even if there were net inflows, from EUR 104bn in 4Q19 to EUR 59bn in 1Q20. In 2Q20, net inflows into bond funds increased to EUR 157bn. Outflows for retail EU equity UCITS continued at around EUR -32bn in 1H20. Mixed UCITS had outflows of EUR -2bn in 1Q20, and net inflows of EUR 7bn in 2Q20 (T.82).

When analysing UCITS performance **by management type**, if both retail and institutional investors are considered, equity UCITS experienced a broad decline in gross annual performance in 1Q20 with UCITS equity ETFs gross performance being at -11.3% followed by equity active and passive UCITS, both at -10.4%. However, performance improved in the 2Q20 with gross performance turning positive, +2.8% for active funds followed by passive funds (+1.6%) and ETFs (0.8%). Costs remained broadly stable with highest cost levels for active equity UCITS. Overall, net annual performance in 1Q20 was strongly negative (A.168) for both passive equity UCITS (-11%) and active and ETF equity UCITS (-12%). In 2Q20, net performance stood at 1.2% for both active and passive funds (A.168).

Net flows in equity UCITS differed widely by management type, as ETFs saw more inflows than other funds. In 1Q20, passive equity UCITS net flows declined to EUR 18bn from EUR 23bn in 4Q19; active UCITS declined to EUR -57bn from -45bn and for ETF equity UCITS to EUR 31bn from EUR 48bn. In 2Q20, trends continued with a slowdown in inflows for passive funds, and further outflows for active funds while ETFs recorded high inflows (T.83).

T.76

Closet Indexing

Identifying potential CI funds

Closet indexing (CI) refers to the situation in which asset managers claim to manage their funds in an active manner while in fact tracking or staying close to a benchmark index passively managing the fund. An economic incentive to do so is that fees for funds with an active mandate tend to be higher than those for passive funds.

Joint supervisory and analytical work has been carried out by ESMA and in several EU Member States, to ensure investor protection and to guarantee a fair treatment especially in terms of fees charged to investors.

[29] See also the article “Costs and performance of potential closet index funds”, p.93-102.

[30] ESMA, ASR on Performance and Costs of Retail Investment Products, 2020.

Analytical and supervisory work

The following actions have been taken so far at the ESMA level:

- The UCITS Key Investor Information Document (KIID) Regulation foresees disclosures obligations for past performance (Article 18(1)) and benchmark (Article 7(1)d).
- In February 2016, ESMA issued a statement informing stakeholders of the potential to be a CI for some equity UCITS. To confirm potential CI strategies, however, identified practices went through further supervisory scrutiny.
- Following this statement, ESMA has increased coordination with national competent authorities (NCAs) and has also assigned specific investigations to NCAs to determine the potential extent of closet indexing at the national level.
- In June 2018 and January 2020, two ESMA workshops took place to continue this coordination and enhance supervisory convergence by facilitating the exchange of insights and good practices amongst peers.
- In March 2019, ESMA updated its Questions and Answers (Q&As) regarding the application of the UCITS Directive.

All the above highlights ESMA's sustained commitment to addressing this risk. While continuing to play a role in coordinating NCAs practices and enhancing supervisory convergence, ESMA is complementing these measures with further analytical work.

ESMA Closet Index Indicator (CII)

In line with the criteria published in 2016, ESMA has developed an indicator aiming to identify UCITS exhibiting patterns that are potentially associated with CI. This is different from the risk article on closet index following this publication. The article focuses on a better understanding of the relationship between closet index practice and the costs and performance of EU-domiciled funds rather than on the identification of potential closet indexers.

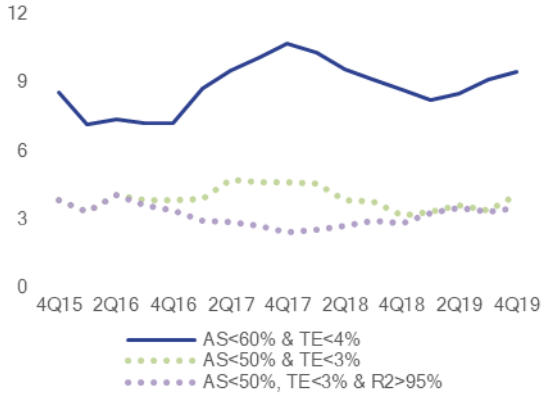
The confirmation of funds actually engaging in CI strategies can only be fully established when combined with supervisory scrutiny.

The ESMA CII focuses on UCITS EU-domiciled equity funds not categorised as index-tracking UCITS and having management fees greater than 0.65% of the NAV of the fund. The sample used is composed of close to 2,000 equity UCITS domiciled in the EU, with funds potentially changing over time. The same set of criteria identified in the ESMA statement of 2016 has been followed by the results reported in T.77.

T.77

ESMA CII

Variable CI patterns, increase in 2019



Note: EU active equity UCITS share of potential closet index (CI) within our sample. Share of total, %. Potential CI based on three criteria: Active Share (AS) < 60% and Tracking Error (TE) < 4%; AS < 50% and TE < 3%; AS < 50% and TE < 3% and R-squared (R2) > 95%.
Sources: Morningstar Direct, ESMA.

Focusing on the criterion based on AS<60% and TE<4%, during 2019 an increase in the share of funds exhibiting patterns potentially associated with CI practices can be observed. However, it remained below the highest levels reached at the end of 2017 at 11%. In 4Q19 the maximum share of CI over the total number of funds reaches 9% of funds when applying a criterion of active share (AS) <60% and tracking error (TE) <4% (blue line). Considering the other two criteria, the maximum is at 5% for AS<50% and TE<3% and 4% for AS<50%, TE<3% and R2>0.95.

Consumer complaints: overall volumes steady

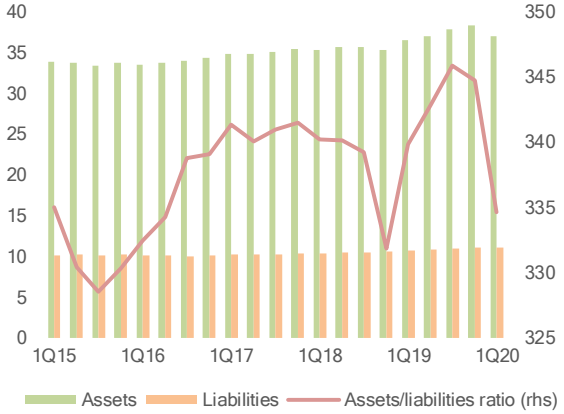
Among NCAs reporting data quarterly, **complaints** in connection with financial instruments – reported via firms as well as directly by consumers to NCAs – remained steady (A.169) and close to the 2 year average. Interpreting trends here requires an understanding not only of recent events but also of data limitations – such as significant time lags – and heterogeneity between countries.

Relatively high levels of complaints around contracts for differences (CFDs) persisted in 1Q20. However, the data do not include some major retail CFD markets (e.g. NL, PL) and only a limited number of complaints can be categorised by financial instrument. Among complaints with a breakdown by financial instrument, those regarding funds rose to 20% of the total in 4Q19 before dropping back to 12% in

1Q20. Complaints concerning equities rose 5pps in 1Q20 to 27% of the total, possibly reflecting turbulent conditions in March 2020 (A.172). The most common MiFID service associated with complaints in 1Q20 was the execution of orders (75%). The leading causes were general admin (46%), fees/charges (18%) and poor information (15%) (A.173-A.171).

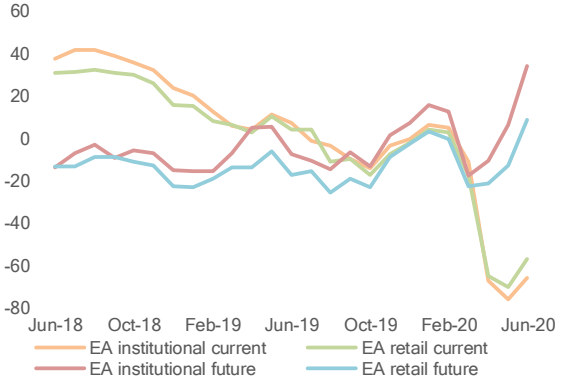
Key indicators

T.78
Asset to liabilities ratio
Sharp decline



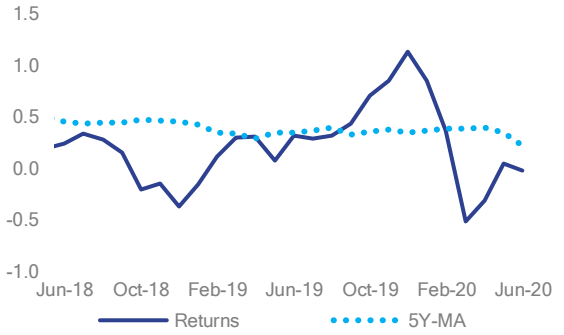
Note: Financial assets and liabilities of EU28 households, EUR tn. Assets/liabilities ratio in %.
Sources: ECB, ESMA.

T.79
Market sentiment
Current sentiment fell to historical lows in 1Q20



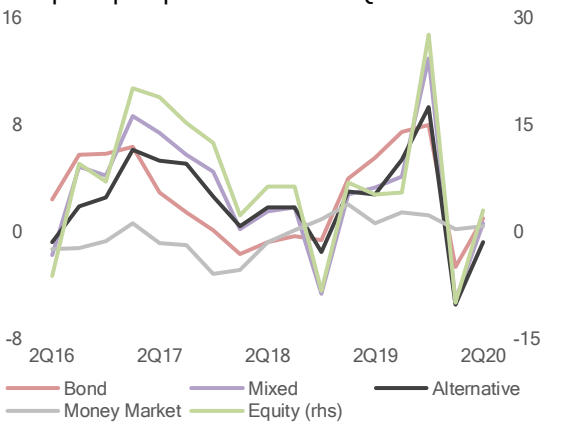
Note: Sentix Sentiment Indicators for the EA retail and institutional investors on a ten-year horizon. The zero benchmark is a risk-neutral position.
Sources: Refinitiv Datastream, ESMA.

T.80
Portfolio returns
Rebound in April following steep decline



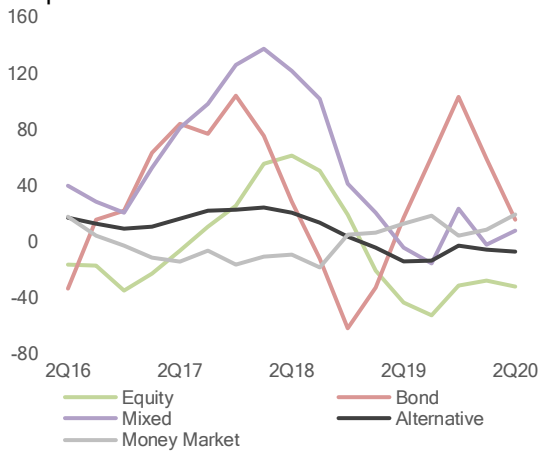
Note: Annual average gross returns for a stylised household portfolio, in %. Asset weights, computed using ECB Financial Accounts by Institutional Sectors, are 37% for collective investment schemes (of which 12% mutual funds and 25% insurance and pension funds), 31% for deposits, 22% for equity, 7% debt securities and 3% for other assets. Costs, fees and other charges incurred for buying, holding or selling these instruments are not taken into account.
Sources: Refinitiv Datastream, Refinitiv Lipper, ECB, ESMA.

T.81
UCITS annual performance by asset class
Sharp drop in performance in1Q20



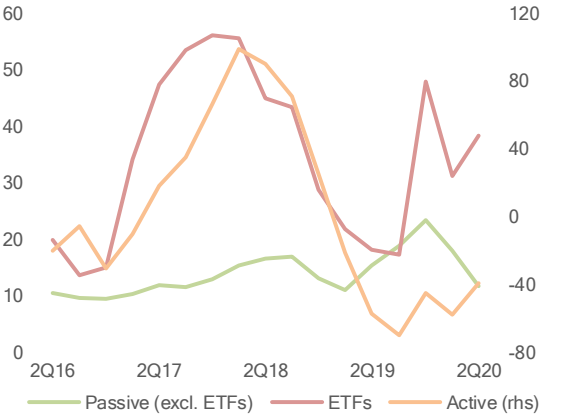
Note: EU-27 UCITS evolution of gross annual performance, retail investors, by assets class, %. Equity on the right hand side.
Sources: Refinitiv Lipper, ESMA.

T.82
Annual net flows by asset class
Drop in flows across asset classes



Note: EU-27 UCITS annual netflows, retail investors, by assets class.
Sources: Refinitiv Lipper, ESMA.

T.83
Annual net flows by management type
Rebound for ETFs



Note: EU equity UCITS annual net flows at quarterly frequencies, by management type, EUR bn. Active right-hand size (rhs) axis.
Sources: Refinitiv Lipper, ESMA.

Structural developments

Market-based finance

Trends

The COVID-19 turmoil has also had a strong impact on primary markets. During the period of acute market stress, primary issuance practically came to a standstill for equity and bonds. In the equity space, only incumbent firms were able to tap markets through follow-on issuance in March. Bond issuance rebounded from early April onwards, first in the investment-grade segment, followed in May by lower-rated issuers. However, small and medium-sized enterprises (SMEs) remain at risk of facing financing gaps.

Corporate financing: incumbents versus new firms

The key priority of the Capital Market Union agenda is to ease access to finance for EU companies, including SMEs. Well-functioning capital markets are also fundamental in times of crisis as they offer alternative sources of finance to businesses.

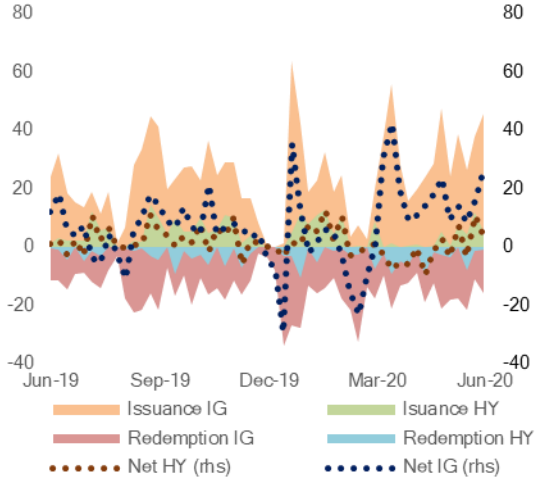
Market financing of EA NFCs declined by around -11% compared with one year earlier (T.87). Bank lending increased by almost 10% with respect to the previous quarter. This is a reversal of the trend observed for NFC financing in previous years, which saw market financing overall record solid growth rates overall and the share of bank lending decreased. The 2020 developments can largely be explained by the COVID-19 impacts, as the increase in bank loans is linked to government guarantee schemes for new loans, which are granted by financial institutions to NFCs so that they can support their businesses throughout the crisis.

During the acute phase of the crisis, **primary equity markets** practically came to a standstill as low liquidity and high volatility raised the cost of equity, preventing companies from raising new capital. Activity in the **Initial Public Offerings (IPOs)** also remained subdued from April onwards. Overall, only 15 new IPOs launched from January to April, amounting to a total of EUR 1bn (T.88). In contrast, firms that were already public managed to raise capital through **follow-on issuance**. Secondary equity offerings amounted to approximately EUR 35bn in 1H20, a 34% increase compared with 1H19. Around half of the issuance in March and April was directly related to the impact of COVID-19, as firms raised cash for debt repayment, working capital or for M&As.[31] In May and June, IPO issuance recovered to pre-crisis levels.

Similar developments were observed in corporate bond markets. **Corporate bond issuance** was very low in March for IG and HY issuers. However, with the improvement in financial conditions, IG issuance surged first, reaching record highs at the beginning of April with more than EUR 100bn of total volume issued in two weeks. Overall, the second quarter of 2020 saw the highest issuance in IG bonds (more than EUR 300bn) since 2008. Total issuance in IG bonds has been dominated by AA and BBB-rated securities (T.84). HY issuance followed in May and June with issuers able to raise cash through bond offerings.

[31] See Association for Financial Markets in Europe, "Initial Impact of COVID-19 on European Capital Markets", April 2020.

T.84
Corporate bond Issuance
Surge in IG issuance in 2Q20



Note: Weekly gross (lhs) and net (rhs) issuance and redemption of corporate bonds in the EEA31 by bond grade, EUR bn.
Sources: Refinitiv EIKON, ESMA

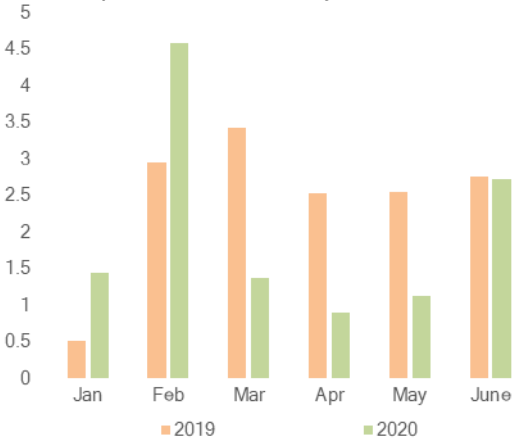
Issuance activity remained subdued in April for HY issuers as investors opted for IG issuers over HY. Net HY issuance was negative for most of the second half of 2020, with only EUR 77bn of volumes issued since 1 January. This reflects concerns about rising default rates and the deterioration of credit quality of lower rated corporations. However, since May HY issuance has picked up.

The bifurcation between highly rated firms, able to issue bonds and equity, and riskier firms all but shut out from capital markets in March and April could raise medium term issues if it were to reoccur in the future. Cash-strapped firms are more likely to default, with losses for creditors, and negative impacts on employment which could slow down the economic recovery.

Securitisation: decline in issuance

The **CLO** market was under significant pressure during the pandemic among credit deterioration and asset scarcity. According to J.P. Morgan data, total CLO issuance in the EU amounts to a total of EUR 6.6 bn in the first four months of 2020, EUR 3bn less than the total recorded for the same period last year (T.85). The fast-growing trend of CLO issuance was interrupted in March, with issuance declining by 60% with respect to the previous month and continuing to evolve at low levels in April and May. The trend reversed in June, when CLO issuance picked up and returned to levels observed during 2019.

T.85
CLO Issuance
60% drop between February and March



Note: EU CLO issuance, in EUR bn
Sources: JP Morgan, ESMA

Linked to credit concerns, **securitisation** activity decreased with volumes of around EUR 30bn in 1Q20, 6% less than 1Q19 and 48% less than 1Q18.[32] Most of the issuance occurred privately because of low liquidity in public markets. This is reflected in the number of simple, transparent and standardised (STS) notifications to ESMA. Out of the 127 STS notifications in 2020, more than 75% occurred in private transactions.

SMEs: funding shortfall

Cash flows are vital for small and medium sized firms to sustain their business, therefore lack of liquidity is only sustainable at very short horizons. For this reason, SMEs need to heavily rely on sources of **external financing**. Before the COVID-19 pandemic, EU SMEs had reported that access to external funds had been more difficult because of the rising macroeconomic uncertainty and their weakening financial situation.[33] According to the 2020 ECB survey on access to finance of enterprises (SAFE), in March 2020, SMEs external financing gap became positive for the first time since 2015.

The impact of COVID-19 on EU SMEs has been dramatic. As national governments began to impose containment measures, SMEs operations and revenues came to a halt. At the initial stage

[32] See AFME Securitisation Data Snapshot: Q1 2020

[33] See Survey on the Access to Finance of Enterprises.

of the crisis, the main concerns were addressed to ensure adequate business continuity and keep operations alive.

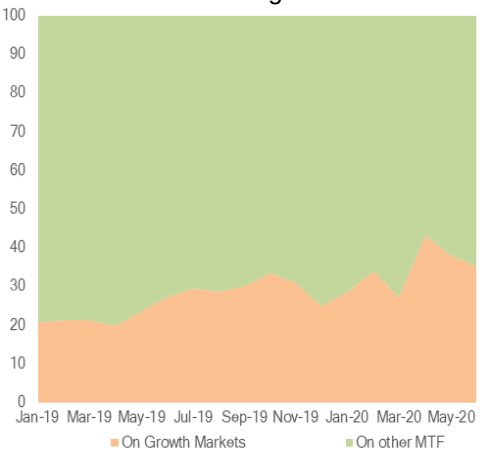
Overall, reliance on credit lines or bank loans remained large throughout the crisis, and only a small share of SMEs actually benefited from equity markets as a source of external financing. Unlike larger companies, SMEs struggle to raise funds in capital markets and the securities they issue are most often not eligible for central banks' purchases.[34] Therefore, part of the increased reliance on bank funding relates to access to support measures by governments such as loan guarantees, which are intermediated by the banking system. In that context, the **equity external financing gap** has increased, pointing to SMEs facing challenges in raising equity capital. According to the ECB's survey, SMEs are also expecting increasing difficulties in accessing credit lines and bank overdrafts going forward.

In the context of the pandemic, transparency data reported by EU trading venues under MiFID II show that 7,000 SMEs had issued shares available for trading in the EU as of the first half of 2020[35]. Around the same level was observed in 2Q19. However, only five new small issuers and one medium issuers were admitted as of 2Q20.

Despite the current crisis, SME shares' secondary market liquidity slightly improved, as around 75% of instruments were traded at least once a month (A.185), compared with 72% last year. However, this still represents one of the major challenges for SME issuers.

SME trading volumes increased to an average of EUR 12bn per month in 1Q20 from EUR 8bn in 1Q19. This accounts for 0.5% of trading volumes in the EU (T.81). Notably, the share of SME trading in March dropped to less than 0.4% of the total in the EU. Out of this, the combined volumes of the active 17 SME growth markets (GMs) increased to EUR 4bn from EUR 1.6bn one year before. Therefore, the volume of SME shares traded in GM represents 30% of total SME trading in the EU (T.86).[36] After a stabilisation at low levels in May, SME trading volumes spiked again in June to EUR 12.8bn. In the same period, the share of trades on SME GMs remained high at 35% of total SME trading (EUR 4.5bn in June).

T.86
Monthly trading volumes of SME shares
Increase in SME trading on GMs



Note: Share of monthly trading volumes on growth markets of small and medium entities that have issued shares publicly available for trading in the EU (lhs, in %). SME categories based on market capitalisation: small cap = less than EUR 20mn; medium cap = from 20mn to 200mn.
Sources: FIRDS, FITRS, ESMA

Market-based credit intermediation

MMFs, investment funds, financial vehicle corporations (FVCs) and other **financial institutions** (OFIs) represent a wide range of institutions that can potentially engage in credit intermediation, liquidity and maturity transformation. In 4Q19 this group accounted for EUR36tn in total assets, which was stable compared with 2018. Other OFIs represent 52% of this group (T.91). These are challenging to monitor, as they have varying levels of engagement in credit intermediation.

Non-bank financial entities are an important source of **wholesale funding** for the banking sector, which increased in 2019 across funding sources (8.5% year on year) (T.90). This was primarily driven by the rise in OFI deposits (7.7%) and the substantial increase in MMF debt securities (12.8%). While this contributes to the diversification of bank funding, it also highlights,

[34] See https://www.bis.org/fsi/fsibriefs5.pdf.

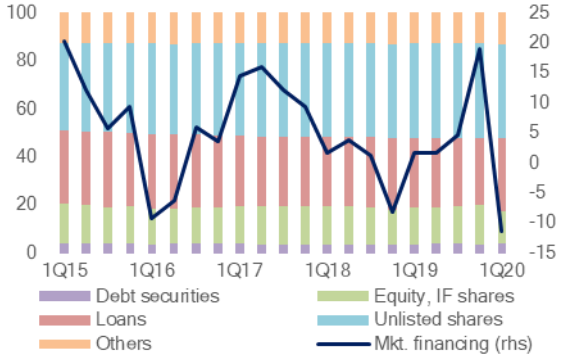
[35] In our methodology, the classification of SME issuers here is based on market capitalisation reported in 2018. Only share issuers with a valid LEI for which the market capitalisation meets the relevant MiFID II conditions have been considered SMEs here, so this estimate may understate the actual number of SME issuers.

[36] MiFID II/MiFIR introduces the possibility for operators of multilateral trading facilities (MTFs) or MTF segments to be registered as an SME growth market provided that 50% of the issuers with shares available for trading on the relevant segment have a market capitalisation of less than EUR 200mn. GMs provide for lighter reporting burdens and reduced compliance costs. As of April 2020, there are 17 growth markets out of 223 registered MTFs.

from a financial stability perspective, the importance of the new rules on MMFs, considering their role in the funding of the banking sector.

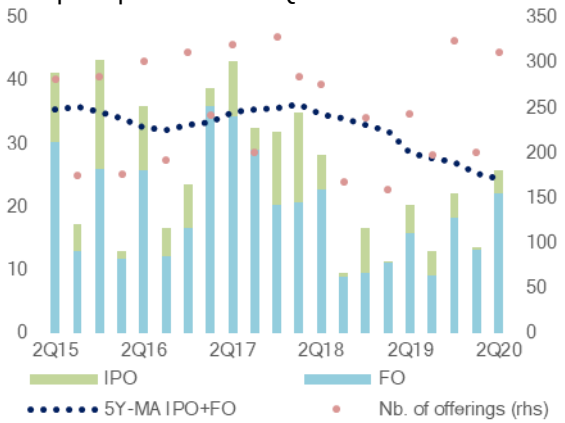
Key indicators

T.87
Market financing
Decline in 1Q20



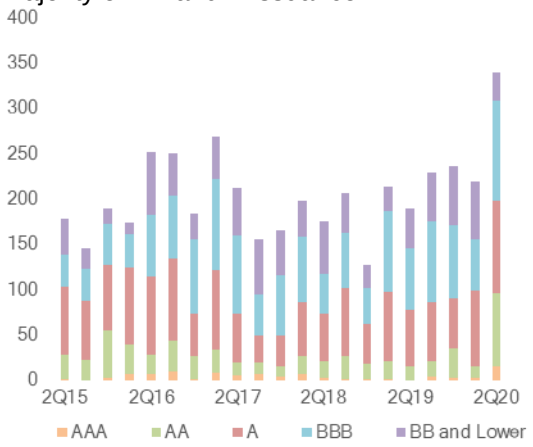
Note: Liabilities of EA non-financial corporations (NFC), by debt type as a share of total liabilities. Others include: financial derivatives and employee stock options; insurance, pensions and standardised guarantee schemes; trade credits and advances of NFC; other accounts receivable/payable. Mkt. financing (rhs)= annual growth rate in debt securities, equity and investment fund (IF) shares, in %.
Sources: ECB, ESMA.

T.88
Equity issuance
Sharp drop in IPOs in 1Q20



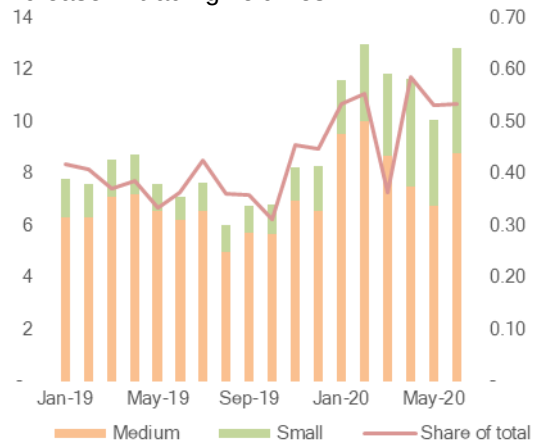
Note: Equity gross issuance in the EEA30 by type, EUR bn, and number of equity offerings. 5Y-MA=five-year moving average of the total value of equity offerings.
Sources: Refinitiv EIKON, ESMA.

T.89
Corporate bond issuance
Majority of AA and A issuance



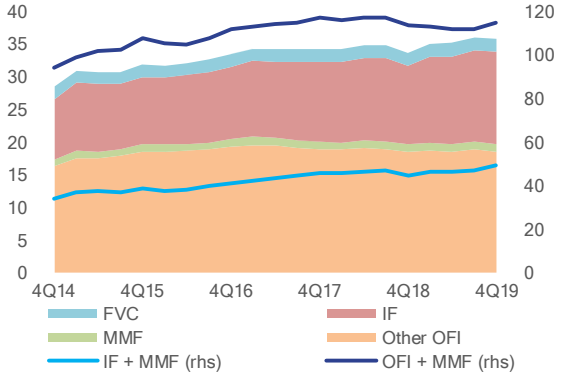
Note: Quarterly corporate bond gross issuance in the EEA30 by credit rating, EUR bn.
Sources: Refinitive Eikon, ESMA

T.90
SME trading volumes
Increase in trading volumes



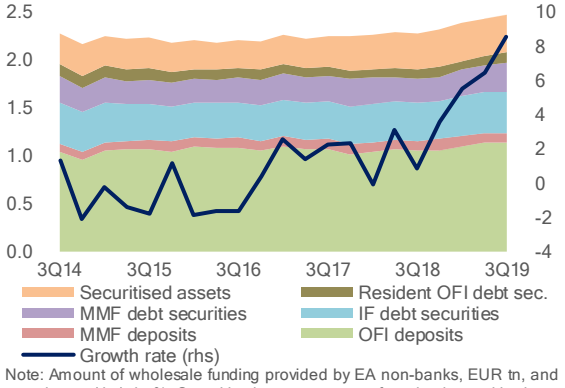
Note: Monthly trading volumes of SME shares in 2019, EUR billion, and % share in total equity trading. "Small"=(0,20mn], "Medium"=(20mn, 200mn].
Sources: FIRDS, FITRS, ESMA

T.91
MMFs and other financial institutions
Increase driven by investment funds



Note: Total assets for EA MMFs and other financial institutions (OFI): investment funds (IF), financial vehicle corporations (FVC), Other OFI estimated with ECB Quarterly Sector Accounts, in EUR tn. Expressed in % of bank assets on rhs.
Sources: ECB, ESMA.

T.92
Non-bank wholesale funding
OFI deposits and MMFs drive the growth



Note: Amount of wholesale funding provided by EA non-banks, EUR tn, and growth rate (rhs), in %. Securitised assets are net of retained securitisations. Resident OFI reflects the difference between the total financial sector and the known sub-sectors within the statistical financial accounts (i.e. assets from banking sector, insurances, pension funds, financial vehicle corporations, investment funds and money market funds).
Sources: ECB, ESMA.

Structural developments

Sustainable finance

Trends

Environmental, Social and Governance (ESG)-oriented assets such as benchmark equity indices and funds have outperformed their non-ESG peers again in the first half of 2020 (1H20). Investors' appetite for ESG funds remained high with net inflows in 1H20 compared with large net outflows for the rest of the equity fund industry. The green bond market continued to expand even as some agency and supranational issuers shifted their focus to social bonds to tackle the socio-economic consequences of COVID-19. Green bond liquidity is improving despite a deterioration in corporate bid ask spreads in March and April, in line with broader bond market developments.

Environmental, social and governance investments

The full implications of the COVID-19 crisis for the development of sustainable finance are complex and will take years to play out. Still, some of the early effects on environment-related issues have already become evident, namely on the policy agenda and on greenhouse gas emissions.

The urgency of the situation has led policymakers to focus on measures aimed at preserving financial stability and supporting the economy. However, a vivid debate has taken place in Europe on the need to consider environmental objectives as part of the policy package, in both the monetary[37] and the fiscal space. Compared with previous crises, this shows that sustainability-related concerns have made clear inroads into the public agenda.

Meanwhile, the unprecedented lockdown measures imposed by many governments had had a major positive externality. The decline in economic activity and restrictions on population movement have led to a sharp drop in energy demand, and global CO2 emissions are now forecast to decline by 8% in 2020.[38] The fact that global emissions need to decrease by 7.6% every year for the next decade so that we can reach the 1.5°C Paris Agreement target highlights the scale of the challenges ahead.[39] To step up to this challenge, the development of sustainable finance as a means to accelerate the transition to a green economy appears all the more critical. The ability of markets to innovate could prove a decisive factor, as exemplified by a flurry of social bond issuances in response to COVID-related healthcare issues (see Box T.93). However, a pivotal change is only likely to take place once adequate market incentives are in place.

In this context, the resilience of ESG assets has come into focus, with several noteworthy developments in equity markets. First, ESG equity indices have shown resilience during the crisis: As of end-June, gross annual returns for the MSCI World ESG Leaders index and EuroStoxx ESG Leaders 50 were 350 bps and 450 bps respectively above their non-ESG peers (T.106). Second, 54% of ESG-oriented funds (most of which invest in equities) outperformed their technical benchmark in 1Q20 compared with 44% of conventional funds, with a 100 bps differential in the average gross returns of the two cohorts.[40] ESG fund outperformance appears to have been sustained in the second quarter.[41]

This resilience can be explained to an extent by sectoral developments. Fossil-fuel producers have suffered from the oil price crash while the

[37] See for example C. Lagarde speech, 27 February 2020, "Climate change and the financial sector":

[38] International Energy Agency, "Global Energy Review 2020"

[39] United Nations Environment Program (UNEP), "Emissions Gap Report 2019"

[40] See http://lipperalpha.refinitiv.com/2020/04/monday-morning-memo-are-esg-funds-outperformers-during-the-corona-crisis/

[41] See https://www.morningstar.com/articles/991091/sustainable-stock-funds-held-their-own-in-second-quarter-rally

lockdown had an outsized impact on energy-dependent sectors such as transportation. Meanwhile, technology and healthcare companies saw demand for their products soar, while they tend to be overrepresented in ESG indices and portfolios.

However, this does not entirely explain the differential or the consistent outperformance of ESG indices over the last few years. Other explanations put forward by market observers include the capacity of ESG leaders to innovate, prudent risk management, long-term targets and flexible internal policies (e.g. teleworking), making these companies generally better equipped for the new situation.

T.93
Social bonds
Promising market growth

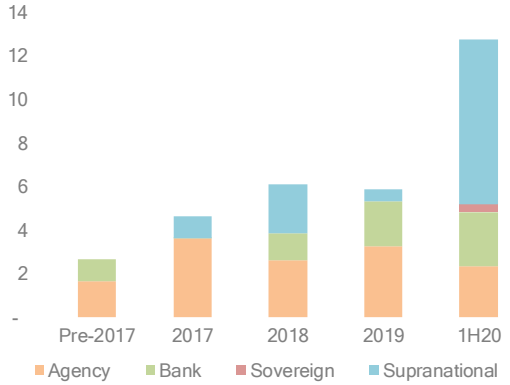
Social bonds are financial instruments that have their proceeds earmarked for financing eligible social projects. Their aim is to address global social challenges and offer investors the chance to diversify their portfolio in accordance to personal values. The International Capital Market Association (ICMA) Social Bond Principles, linked to the UN Sustainable Development Goals, are the leading source in offering a roadmap of social issues to be addressed and include areas such as essential services, socio-economic advancement, or employment (including through SME financing and microfinance).[42]

According to the Principles, the social bond market includes not only standard bonds with a social use of proceeds, social securitised bonds and covered bonds, but also social impact bonds (SIBs), which can be described as futures contracts fixed on social outcomes.

Growing interest in social bonds

Based on data compiled from various sources,[43] we estimate that the total volume of social bonds outstanding reached around EUR 33bn by mid- 2020,[44] or around 10% of the EU green bond market. Issuance soared in 2020, a reflection of social bonds' relevance in the era of COVID-19 (T.94). Indeed, the recent turmoil has not only increased the need to promote investment in healthcare but has also further highlighted general social issues such as inequality or worker protection. This could help focus efforts on social issues, spurring increased attention to social bonds from both investors and issuers.

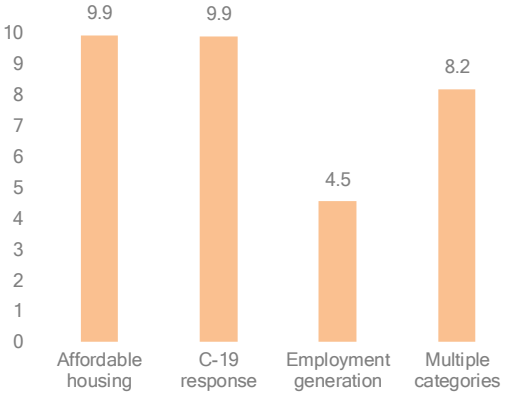
T.94
Gross social bond issuance
Large volumes from supranationals in 1H20



Note: Gross social bond issuance volumes available for trading in the EEA by issuer type, EUR bn.
Sources: Borsa Italiana, ICMA, Euronext, Luxembourg Stock Exchange, NASDAQ OMX, Vienna Stock Exchange, FIRDS, ESMA.

According to ING, there were EUR 237bn in so-called pandemic bonds issued in 1H20[45] (including COVID-19 response bonds), but only 15% fall under a social or sustainability bond framework.[46]

T.95
Social bond financing by proceed allocation
Focus on affordable housing and COVID-19



Note: Social bond volumes outstanding in the EEA according to proceed allocation, EUR bn. Employment generation includes SME financing and microfinancing. 'Multiple categories' includes: access to essential services, affordable housing, affordable basic infrastructure, employment generation, food security, and socio-economic advancement and empowerment
Sources: Borsa Italiana Euronext, ICMA, Luxembourg Stock Exchange, NASDAQ OMX, Vienna Stock Exchange, FIRDS, ESMA.

Data collected from various European exchanges show that social bond issuance volumes from the public sector more than trebled from 2019 to EUR 25bn

[42] See https://www.icmagroup.org/green-social-and-sustainability-bonds/social-bond-principles-sbp/

[43] This includes bonds listed as "social bonds" on the Bourse Luxembourg, LSE, Vienna Stock Exchange and Euronext, and the ICMA social bond database.

[44] Owing to the absence of a central register and legal definition for social bonds, market estimates may vary.

[45] See https://think.ing.com/articles/sustainable-finance-green-bonds-fade-social-bonds-flare/

[46] According to the ICMA sustainability bond guidelines, sustainability bond proceeds can only be used for a combination of green and social projects. The difficulties in clearly identifying the framework under which COVID-19 bonds are issued mirror the prevailing challenges in the market to develop clear standards and boundaries between the sustainable bond categories.

during the first six months of 2020. The vast increase in supranational bond issuance highlights the key role of the public sector in tackling COVID-19 consequences through social finance. Aside from COVID-19 issues, social bonds also target affordable housing, employment generation (including through SME financing) and access to essential services (T.95).

Taxonomy and liquidity issues

Despite industry guidelines, social factors remain notably challenging to define because of the difficulties in assessing cause-evidence relationships between factors influencing social change and unclear definitions of social categories. Moreover, the absence of harmonised disclosure requirements on social issues and verification standards, including criteria against which social bonds can be assessed (in terms of effectiveness and proceed allocation), contribute to information asymmetry and disclosure risks. Concretely, this means that the allocation of social bond proceeds may not be aligned with investors' understanding.

Compared with other instruments used for social project financing such as fixed-term loans, social bonds offer the advantage of being tradable securities. This means that investors are not necessarily locked in for years, despite the typically long horizon of the projects being financed (most social bonds have a four to 15-year maturity), while bond prices react dynamically to market developments. However, given the small size of the market and low trading volumes, liquidity issues may prevent investors from selling these securities when they need to.

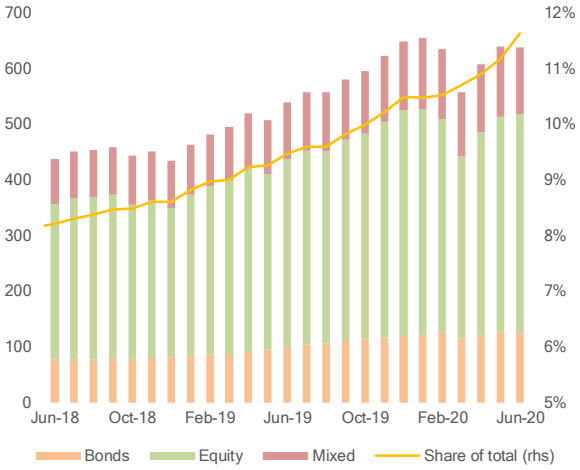
The specific characteristics of SIBs create further possible issues. SIBs involve at least three parties: a commissioner, a social service provider and an investor. The pay-out of return (and often the reimbursement of principal) to the investor is contingent upon achieving a pre-defined target. While this increases the likelihood of a positive impact on social issues, investors can face losses, compensated by higher potential returns. However, possible information asymmetries imply that investors may overestimate the probability of projects reaching their targets.

Social bonds are an innovative and promising way to provide necessary funding to social projects while offering investors the opportunity to align their investments with personal values. However, challenges from low liquidity, the absence of social taxonomy, and disclosure requirements may hamper the full market potential.

ESG funds and labels

The appeal of ESG assets during the crisis was further reflected in resilient investor appetite for ESG fund shares. EU-domiciled ESG equity funds attracted net inflows of EUR 14bn (2% of AuM) in 1H20, while other EU equity funds experienced net outflows of EUR 77bn. As a result, the share of ESG fund assets in the EU fund industry has grown continuously and reached 12% in June (T.96).

T.96
ESG fund AuM by fund type
Share of ESG funds continues to grow



Note: AuM of ESG funds by type of fund in EUR bn and share of ESG fund AuM over total fund AuM of equity, bond and mixed funds (rhs).
Sources: Morningstar, Refinitiv Lipper, ESMA.

The universe of ESG funds includes both ESG-labelled funds and non-labelled funds following ESG strategies. This covers funds that consider companies' ESG in their investment policy (through positive or negative screening), funds actively engaging with companies on sustainability-related matters, impact funds with predefined ESG metrics and targets, and specialised funds investing only in e.g. renewable energies or clean water assets.

Within labelled funds, a high degree of heterogeneity exists across EU countries due the absence of an EU-wide ESG label. ESG fund labels exist for example in Austria, France, Germany, and Luxembourg but rely on different criteria. In some EU countries, ESG labels do not exist. These country-specific situations raise consistency issues when funds are marketed beyond national borders.

For non-labelled funds, data providers rely primarily on fund documentation (prospectus, KIID, etc.). However, this does not provide any guarantee that the funds achieve their sustainability objectives, nor does it allow for the benchmarking of sustainability performance against objective criteria. This could result in misalignment between investors' sustainability goals and their investments.

To address these issues, several fund data providers have introduced portfolio-level ESG

ratings[47], which are based on the ESG rating of individual portfolio securities.[48] These fund ESG ratings can be useful to investors, in that they allow for greater comparability and transparency of funds' sustainability credentials and are based on an objective third-party assessment. However, fund ratings have their own limitations: they rely on purely quantitative criteria but ignore qualitative aspects such as fund manager's engagement with shareholders or companies; they rely on ESG ratings, which are generally viewed as inconsistent (see box T.97); and they create possible biases against non-rated companies.[49]

T.97
Sustainability ratings
Shortcomings of ESG ratings pose risks

Sustainability or ESG ratings are scores assessing entities on criteria related to ESG themes of relevance for business or society (or both). The concept covers a wide variety of ratings, as at present there is no legal definition of what constitutes an ESG rating.

When looking at the market one can broadly distinguish three main categories. Most ESG ratings try to capture the exposure of entities to ESG risks and the extent to which these risks are managed. A second category of ratings measures the impact that entities have on ESG factors, such as air pollution or gender (im)balance in key positions. The last type of ratings looks at very specific aspects, such as the degree of ESG disclosure, or their relevance for credit ratings. Not all ratings cover 'E', 'S' and 'G' factors; instead some focus on only one of the three. The object of ESG ratings is usually a private-sector or public-sector issuer rather than a financial instrument.

ESG ratings have become increasingly popular and receive a fair amount of attention from the media and academics, who often criticise the limited comparability of such ratings. For example, a study[50] finds that ESG ratings across five major ESG rating providers were only 60% correlated, compared with 99% for credit ratings from the three largest CRAs. This mainly reflects differences in measurement of variables and aggregation methodologies.

Adding to this problem is the lack of transparency of methodologies. To palliate ESG data gaps and consistency issues, some sustainability rating agencies rely on third-party providers or proprietary sources, meaning that some of the data and assumptions underlying ESG ratings are not freely accessible by investors.

A third problem is the difference between relative ratings (positioning entities among their sector peers) and absolute ratings (comparing all rated entities on the same scale). Unclarity about this distinction can leave investors wondering why for example oil companies can receive higher ratings than firms that are active in cleaner industries.

Such differences in the definition, scope and methodology used by ESG rating providers cause confusion among investors.

ESG rating industry risks

These issues have important implications. Firms and industries may exploit them to create an image that does not match reality (greenwashing or socialwashing), thus misleading investors. Mispricing of climate risk within asset prices may have financial stability effects if sudden corrections were to take place. Misallocation of capital due to confusion or incorrect information could also hinder the transition to a low-carbon economy.

Another source of concern is the structure of the ESG rating market. Over the last few years there has been a significant trend of consolidation through mergers and acquisitions, the latter occurring primarily by established CRAs, benchmark administrators and data vendors buying specialised firms. No data on market share are available today but the emergence of key players is becoming evident. This may help reduce heterogeneity to some extent and arguably raise standards in the ESG rating industry. However, in the medium-term the risk is to create an oligopoly situation, which could be harmful to investors.

The shortcomings of ESG ratings have implications not only for investor protection and financial stability, but also for sustainable development in the long run owing to mispricing of environmental risk and a suboptimal allocation of resources. Inconsistent ratings lead to issues down the ESG investment value chain. Investment misallocation is likely to take place, either unintentionally through the composition of ESG-rating based indices, or intentionally from greenwashing and product mis-selling. A significant risk that these shortcomings pose is the potential rejection of sustainability-driven investment principles, should widespread disbelief in ESG ratings take hold.

Nonetheless, fund ESG ratings remain the next-best option after labelling, and a clear step up from the complete absence of information. There

[47] Morningstar introduced portfolio sustainability ratings in 2016. MSCI launched its own fund ESG ratings in 2019, followed by Refinitiv in 2020.

[48] Fund ESG ratings involve two main steps: for each fund a portfolio score is calculated as an asset-weighted average of the ESG ratings of individual securities portfolio holdings; fund ratings are then assigned by comparing each fund's portfolio score with the average score of funds with similar investment strategies (e.g. European large caps).

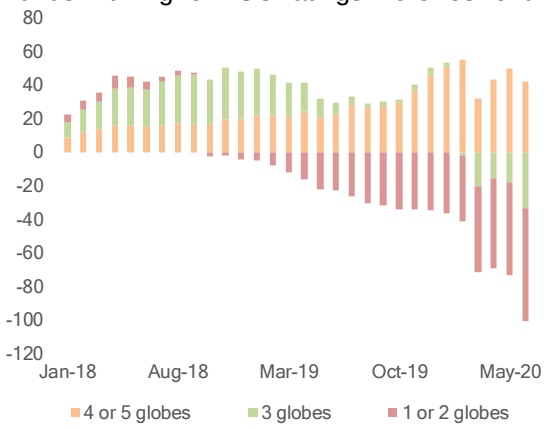
[49] In order for funds to receive a portfolio ESG rating, the data providers require that at least two thirds of their portfolio AuM have an ESG rating. This creates a bias in favour of companies that have the means to develop ESG performance indicators and disclose relevant public information that feeds into these ratings.

[50] Berg et al. (2019), "Aggregate confusion: The divergence in ESG ratings", MIT Sloan Research Paper No. 5822-19

also appears to be a degree of overlap between funds claiming to pursue sustainable strategies and funds with high ESG ratings: according to Morningstar, out of the roughly 2,000 ESG funds in the EU that have an ESG rating, around 65% were rated "High" or "Above average". This compares with 37% for non-ESG funds with an ESG rating, which also highlights that a number of funds still receive a favourable rating for non-ESG related reasons (sector, benchmark, geographical focus, etc.).

For equity funds that have an ESG rating (86% of EU equity funds), industry trends are similar to those reported above in terms of flows and performance. Highly rated equity funds have attracted much more net flows than other funds over the last two years and have proved more resilient since the beginning of the crisis (T.98).[51]

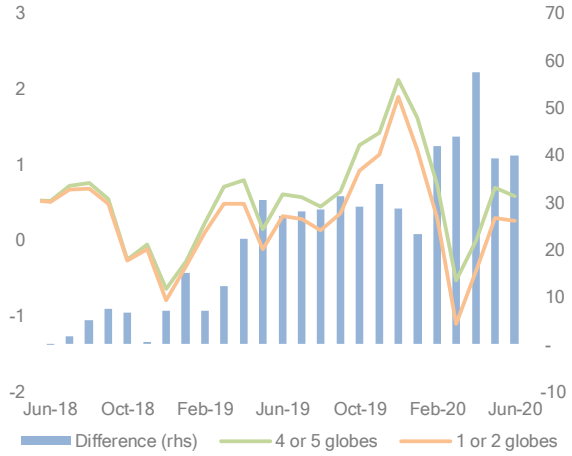
T.98
Equity fund flows by ESG rating
Funds with higher ESG ratings more resilient



Note: Monthly cumulative net flows of EU-domiciled equity funds since January 2018 by Morningstar sustainability rating, EUR bn.
Sources: Morningstar, Refinitiv Lipper, ESMA.

Funds with higher ESG ratings have also outperformed other equity funds by around 40 bps over the last twelve months, with a peak of 60 bps in March 2020 (T.99). While this may be seen as proof of the resilience of ESG-oriented assets in the current crisis, it is important to keep in mind that the sectoral factors highlighted above also apply to an analysis of performance based on ESG ratings.

T.99
Equity fund gross performance by ESG rating
Funds with higher ESG ratings outperform



Note: EU-domiciled equity funds' annual average monthly returns by Morningstar Sustainability Rating, asset weighted, in %, and difference in basis points (rhs).
Sources: Morningstar, Refinitiv Lipper, ESMA.

Green finance

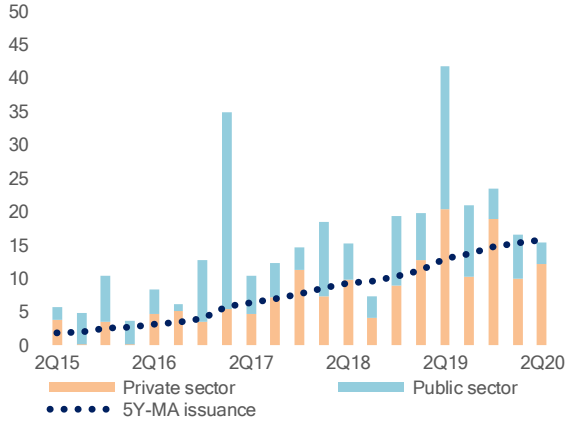
Green bonds

Green bond issuance volumes slowed down significantly in March and April, in line with broader bond market developments. Quarterly gross issuance averaged EUR 15bn in 1H20, down 40% from 2019 (T.100). This also reflected a shift towards social bonds by supranational issuers as they turned their attention to the socio-economic consequences of the pandemic.[52] Nonetheless, the green bond market continued to grow: as of June 2020, the amount of green bonds outstanding in the EU was EUR 331bn (+8% from end-2019), including EUR 167bn in private sector bonds (+14%; T.103).

[51] Morningstar's ESG ratings are distributed across funds within the same peer group (e.g. European large caps) and range from 5 globes (highest) to 1 globe (lowest).

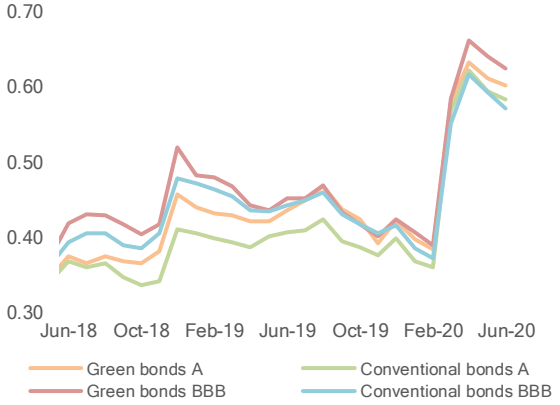
[52] See box T.93.

T.100
Green bond issuance
Public sector issuance declined in 1H20



Note: Green bond gross issuance in the EEA30 by sector, EUR bn.

T.101
Corporate-sector bond bid-ask spreads
Spreads widened for all bonds



Note: Average bid-ask spread for corporate green bonds and other bonds issued by the same issuer included in the Markit Iboxx EUR Liquid index, by credit rating, in bps.
Sources: Markit Iboxx, ESMA

In 2019, green bond trading volumes in the EEA soared by 65% compared with 2018 and amounted to EUR 429bn. While sovereign bonds dominate overall bond trading, trading in corporate green bonds exceeded sovereign green bonds for the first time in 2019. In line with the broader bond market, the largest share of trading occurred off-exchange (40% OTC and 31% through systematic internalisers). Trading on-exchange was concentrated on UK venues (82%), with Bloomberg Trading Facility Limited and Tradeweb Europe Limited accounting for a combined 60% of traded volumes.

Another sign of the structural improvement in green bond market liquidity is that the number and share of green bonds included in the Markit iBoxx EUR Liquid index has grown consistently to reach 3% in 1H20.

Liquidity as measured by bid-ask spreads deteriorated significantly from March for both green and conventional bonds. Corporate green bond bid-ask spreads rose to a high of more than 0.6 bps in April (T.101). Using this measure, corporate green bonds appear to be generally less liquid compared with the bonds issued by the same issuer for the same credit rating, despite increasing convergence since the beginning of 2019. The same can be observed for sovereign green bonds (T.105)

Green securitisation

Green securitisation may refer to any of several possible arrangements: the securitisation of underlying exposures that themselves are ‘green’ (such as electric automobiles, and energy-efficient residential real estate), securitisations whereby investor funds are ring-fenced for the purpose of funding ‘green’ projects and, finally, financial instruments in which capital freed up by the originator because of securitisation (i.e. due to capital relief) is used directly to lend or otherwise finance ‘green’ activities.

With respect to the securitisation of ‘green’ underlying exposures, the EU market for securitisation has observed several issuances in recent years, beginning with one issuer in 2016 in the Netherlands. However, despite some initial early optimism following that issuance, there has been limited issuance in Europe of such types of securitisations.[53]

There is nevertheless potential for green securitisations to grow in importance: the entry into force of the Securitisation Regulation on 1 January 2019 includes a requirement that originators, sponsors, and Securitisation Special Purpose Vehicles comply with additional detailed disclosure requirements. If the securitisation seeks to meet the Simple, Transparent, and Standardised criteria, further disclosure of the

[53] Private securitisations—which are not required to draw up a prospectus and are often arranged between an originator and a closed group of investors—could also in recent years have included ‘green’ securitisations. However, owing to their private nature there is insufficient information to make any conclusive observations about this securitisation market segment.

environmental performance on each underlying exposure must be provided.

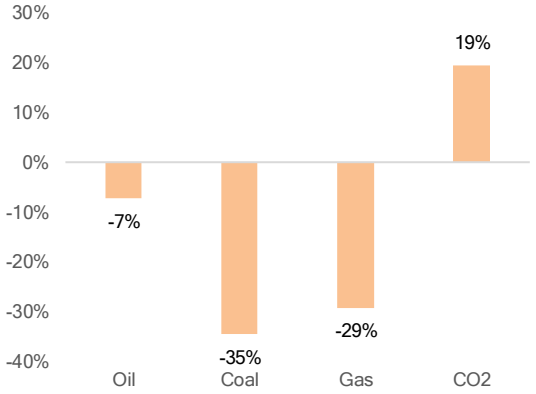
This clarity could in turn unlock greater investment in this asset class, by attracting funds from investors seeking to invest specifically in green products and from portfolio managers bound by their investment criteria to allocate capital to green products (but who wish to diversify their investments into another asset class).[54] It will subsequently be technically possible to monitor and distinguish the extent to which securitisations in the EU include energy-efficient products.

Emissions trading

As EU Member States introduced lockdown measures, carbon prices fell steeply in March to reach a low of EUR 16 per metric tonne of CO2 (-33% in two weeks; T.108). Prices then recovered to finish the second quarter at around EUR 27, reflecting growing expectations of a rebound in energy demand. Lower prices led to a reduced spot trading, with volumes down by one third in 1H20 from the same period last year.

However, spot trading is only a small fraction of the overall picture, with the emission allowance derivatives market more than 250 times larger than the spot market. The market is dominated by ICE Futures Europe, while OTC trading is marginal at less than 1% of the market. Turnover increased by 19% in 2019, to EUR 270bn, while it declined by 35% for coal (to EUR 78bn) and 29% for gas (to EUR 442bn; T.102). Despite a 7% decline, oil continues to dominate energy derivatives mrkets, with more than EUR 24tn traded last year.

T.102
Exchange-traded commodity derivatives turnover
Fossil-fuel derivatives turnover declined in 2019

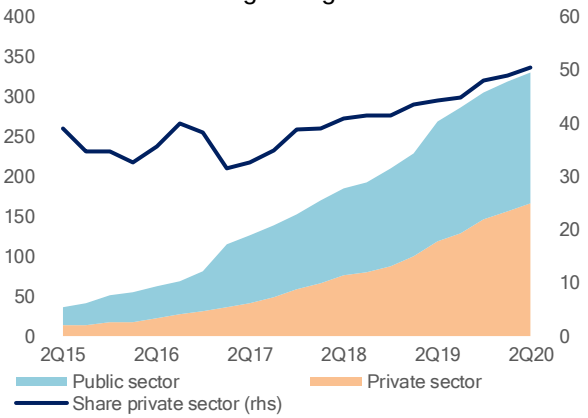


Note: Change in annual turnover of selected exchange-traded commodity derivatives, in %.
Sources: EEA trading venues, ESMA.

[54] The entry into force of the detailed disclosure templates for securitisations is expected during 2020. Until then, the previous disclosure templates under Delegated Regulation (EU) 2015/3 are being used.

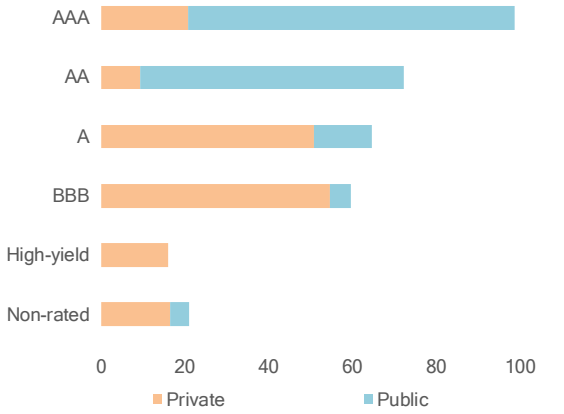
Key indicators

T.103
Green bonds outstanding
Private-sector share growing



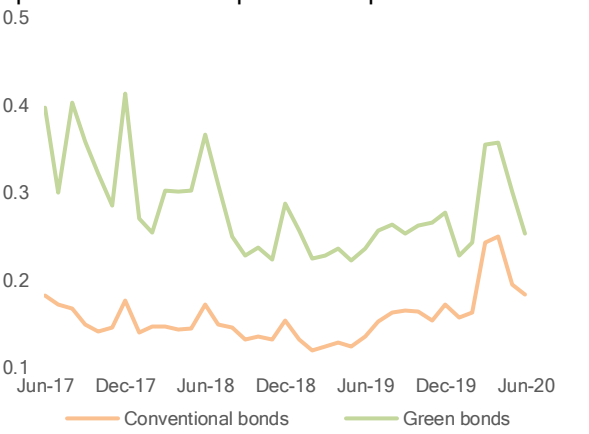
Note: Outstanding amount of green bonds in the EEA30 by sector, EUR bn, and share of private sector (rhs), in %.
Sources: Refinitiv EIKON, ESMA.

T.104
Green bond credit quality by issuer type
Average credit quality remains high



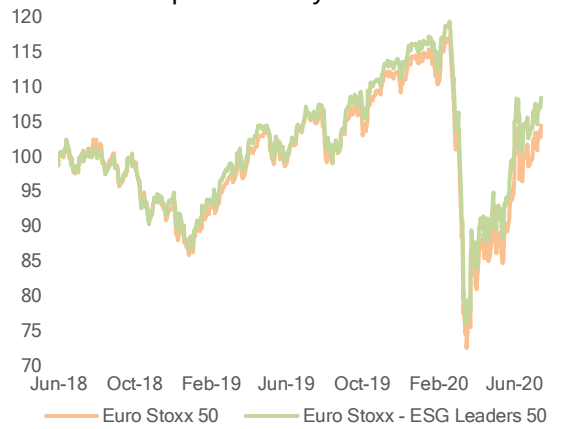
Note: Outstanding amount of green bonds in the EEA30 by credit rating and sector, EUR bn
Sources: Refinitiv EIKON, ESMA.

T.105
Sovereign green bond and conventional bond liquidity
Spread narrows despite recent peak



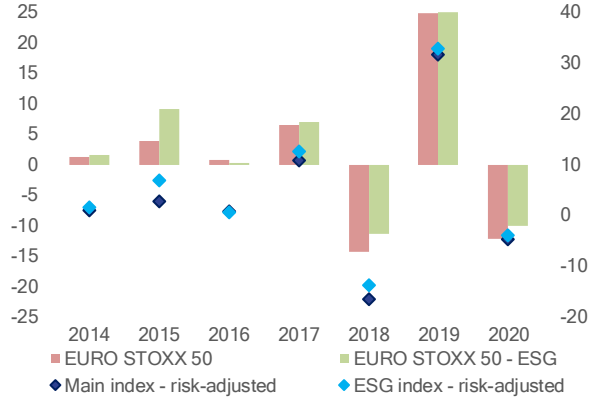
Note: Average bid-ask spread for green bonds and other bonds issued by the same sovereign issuer traded on EuroMTS, in bps.
Sources: MTS, ESMA.

T.106
Euro area ESG stock indices
ESG index outperforms key benchmark



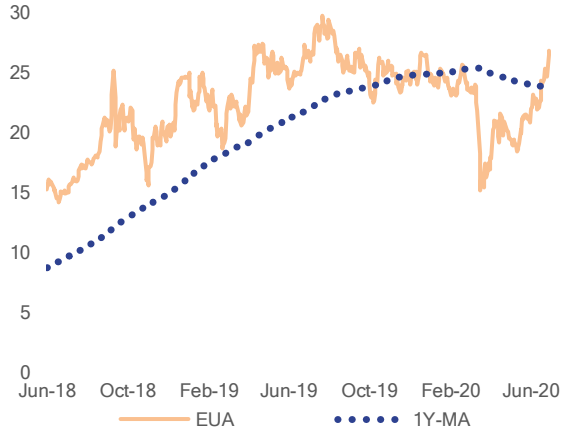
Note: Euro Stoxx 50 ESG leaders and broader indices, indexed with 01/06/2018=100.
Sources: Refinitiv Datastream, ESMA.

T.107
ESG index risk-adjusted returns
Higher risk-adjusted performance for ESG index



Note: Annual returns of the EURO STOXX 50 and its ESG leaders subindice, in %. Risk-adjusted returns, on rhs, measured as Sharpe ratios. Current year data year-to-date.

T.108
Emission allowance spot prices
Carbon prices fell steeply before recovering



Note: Daily settlement price of European Emission Allowances (EUA) on European Energy Exchange spot market, in EUR/tCO2.
Sources: Refinitiv Datastream, ESMA.

Structural developments

Financial innovation

Trends

COVID-19 lockdowns are expected to accelerate digitalisation of financial services. While positive from an efficiency perspective, this may accentuate risks, such as cyber risk, high market concentrations among data service providers and fragilities in the FinTech sector. Crypto assets were not spared from the COVID-19 turmoil. So-called 'global stablecoins' continue to be under close scrutiny by central banks and regulators.

COVID-19 accelerates digital transformation

COVID-19 is changing consumer behaviour and accelerating digital transformation in firms. As millions of employees have been working remotely, demand for video-calling platforms and critical cloud infrastructure has soared. Similarly, the pandemic has spurred an uptake of contactless payments to limit the spread of the disease.[55] Large technology firms have outperformed equity stock markets during the COVID-19 crisis. As an example, the weight of Microsoft, Apple, Amazon, Google's parent Alphabet and Facebook in the S&P 500 gradually increased from 16% early January to 22% end-June, representing a rise in market capitalisation of more than USD 1.2trn, despite the market turmoil.

However, smaller FinTech businesses and early stage companies are likely to suffer most from the downturn, as their revenue flows come under strain and scarcity of capital increases. After several years of record levels, FinTech funding contracted in 1Q20, as a result of investors becoming more risk averse with the crisis. This could have negative knock-on effects on innovation at least in the short run.[56] Deteriorating business performances in firms and lower valuation levels may also trigger consolidation. While digital transformation has increased during the COVID-19 crisis, innovation in other areas may slow down, as resources are being re-prioritised to address the fallout of the pandemic at both incumbent and FinTech firms.

Overall, the crisis may provide some positive outcomes for consumers, through increased digitalisation and enhanced products and services, possibly at a lower cost (Box T.108). Meanwhile, it may hinder innovation in certain areas and contribute to further increasing the dominance of BigTechs. In addition to competition issues, this could exacerbate concentration risks and raise financial stability concerns, owing to the complexity and lack of substitutability of the services offered by BigTechs.

T.109
Financial innovation scoreboard
Assessment of risks and opportunities

The ESMA financial innovation scoreboard is a framework that provides a ranking relating product features to ESMA's objectives to prioritise which financial innovations require deeper analysis and potential policy responses.

CAs – small in size, concerns around stablecoins

Crypto Assets (CAs) are mostly outside regulation and characterised by extreme price volatility, creating risks to investor protection. Most CA trading platforms are unregulated and prone to market manipulation and operational flaws. Stablecoins could raise financial stability concerns.

DLT – some interesting experiments

Distributed Ledger Technology (DLT) has the potential to improve consumer outcomes. Applications are still limited, but scalability, interoperability and cyber-resilience challenges will require monitoring as DLT develops. Risks include anonymity as well as potentially significant governance and privacy issues.

AI, ML and Big Data – potential longer-term impact

The increasing adoption of Artificial Intelligence (AI) and Big Data helps financial services companies to be more efficient and therefore may lead to cost reductions for investors.

[55] Finextra, 2020. 'COVID-19 spurs contactless payments takeup – Mastercard', 30. April 2020

[56] CB Insights, 2020. 'How COVID-19 Is Impacting Fintech Financing', April 2020

Operational risks are present, as are risks around explicability of AI-based recommendations, strategies and analysis.

Cloud and digitalisation – growing with positive outcomes but risks as well

The growing use of cloud and digitalisation of financial services have positive outcomes but raise specific risks, including in relation to digital operational resilience.

RegTech/SupTech – potential benefits

The widespread adoption of RegTech/SupTech may reduce certain risks. For example, the use of machine learning tools to monitor potential market abuse practices has the potential to promote market integrity.

Crowdfunding – market remains muted

Crowdfunding improves access to funding for start-ups and other small businesses. The projects funded have an inherently high rate of failure. The relative anonymity of investing through a crowdfunding platform may increase the potential for fraud.

Crypto-Assets: not immune to market turmoil

CA valuations generally followed overall market developments during the COVID-19 crisis, albeit with even larger price swings. Valuations fell by almost 50% within a week in early March. However, following a steady recovery throughout April and May, valuations stand close to their 2020 highs and the total market capitalisation of CAs now exceeds the levels of early 2020 at about EUR 234bn (T.113). Bitcoin's price rebounded most strongly (T.114), seemingly boosted by the 'Bitcoin halving'.[57] While there are more than 5,000 CAs outstanding, Bitcoin continues to dominate by far at about two thirds of the total market capitalisation.

As in securities markets CA trading volumes increased during the extreme bouts of volatility in March (A.211). Meanwhile, open interest in Bitcoin futures remained very low (T.115), despite the recent launch of funds investing in CA futures.[58] Investment products using CAs as underlying remain small in the EU. Overall, 70 crypto-focused hedge funds, mainly in the US, seemingly closed in 2019 and the number of new funds created has halved compared with 2018.[59] In addition, most of these funds are small, controlling less than USD 10m in assets. The US Securities and Exchange Commission has rejected all previous Bitcoin ETF proposals filed to date.[60]

The Initial Coin Offerings (ICOs) market has virtually halted, following both regulatory and enforcement actions globally. Looking at DLT initiatives more generally, certain projects may be delayed following the COVID-19 crisis.[61]

Stablecoins: under close scrutiny

Stablecoins, including those with 'a potential reach and adoption across multiple jurisdictions and the potential to achieve substantial volume'[62] also known as 'global stablecoins' (GSCs), continue to be a topical issue, considering the challenges and risks that they raise, including risks to public monetary policy and financial stability. There are more than 50 stablecoins outstanding, of which about half are active, but their total market capitalisation remains small. Tether, the first to be launched in 2014 and the largest in size, had a market capitalisation of about USD 9.2bn as of end June. The market capitalisation of Circle's stablecoin (USDC), the second largest, was about USD 1.1bn at the end of 1H20.

The most prominent initiative in the space is Facebook's Libra project, which immediately attracted scrutiny from central banks and regulators when it was first announced in June 2019, because of its ability to reach a large scale quickly.[63] In April 2020, the Facebook Association published a revised whitepaper[64] on the project in an attempt to address the concerns raised by regulators globally. Key changes relative to the earlier project include the integration of single-currency stablecoins, a restricted access to the Libra Payment Network, and the use of a permissioned DLT.

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57 For the third time in the network's history, the reward for mining a block will be divided by two, meaning that it will become more costly to mine new Bitcoins. Considering that the total supply of Bitcoins is capped through time, the process of halving is boosting the Bitcoin price.

58 For example, see the launch of Stone Ridge in the US and Napoleon in France.

59 Crypto Fund Research

60 Coindesk, 'SEC rejects latest ETF bid', 26 February 2020

61 IT news, 'ASX revises Chess replacement timeline', 25 March 2020

62 See FSB, 'Consultation on regulatory, supervisory and oversight recommendations for "global stablecoin" arrangements', 14 April, 2020

63 For greater details on the Libra project, see ESMA (2019), Report on Trends, Risks and Vulnerabilities, No 2

64 Libra, White Paper

The FSB has launched a consultation on the regulatory, supervisory and oversight challenges raised by GSCs, in which they set out 10 high-level recommendations. [65] ESMA is actively cooperating with other global regulators on those matters, considering the cross-border nature of GSCs. Relatedly, six central banks, namely the Bank of Canada, the Bank of England, the Bank of Japan, the ECB, the Sveriges Riksbank and the Swiss National Bank, in partnership with the Bank for International Settlements have joined forces to explore the possibility to create a Central Bank Digital Currency (CBDC).[66] A recently published bulletin by the BIS suggests that COVID-19 could amplify the call for CBDCs.[67] Yet, many challenges remain for such instruments to be launched successfully. A recent paper from the ECB proposes a two-tier remuneration as a possible way to address certain challenges attached to CBDCs.[68]

Operational resilience paramount

The use of cloud by businesses across the economy has significantly increased over the last few years (T.111), and more financial sector firms have been migrating services to the cloud. The COVID-19 crisis has further accelerated this phenomenon, as firms had to put in place remote working facilities. For example, Microsoft saw a 39% jump in its commercial cloud revenue to USD13.3bn in 1Q20 and several global investment banks have recently signed new partnerships with cloud service providers (CSPs).[69]

While ESMA is cognisant of the benefits that cloud computing can bring, it is mindful of the new risks that it can introduce for individual firms. From a system-wide perspective concentration in the cloud services market, which is dominated by a small number of large CSPs is a potential emerging issue. This may become more prominent with further increasing digitalisation. Synergy Consulting estimated that the largest four CSPs as of 3Q19 make up 72% of global revenues for the 'Infrastructure-as-a-Service' and 'Platform-as-a-Service' markets. If financial sector firms use the cloud for critical services, there is therefore the potential for concentration risk, with potential negative outcomes for financial stability.

ESMA is developing guidelines on outsourcing to CSPs to help firms and competent authorities identify, assess and monitor the risks stemming from cloud outsourcing. The proposed guidelines[70], which are currently being consulted on, are consistent with the recommendations on outsourcing to CSPs published by the European Banking Authority (EBA) in February 2017 and subsequently incorporated into revised EBA guidelines on outsourcing arrangements in February 2019, and the guidelines on cloud outsourcing published by the European Insurance and Occupational Pensions Authority (EIOPA) in February 2020. After receiving the feedback from the consultation, ESMA expects to publish final guidelines on outsourcing to CSPs in 1Q21.

Growing digitalisation and the use of Information and Communication Technology (ICT) for financial services also means that digital operational resilience is crucial. Finance is estimated to be three times more at risk of cyber-attacks than other sectors, even though it outspends them as regards protection mechanism against ICT risks.[71] In addition, the pandemic has led to the widespread use of remote working arrangements. Such reliance on ICT systems makes cyber resilience even more important than before the outbreak. At the same time, cyber attacks have increased with a growing number of phishing and fraud attempts.

Last December, the European Commission launched a public consultation[72] on a digital operational resilience framework for financial services, building on the joint European Supervisory Authorities (ESAs) Advice published in April 2019. The Consultation outlines possible legislative improvements in four main areas, namely requirements on ICT risk management, incident reporting requirements and information

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65 FSB, 'Consultation on regulatory, supervisory and oversight recommendations for "global stablecoin" arrangements', 14 April, 2020

66 Finextra, 2020. 'Central banks form group to explore digital currency creation', 21 January, 2020

67 BIS, 2020. 'BIS Bulletin, N.3', April 2020

68 ECB, 2020. Working Paper Series, 'Tiered CBDC and the financial system', January 2020

69 Financial Times, 2020. "Microsoft growth accelerates as pandemic boosts cloud business", 30 April 2020

70 ESMA, 'Consultation Paper: Draft guidelines on outsourcing to cloud service providers', 3 June 2020

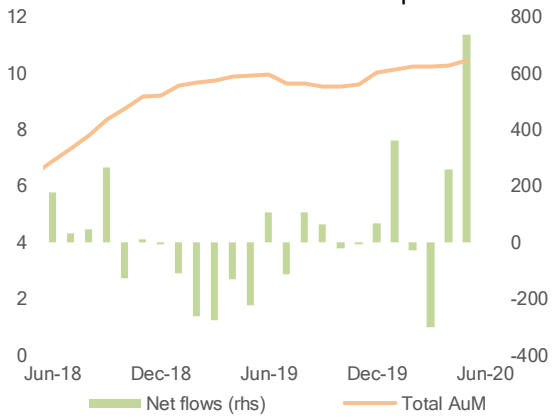
71 European Parliament, 'Fintech: the influence of technology on the future of the financial sector'

72 European Commission, Consultation on Digital Operational Resilience framework for financial services

sharing, a digital operational resilience testing framework, and the oversight of critical ICT third-party providers. A consistent incident reporting and information sharing framework is indeed an important component to assess the type and scope of the risks involved. An ESMA assessment classified most ICT incidents reported for Trade Repositories in 2018-19 as having an impact on data availability (T.112).

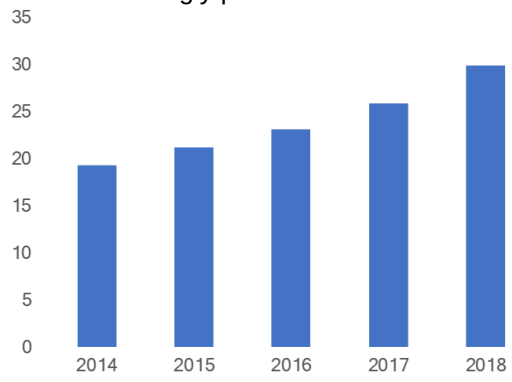
Key indicators

T.110
Fund strategies focused on AI and FinTech
AI and FinTech investment reach plateau



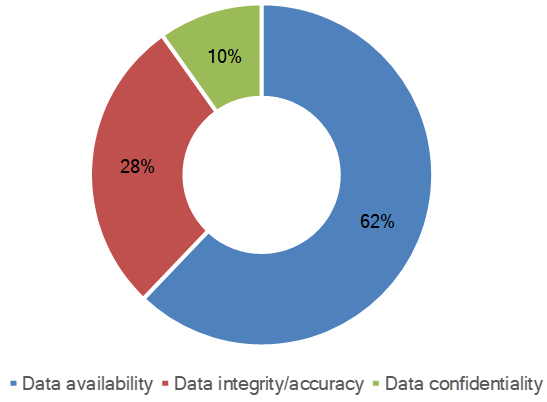
Note: Total AuM, EUR bn, and monthly net flows, EUR mn, for selected EU-domiciled funds (n=32) whose name includes reference to AI, automation, FinTech or robotics.
Sources: Morningstar Direct, ESMA

T.111
Cloud services
Firms increasingly purchase cloud services



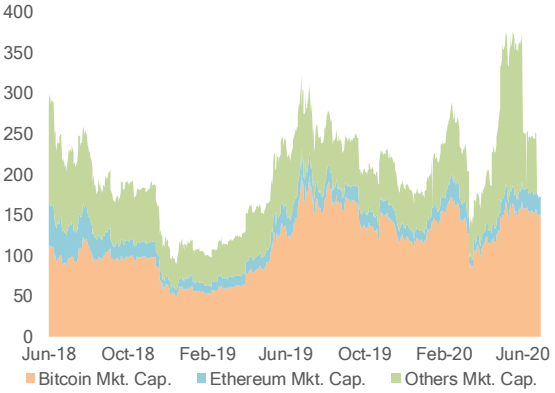
Note: Percentage of busineses purhcasing cloud computing services by year in 22 EU countries, %. Countries included: AT, BE, CZ, DE, DK, EE, ES, FI, FR, GR, HU, IE, IT, LV, LT, LU, NL, PL, PT, SI, SK, SE. Firms across the economy with at least 10 employees were surveyed.
Sources: OECD, ESMA

T.112
Digital operational incidents
Impact on data availability for TRs



Note: ESMA analysis of impact type of IT incidents reported for trade repositories in the EU, 2018-19
Sources: ESMA

T.113
Cryptoasset market capitalisation
CAs not immune to COVID-19 market turmoil

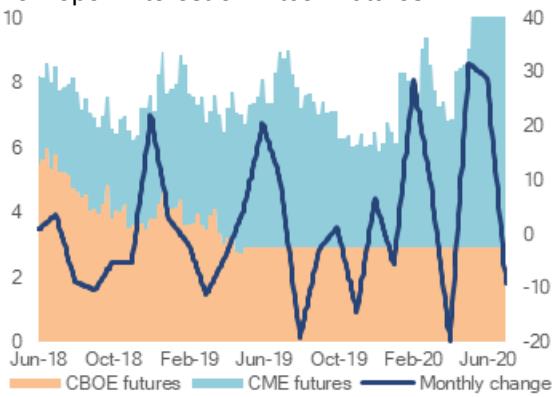


Note: Market capitalisation of Bitcoin, Ethereum and other crypto-currencies, in EUR bn.

T.114
Cryptoasset prices
Marked rebound from 1Q20 trough

Note: Prices of selected crypto-assets, EUR thousand.

T.115
Bitcoin futures market
Low open interest on Bitcoin futures



Note: Total open interest in Bitcoin futures, in thousand of contracts, and change in monthly average total open interest, in %.

Risk analysis

Financial stability

Model risk in CLOs

Contact: damien.fennell@esma.europa.eu

Summary

The benefits of securitisation depend on its ability to effectively engineer and limit credit risk. This article explores the approaches to modelling CLO credit risk adopted by the three main CRAs. It discusses the differences and some limitations in approaches and how these might potentially affect credit ratings' accuracy. Finally, it sets the discussion in the context of some of the recent developments in the leveraged loan and CLO markets, including those stemming from COVID-19. Together, these make clear the importance of sensitivity analysis to identify model and credit rating limitations and how the transparency of these is key to informing investors' reliance on ratings.

Introduction

Structured finance promises benefits by creating lower risk securities from pools of higher risk collateral. Its rise in the 80's and 90's enabled borrowers to benefit from more plentiful and cheaper funding from investors who would not directly lend to them, but who were happy to invest in the structured lower-risk tranches.[73]

However, structured finance also presents risks. In the 2000's regulatory arbitrage, originate-to-distribute and an over-reliance on Credit Rating Agencies (CRAs) to assess credit risk resulted in the build-up of imbalances in the U.S. mortgage-backed Collateralised Debt Obligation (CDO) markets. The global financial crisis of 2007-2008 then made clear how a lack of due diligence by investors and conflict of interests among CRAs can result in dramatic effects on financial markets and the real economy (FCIC 2011).

In particular, the crisis showed how default correlation — a key input in securitisation — had been underestimated in credit rating models, leading to significant under-identification and under-pricing of risk. When house prices declined throughout the U.S., a large portion of mortgages that had been issued in different states and that had been pooled into mortgage-backed securities (MBSs) started to default at the same time. This resulted in waves of massive downgrades on AAA-rated CDOs and a rise in defaults for US CDOs.

Following the crisis, a European regulatory framework for CRAs was established[74] and a range of regulatory initiatives were taken to ensure that securitisation would better provide financing in the economy without jeopardising financial stability.[75]

The securitisation markets have changed since the crisis. Some of the worst performing products of the crisis, such as CDOs squared, have largely disappeared. However, in other areas structured finance markets have seen a resurgence. In particular, Collateralised Loan Obligation (CLOs) markets have raised concerns among policymakers.[76]

The recent surge in issuance of leveraged loans alongside a deterioration in underwriting standards and tight loan spreads (until the COVID-19 pandemic) has been fuelled in part by the rise of CLOs, which are estimated to account for about half of the leveraged loan market. Investors looking for yield have been attracted to

[73] This article has been authored by Antoine Bouveret, Damien Fennell and Robin Horri.

[74] Regulation (EC) No 1060/2009 of the European Parliament and of the Council of 16 September 2009 on credit rating agencies.

[75] In the EU, for example, risk-retention rules were introduced for securitisation issuers and transparency was enhanced (e.g. loan-by-loan reporting and the establishment of securitisation repositories). It also introduced requirements that a distinct rating scale be used by CRAs for structured finance credit ratings and that tranches be rated by two different CRAs.

[76] See FSB (2019) for example.

the relatively high returns and high credit ratings of most CLO tranches. Total leverage loans outstanding in Europe were about EUR 200bn in 3Q19, while CLOs outstanding stood at around EUR 120bn in September 2019.[77]

Given the recent growth in the CLO market and growing concerns, ESMA recently carried out a thematic review of the CRA methodologies for rating CLOs (ESMA 2020). The box below summarises its findings (RA.1).

RA.1
ESMA's thematic review of CRA CLO practices
Main findings of ESMA's CLO thematic review

The report's findings are as follows:

- *The internal organisation of CRAs* - the CLO rating process is segmented between a CLO analytical team and a corporate analytical team in all CRAs. A smooth and ongoing exchange of information between internal teams is key to ensuring a holistic assessment of CLO creditworthiness. CRAs should ensure the capacity for the timely identification of all inherent risks to CLOs;
- *The interactions with CLO issuers* - as CLO arrangers and managers can identify which CRA may assign the best ratings for each CLO tranche, it is key that CRAs ensure the independence of their rating process from any influence from their commercial teams and/or arrangers;
- *Model/third party dependencies leading to potential operational risks* - the dependency on rating models and data provided by third parties, and the high automation of processes, present operational risks that need to be monitored by CRAs to avoid potential errors in credit ratings;
- *Rating methodologies, modelling risks and commercial influence* - CLO methodologies are underpinned by assumptions and modelling approaches that can have an impact on credit ratings. ESMA highlights the importance of providing transparency to market participants on the limitations of methodological approaches. In addition, CRAs should ensure that evolutions in CLO methodologies are not influenced by commercial interests;
- *The thorough analysis of CLOs* - it is key that CRAs continue to monitor market trends and perform a thorough analysis of all relevant developments in CLO contractual arrangements.

As the report is based on information collected up until March 2020, it does not assess the consequences of the COVID-19 outbreak. In light of this, ESMA expects CRAs to continue to perform regular stress-testing simulations and provide market participants with granular information on the sensitivity of CLO credit ratings to key economic variables.

This paper was informed by and complements the thematic review, by focusing on the type of models used by CRAs to assign CLO ratings. In addition, while informed by the thematic review, the paper is based on publicly available information. It does not disclose or rely on information shared with ESMA by the CRAs as part of the thematic review or other supervisory activities.

The paper aims to understand if the lessons of the financial crisis have been sufficiently learnt – given the past experience of CDOs and the recent growth of CLOs – or whether the benign macroeconomic backdrop (until the COVID-19 pandemic) has increased risks for the next crisis.

To answer this question, we take a closer look at the type of models used by CRAs to assess default risk among CLO tranches and assign credit ratings. We do not investigate, assess or compare specific CRAs' CLO rating models or processes. Instead, the aim is to identify the kinds of model risk that can arise for the type of models used by CRAs.

We show that the modelling and calibration of default correlation within the CLO portfolio is key in determining credit ratings. However, owing to a lack of data the estimation of correlation is very difficult. Nonetheless, moderate changes in default correlation can have a sizeable impact on default probability (and on credit ratings' accuracy). This in turn underlines the importance of model sensitivity analysis and stress testing. Yet, as found in the thematic review, reverse stress tests and sensitivity analysis of default correlation among the three largest CRAs remains limited.[78]

Moreover, recent developments in the leveraged loan market point to a deterioration in loan documentation, a widespread decline of financial covenants and increased use of accounting techniques by borrowers to reduce their apparent financial leverage (i.e. 'add-backs' influencing EBITDA levels).[79] These trends magnify the risk that when defaults occur, they are more likely to occur together – clustered across firms and sectors (since it takes a higher shock to make firms default).

The remainder of the paper is structured as follows: the next section provides an overview of

[77] Leverage loan market size from AFME (2019), CLO market size from TwentyFourAM (2019).

[78] ESMA (2020).

[79] See, for example, p.7-10, FSB (2019).

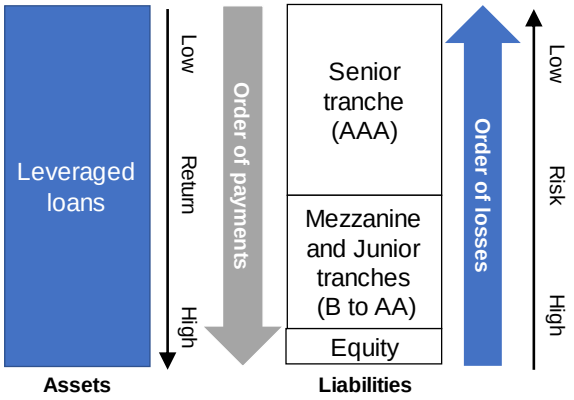
the main model types used by CRAs. We then compare these before exploring some limitations of the models using sensitivity analyses, in particular looking at the modelling of tail-dependence in defaults. It then looks at the relevance of this model risk in the context of the ongoing COVID-19 crisis. The paper concludes with a call for more transparency on CRA models and their limitations, including for more information on the modelling of tail-dependence of defaults, which tend to cluster during recessions.

What are CLOs?

A CLO is a securitised product backed by a pool of leveraged loans on the asset side, which are funded by the issuance of debt and equity CLO tranches with a different degree of seniority on the liability side. The interest and principal payments on the loans are repaid to the tranche investors according to a waterfall approach. The most senior AAA-tranches are paid first, then mezzanine tranches and so on. Once the debt tranches have been paid, equity tranches are paid the remaining revenue. When losses occur, equity tranches are the first to absorb losses, then the most junior debt tranches and so on. Senior tranches are protected unless the losses are too large to be absorbed by the equity and mezzanine tranches (RA.2).

Total portfolio defaults and losses depend on how likely defaults are to co-occur among the loans in the pool. When loans tend to default together (i.e. when default correlation is higher) then the total loss in the portfolio will tend to be higher and more senior tranches will be more likely to default. In addition, the more correlated defaults are, the better this is for the equity and junior tranches and the worse it is for the more senior tranches. This is because when defaults co-occur then the total loss (when it occurs) will be higher, and the losses are more likely to be large enough to exceed the junior tranches and any overcollateralisation, and thus hit the more senior tranches.[80]

RA.2
The structure of a CLO
Tranches, risk, returns and payment waterfall



Source: Natixis Asset Management (2017) with ESMA amendments

Unlike other securitised products, in CLOs the pool of loans is usually dynamic and actively managed.[81] CLOs also have covenants that stipulate how the CLO should be managed. The CLO manager runs the CLO and is usually able, within constraints set by the covenant, to buy or sell loans in the underlying pool. This flexibility typically lasts until principal repayments begin to be made to the debt tranches, as the underlying loans themselves are repaid. This ability to manage the underlying pool of loans makes the CLO manager important to the performance of the CLO.

Included in the CLO covenants are a range of tests that act as regular checks to ensure a CLO works as designed. These include the overcollateralisation tests (OC) for the debt tranches. For a given debt tranche, the OC test checks if the value of the pool of loans, less the face value of more junior tranches, remains higher than the face value of the tranche. If an OC test fails, all excess cash flows are diverted to the senior tranches. Another test, the interest coverage test, checks if the total interest due on the leveraged loans is sufficient to cover the interest owing to CLO investors. Failure in any of the test triggers some restrictions on the CLO manager in order to protect senior noteholders.

When a CLO is created, an arranger – typically an investment bank – advises the issuer on the structure of the CLO and a credit rating agency rates the tranches. In the EEA issuers are

[80] In other words, with higher correlation expected losses tend to be shared more among the different tranches. As a result, more senior tranches will tend to fare worse on average and more junior tranches will tend to fare better when default correlation is higher.

[81] CLOs with actively managed portfolios do not to qualify for STS status under the Securitisation Regulation. See Article 20(7) of the Securities Regulation.

required to obtain two credit ratings for each structured finance debt instrument issued, which needs to be from different and independent CRAs.[82] In addition to issuing an initial rating for a debt tranche, the CRA monitors the performance of the CLO debt tranche through the life of the CLO and may take a rating action (issue a rating outlook, watch, downgrade or upgrade) as circumstances change, for example, if the credit quality of the underlying loans changes.

CRA models for rating CLOs

CRAs models for rating CLO debt tranches can be typically split into two parts:

- *A portfolio model* which assesses the overall credit risk of the pool of leveraged loans, using inputs on the individual loans and the portfolio.
- *A cash-flow model* which assesses tranche payments, defaults and losses that would arise for different performance outcomes for the pool of underlying loans.

This can be used to evaluate default probabilities and expected losses for CLO tranches. These two models together enable CRAs to assess the likelihood of defaults and losses to the different debt tranches and to inform their assignment of credit ratings.

The Gaussian copula approach

This section describes in a simplified way the main modelling approach used by CRAs. In Gaussian copula portfolio credit models, loan defaults are assumed to follow a Gaussian copula, the copula associated with multi-variate normal distributions.[83]

The models that use a Gaussian copula approach estimate the distributions of defaults and losses for the pool of leverage loans using the Monte-Carlo simulation technique.[84] In simplified terms, these models simulate the loan performances in the portfolio using information about the composition of the portfolio and inputs on the individual loans (default rates, expected recoveries) and correlations among loan defaults. The individual loans' performances form a scenario that demonstrates how the whole portfolio might perform. By repeating this simulation a large number of times, one can create the distribution of possible portfolio outcomes. From this the likelihood of different defaults and losses occurring in the portfolio can be estimated.

The cash-flow models are then used to estimate the distribution of payments, defaults and losses for the different CLO tranches. A credit rating for each tranche is then assigned based on where that tranche's default probability or expected losses sit in tables mapping these to rating categories.[85]

While the description above captures the core of how some CRAs assign CLO tranche ratings, in practice the rating process is significantly more complex.[86] The assignment of credit ratings is not determined simply by the application of a model. There are more steps, including feeding in qualitative information that informs the rating. Moreover, the CRAs typically describe their ratings as opinions on the relative rankings of credit worthiness rather than strict measures of default probability or expected loss.

CRAs also usually introduce additional stresses when constructing ratings using a Gaussian copula approach. To mention just a couple, S&P, for example, requires that a rating is stable under the default of the largest obligor, and for AAA and AA-rated tranches it requires that it is stable under the default of the largest industry in the pool.[87] However, Fitch adds the 'obligor concentration uplift', to add conservatism to the rating when a portfolio has loans concentrated in a small number of obligors.[88]

As mentioned earlier, total portfolio defaults and losses depend on how likely defaults are to co-occur among the loan pool. When loans tend to default together (i.e. if default correlation is

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82 See Article 8c(1) of the CRA Regulation.

83 Mathematically, a copula is a function that maps the univariate distribution functions of a set of jointly distributed random variables to their multivariate distribution function. It enables the modelling of the joint dependence of those variables separately from their individual behaviours. The Gaussian copula is the copula of multivariate normal distributions.

84 See, for example, S&P's 'CDO Evaluator' (p.3, S&P, 2019) and Fitch's 'Portfolio Credit Model' (p.2, Fitch, 2019).

85 See for example Fitch (2019) p.31 and p.36 and Moody's (2018).

86 See ESMA (2020) for a more detail on how CRAs rate CLOs.

87 See p.11-13, S&P (2019).

88 See p.13-14, Fitch (2019).

higher) then the total loss in the CLO portfolio will tend to be higher and more senior tranches will be more likely to default. Thus, how well a portfolio credit model captures the co-occurrence of loan defaults is central to its ability to model the credit risk of the whole loan portfolio and of the CLO debt tranches in turn.

The Gaussian copula has mathematical advantages but captures loan default co-occurrence in a limited way. It assumes that loan defaults do not exhibit any 'tail-dependence', that is, how loan defaults happen together does not vary with the extremity of the situation. Mathematically, it assumes a constant default correlation between loans. This means that it treats the likelihood of an occurrence of simultaneous default during a recession the same as it would in normal times. CRA models often also introduce further simplifications, for example, assuming that this default correlation between any two loans is constant over time and is determined by a few features, such as whether or not the loans are from the same industry and/or geographical region.[89]

The Binomial expansion technique

Another approach to modelling portfolio credit risk uses the binomial expansion technique (BET). This approach approximates the behaviour of the actual loan portfolio, if loan defaults are usually correlated, with a hypothetical portfolio of loans in which loan defaults are not correlated and whose defaults follow a binomial distribution.[90]

Using the properties of the binomial distribution, the default and loss probabilities of the loan portfolio can be straightforwardly calculated. The cash-flow model is then used to estimate the default probabilities and expected losses for the CLO tranches. CLO ratings can then be assigned by mapping these losses to ratings.

Similar to Gaussian copula models, CRAs that use the BET model also incorporate refinements to make their ratings more robust. Moody's, for example, introduces a default probability stress factor that effectively raises the rating cut-offs for these more senior ratings by applying a stress to the underlying loan default probabilities when calculating ratings. The default probability stress factor applies if the target rating of a tranche is associated with a low default probability. In these cases, a stress to increase the default probability of the underlying loans is applied, and the tranche ratings are calculated under this stress.[91]

When it was developed, the BET had a major advantage because default probabilities and expected losses of the loan portfolio could be calculated from it analytically, without the numerous calculations of the Monte-Carlo approach which were then slow to compute. With much more powerful computing now widely available, this advantage has been reduced.[92] We nonetheless discuss the BET model here because it is used as part of the assignment of some CLO ratings.[93]

The core of the BET is the modelling of a correlated loan pool using a hypothetical pool of uncorrelated loans. To make it representative of the actual portfolio, the defaults of the hypothetical portfolio are assumed to have the same mean and variance as the actual portfolio (1st and 2nd moment matching). For simplicity, loans in the hypothetical portfolio are assumed to have equal weight. On that basis, one can then derive a relationship between the number of loans in the hypothetical portfolio, which is called the 'diversity score', and the default correlation between loans in the actual portfolio.[94] This shows that the diversity score implicitly captures the default correlation of the actual loan portfolio. The relationship is an inverse one, a portfolio with a higher (lower) diversity score has lower (higher) default correlations. In addition, as the diversity score is rounded down to a whole number when calculated, it implicitly assumes a higher correlation than the correlation from which it is calculated. (RA.7)

The diversity score depends on the number of loans in the portfolio and how many of these are

89 See, for example, p.8-10 Fitch (2019) and

90 The BET approach was developed by Moody's. See Cifuentes et al. (1996) for the original paper setting out the BET approach.

91 The most severe default probability stress is applied where tranche ratings are expected to have very low default probabilities (that is a target rating of Aaa) In this case the underlying loan default probabilities are almost doubled (scaled up by 1.95). As the stress applies to tranches that have a low default probability, it affects higher-rated tranches. Lower rated tranches (B1 or lower) do not face a stress. See p.35, Moody's (2019b).

92 Moody's now complement their BET model with a Monte-Carlo simulation model that uses a Gaussian copula (CDOROM). See p.59, Moody's (2019a).

93 See p.9, Moody's (2019b).

94 For further discussion of the diversity score and how it is derived, see p.271-5 in Bluhm et al. (2002), p.3-5 in Fender et al. (2004), and p.471 in Nickerson et al. (2017).

in the same industries.[95] Diversity scores contributions can vary also depending on geographical regions.[96] Different ways to calculate the diversity score implicitly make different assumptions about loan correlations in the actual portfolio. Similar to CRAs using the Gaussian copula in modelling correlations, how the diversity score is calculated can incorporate important assumptions, for example, the assumption that the defaults of loans in different industries are uncorrelated.

Model calibration

This section briefly outlines how the CRAs set certain key inputs to the model. Model calibration is discussed in more depth in the recent thematic review of CRA practices carried out by ESMA.

Correlation (and diversity score) inputs are particularly important given their importance in assessing portfolio credit risk. Default correlation, however, is also inherently difficult to measure given that it tends to shift in crisis periods, crisis periods tend to be distinctive from each other, and data on crisis periods are relatively limited compared with data from other periods.[97]

CRAs use credit ratings for the underlying leveraged loans (and sometimes credit opinions if ratings are unavailable) as the key inputs for modelling the individual loans in their portfolio models. These are based on historical data linking credit ratings to observed default probabilities for the loans in the portfolio based on their characteristics.[98] Recovery rates are also input based on tables that have been calibrated to historical recovery data.[99]

In setting levels for tranche ratings in terms of default probabilities or expected losses, some CRAs require their highest-rated tranches to be such that they can withstand historically high levels of defaults.[100] Some CRAs use the mappings used for non-structured finance assets to assign ratings in terms of default probabilities or expected losses. [101]

To calibrate correlations, CRAs tend to use a combination of simplifying assumptions (i.e. the correlations take particular values depending on the industries and regions of the loans) with indirect calibration to historical data.[102]

Model sensitivities

This section analyses how the choice of model when rating CLOs can affect ratings. We construct simple copula and BET models and simulate how their outputs vary under different conditions. The aim is to identify similarities and differences among the model types, to identify sensitivities that these kinds of models have, and to understand what insights these may yield for CLO ratings, particularly in stress situations.

It is important to note that we are not comparing specific CRA models here. The aim is to instead understand how models of the type used by CRAs can give different results as inputs change. No particular model discussed here should be associated with a particular CRA, as none of the models here capture the calibration or the more detailed steps and processes used by CRAs to assign ratings.

The work extends on the analysis in TRV 2-2019, which analysed how CLO ratings could vary with correlations and the choice of copula (ESMA, 2019).[103] As was done there, in our modelling we assume a CLO composed of characteristics in the table below (RA.3). Unless otherwise stated, or being varied in the simulation, this presents the CLO modelled in the simulations. The idealised CLO has 100 leveraged loans, each with the probability of default of 20%, corresponding to the five-year default probability of B-rated loans.

The CLO structure is divided into four tranches (equity, junior, mezzanine, senior). The equity tranche absorbs up to the first 8% of losses, followed by the junior tranche (up to 20%), the mezzanine tranche (up to 40%) and finally the senior tranche. So, if losses reached 10%, the equity tranche would be wiped-out, and the junior tranche would absorb the remaining 2%. For simplicity, we do not consider prepayment or interest rate risk in the model in order to focus mainly on correlation. For simplicity, there is also

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95 See, for example, p.39-40, Moody's (2019b).

96 See, for example, p.43-6, Moody's (2019b).

97 Difficulties in and different approaches to measuring correlation as discussed in Nickerson et al. (2017).

98 See, for example, p.17-26 S&P (2019) and p.35-7, Fitch (2019).

99 See p.9, S&P (2019) for example.

100 See S&P (2019) for example.

101 See both Moody's (2018) and Fitch (2019) for example.

102 Fitch, for example, calibrates correlation by matching the default rates of modelled portfolios to the historically observed rates. See Fitch (2019).

103 ESMA (2020).

no overcollateralisation assumed for the CLO (if the face value of the leveraged loans is higher than CLO liabilities).

RA.3
Loan and CLO assumptions in simulation analysis

Portfolio characteristics	
Loans	100 loans (equal par with zero coupon) (10 loans each in 10 different sectors)
Default probability	20% over five years
Default correlation	0.2 - loans in same sector 0 - loans in different sectors
Recovery rate on default	50%
Maturity	5 years
CLO structure	
Equity	8% of portfolio
Junior	12% of portfolio
Mezzanine	20% of portfolio
Senior	60% of portfolio

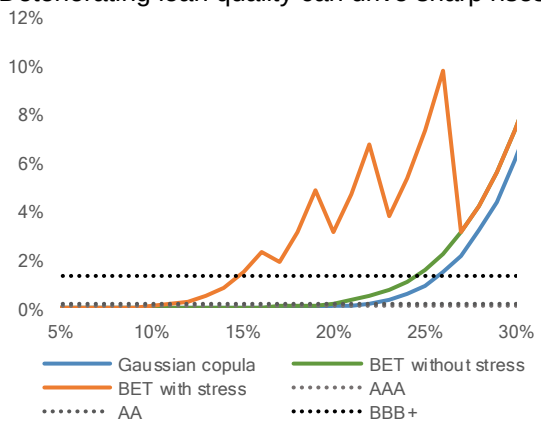
Note: Assumes fixed recovery rate in case of default, no ramp-up or wind-down period, no changes in loan portfolio over life of CLO.

Copulas were modelled using Monte-Carlo simulation with at least 100,000 runs. To run the BET simulations, the diversity score of the portfolio was first calculated from the correlations and the number of loans in the portfolio,[104] the binomial distribution was then used to analytically model outcomes. Finally, for 'the stressed BET', we applied a stress factor[105] to scale up the underlying loan probabilities when it was required for a tranche. As the stress depends on the rating targeted by a tranche, the target rating was taken to be the highest rating for the tranche that did not fall under the stress (to capture the best rating that was robust under the stress).[106]

Default probabilities and recoveries

First, we consider how ratings may change as the underlying loan default probability or recovery rates change. The results show, as one would expect, that credit ratings generally fall as the credit quality of the underlying loans falls (RA.4) or as recoveries fall (RA.5). It is noteworthy in these charts (and others that follow) that the default probabilities show significant oscillations under the stressed BET, this is an artefact of the stepped nature of the stress factors, which in some cases as the unstressed default probability of the tranche increases, is subject to a weaker stress which means that the probability of defaults for the tranche under the stress actually falls. Given this, when interpreting results of the stressed BET in this paper, we disregard these oscillations and focus instead on the trend.

RA.4
Default tranche probability and loan defaults
Deteriorating loan quality can drive sharp rises



Note: Simulated mezzanine tranche default probability (y-axis) under different assumed default probabilities of the underlying loans (x-axis). Assumes 50% recovery rate and uses Fitch tables for ratings levels.
Sources: ESMA calculations.

All three models show a rapid increase in tranche default probability (here the mezzanine tranche) beyond a certain point. The stressed BET is by far the more conservative. In our simulated CLO, it would rate the mezzanine tranche BBB+ when the underlying loans had 15% default probability whereas both the (unstressed) BET and Gaussian models would only rate the tranche this

[104] Expressions for diversity score were derived using 1st and 2nd moment-matching both in the case of a portfolio with a flat pairwise default correlation across all loans, and in the case where there are different correlations for loans in the same and in different sectors. This generalised the derivation on p.471 in Nickerson et al. (2017), assuming different pairwise default correlations for loans in the same and different sectors.

[105] Here we use Moody's table of stresses for simplicity. See p.35, Moody's (2019).

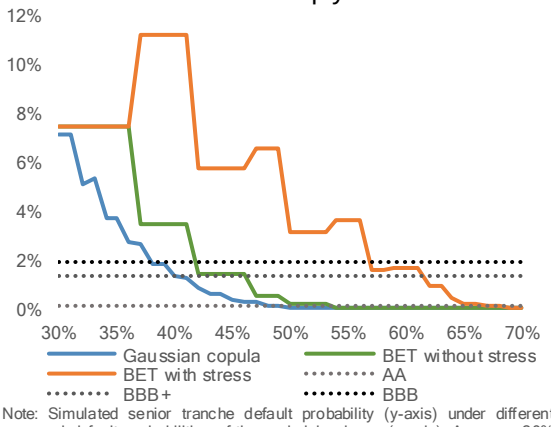
[106] As stress factors above 1 only apply when tranche default probabilities are low, senior and mezzanine tranches are the only ones affected by the stresses in the results below, for equity and junior tranches, stress BET results were the same as the unstressed BET.

level if the underlying loans had a default probability of at least 25%.

For variation in recovery rates the picture is similar – default probabilities rise rapidly under all models once recoveries fall low enough. Stressed BET is again significantly more conservative than the other two models (RA.5).

These two charts show just how much the stress in the BET can affect the tranche rating. This effect is owing to the stress factors being high when the unstressed tranche default probabilities are low. At their highest the stress factors almost double the underlying loan default probability, which has a large impact on the expected loss and default probability of the CLO tranche.

RA.5
Default tranche probability and recovery rates
Lower recoveries can sharply increase risk



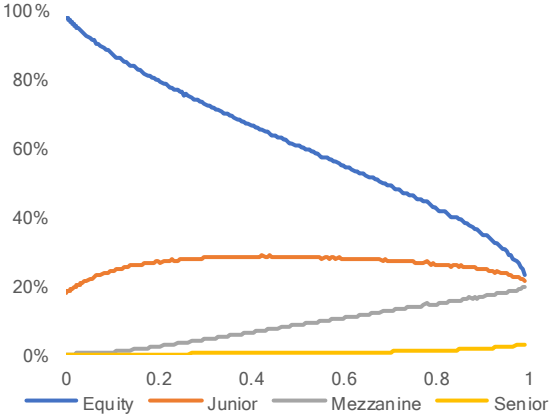
Note: Simulated senior tranche default probability (y-axis) under different assumed default probabilities of the underlying loans (x-axis). Assumes 20% probability of default for underlying loans, rating levels calibrated from Fitch tables.
Sources: ESMA calculations.

Correlation

As mentioned above, correlation is a key input to CLO rating portfolio models. Here we look at how changing correlation can affect CLO ratings. The analysis extends that which is presented in TRV 2-2019, because it allows default correlations to differ depending on whether loans are in the same sector or in different sectors. Distinguishing inter-sector and intra-sector correlation in this way is also closer to how the CRAs model correlation for rating CLOs, as discussed earlier.

First, we explore the simpler case in which the default correlation is assumed to be the same for all loans, first for the Gaussian copula (RA.6) and then for the stressed BET (RA.7). Varying loan correlation from totally uncorrelated to fully correlated, the charts show how expected losses for the tranches change as correlation increases. For the equity tranche, expected loss falls as correlation rises, reflecting that fact that when loan defaults co-occur, losses are more likely to exceed the equity tranche and also be borne by the other tranches. More senior tranches thus fare worse as correlation rises, while the impacts on the junior tranche fall in between those of the equity tranche and the more senior tranches.

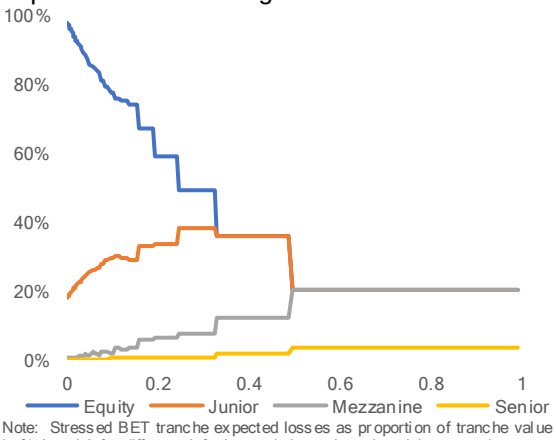
RA.6
Expected loss and default correlation - Gaussian
Higher correlation hits senior tranches more



Note: Gaussian copula tranche expected losses as proportion of tranche value in % (y-axis) for different default correlation values (x-axis) - assuming same default correlation among all loans.
Sources: ESMA calculations

The stressed BET model exhibits the same broad pattern of the Gaussian copula, but with a clear difference. In the BET the expected losses of the tranches change in steps, and these changes occur at a lower correlation than in the Gaussian model, which shows it is more conservative in assigning default probability to the more senior tranches (RA.7)

RA.7
Expected loss and default correlation – stressed BET
Expected losses change at lower correlations



Note: Stressed BET tranche expected losses as proportion of tranche value in % (y-axis) for different default correlation values (x-axis) - assuming same default correlation among all loans.
Sources: ESMA calculations

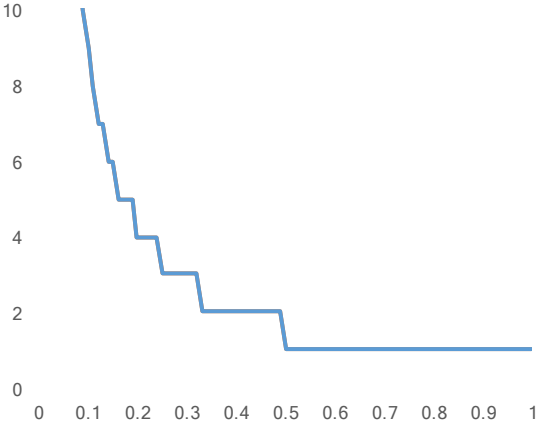
This difference is due to the way in which how the BET models the distribution using a hypothetical

portfolio, whose number of assets equals the diversity score. The diversity score is always a whole number and falls in unit steps with increasing correlation. In addition, as it is rounded down it implicitly and conservatively assumes a higher correlation for the loan pool. These also create step effects, as explained in the box below (RA.8).

RA.8
Diversity score in the BET model
Step effects from diversity score changes

In the BET model, the diversity score is the number of assets in the hypothetical portfolio used to model outcomes for the actual portfolio. As such, it is always a whole number. So, while the diversity score falls with increasing correlation, it can only fall in unit steps, as the chart RA.9 illustrates for our idealised CLO.

RA.9
Diversity score and default correlation
Diversity score falls in steps as correlation rises

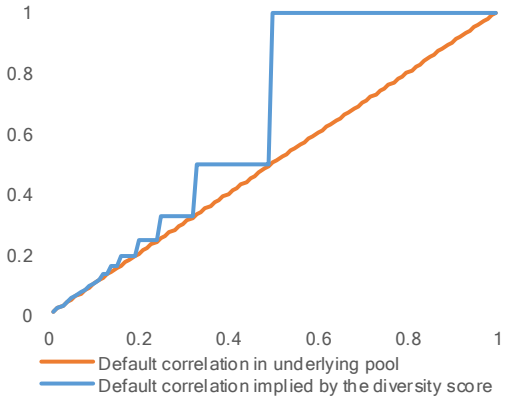


Note: Diversity score (y-axis) vs correlation (x-axis) for the idealised CLO, assuming the same default correlation between all loans.
Sources: ESMA calculations

The step changes in the diversity score mean that when it is low, a diversity score change can significantly change the BET's binomial distribution, which can lead to large step changes in modelled outcomes (see, for example, the step changes in expected loss in RA.7 for correlations above 0.2).

In addition, when calculating the diversity score from the correlation it is rounded down to nearest whole number. This increases the correlation assumed for the loan pool. Chart RA.10 shows how the correlation implicitly assumed by a diversity score varies with the correlation of the loan pool used to calculate the diversity score, for the idealised CLO.

RA.10
Diversity score and default correlation
Implicitly assumes steps in loan correlations



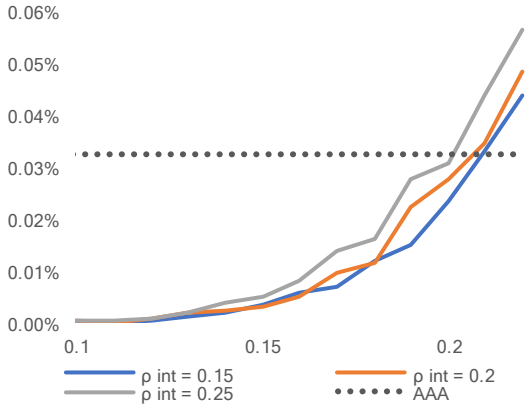
Note: Correlation implied by the diversity score (y-axis) vs correlation of the underlying pool used for calculating the diversity score (x-axis) for the idealised CLO used in our modelling.
Sources: ESMA calculations

The extent of rounding up of correlation increases as the underlying loan correlation increases. For low correlations impacts are minimal, but for high correlations it becomes significant. In our model CLO, for example, once the default loan correlation reaches 0.5 or higher, it is treated as one in the BET model.

Because of these features of the BET model, the expected loss changes in the BET model are fully realised once the default correlation reaches 0.5 because at this point the diversity score is one, which is equivalent to assuming a default correlation of one. For correlations above 0.5, the BET models no longer model any differences. While this shows that the model is conservative in its treatment of correlation when correlation is high, it also shows a limitation of the BET model, namely, that it becomes less discriminating between different outcomes as correlation rises. Overall, the BET model works best when correlation is low. When correlation is high it becomes much more conservative.

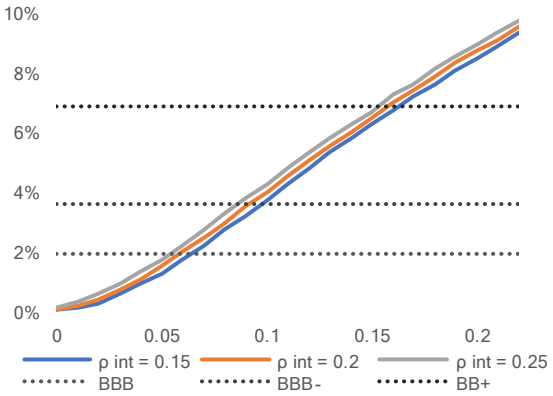
We now explore the more complex situation, in which intra-sector and inter-sector loan correlation can take different values. This is more realistic and closer to CRA models. The charts below show how increasing inter-sector correlation affects the senior and mezzanine tranches respectively, for three values of intra-sector correlation – 0.15, 0.2 and 0.25. (RA.11, RA.12).

RA.11
Senior tranche defaults and sector correlations
Sector correlations increases can affect ratings



Default senior tranche probabilities (y-axis) vs inter-sector correlations (x-axis) for different values of intra-sector correlation (0.15, 0.2 and 0.25). Rating levels from Fitch tables.
Sources: ESMA calculations

RA.12
Mezzanine tranche defaults and sector correlations
Inter-sector correlation increases more impactful



Note: Default mezzanine tranche probabilities (y-axis) vs inter-sector correlations (x-axis) for different values of intra-sector correlation (0.15, 0.2 and 0.25). Rating levels from Fitch tables.
Sources: ESMA calculations

For the senior tranche, an increase in intra-sector correlation increases the default probability a little, but much less than does an increase in the inter-sector correlation. For example, an increase in inter-sector correlation from 0.15 to 0.2 triples the default probability, while the same increase for intra-sector correlation at most increases the default probability by less than half. A similar pattern is visible for the mezzanine tranche – here a 0.05 increase in intra-sector correlation increases default probability by less than 0.5%, while the same increase in inter-sector correlation increases the default probability by over 2%.

The mathematical reason for this is that in our underlying portfolio there are many more loans in different sectors than there are in common sectors. Increasing correlation among loans in different sectors therefore has a much larger impact on portfolio risk and default tranche probabilities. In practice, this shows that there is a model vulnerability (also shared by the BET models) to increases in correlation, and not only large increases in correlation (visible in all of the charts here) but also small increases in default correlation for a large number of loans.

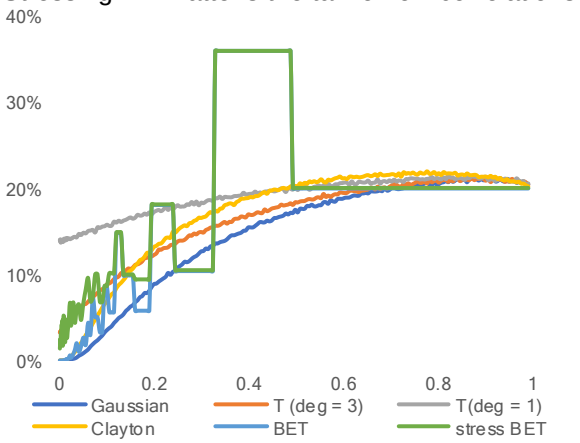
Tail dependence

To conclude this section, we perform a similar analysis to that carried out in TRV 2-2019 looking at how the modelling of the tail of the portfolio risk distribution is important to ratings. In this case we also incorporate the BET models to see how they compare.

The chart below compares how the default probability of the mezzanine tranche, as modelled under different copulas (Gaussian, T, Clayton) and the two BET models, varies with loan default correlation.[107] To simplify the analysis, we assume that all of the loans share the same default correlation. (RA.13)

[107] As the Clayton copula is not parametrised by correlation, a Kendall tau is calibrated from the correlation value using a standard formula.

RA.13
Different copulas and BET
Stressing BET fattens the tail for low correlations



Note:Mezzanine tranche default probabilities (y-axis) vs. correlation (x-axis), assuming constant correlation across all loans.
Sources: ESMA calculations

Default probability increases with increasing correlation under all models. In line with TRV 2-2019, there is also a big difference in the modelled default probability across the copulas. As the tranche default probability increases with increasing correlation, the Clayton copula becomes the most conservative of the copula models in its assessment of default probability. This reflects its ability to model increased tail dependence for the right-hand tail of the default distribution (i.e. more stressed scenarios increasing default correlation, increasing the risk of multiple defaults in the pool). The T distributions also fatten tails (and are more conservative across correlation values), while the Gaussian copula is the most 'optimistic' giving the lowest default probability of the copulas at all correlation values.

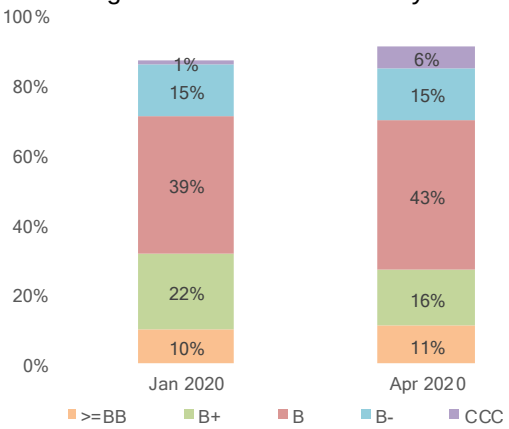
The BET models are generally more conservative than the Gaussian. We can also see how the addition of the stress to the BET fattens the tail when correlations are low. For low correlations it gives much higher probabilities of default than the BET. Again, we see the limits of the BET at high correlation values, with increasingly large jumps as correlation rises, before modelled probabilities become constant once correlation exceeds 0.5.

Relevance

Possible implications for CLO ratings

The COVID-19 situation has had wide-ranging impacts on the real economy and financial markets, leading to a general deterioration in economic outlook. It has acted as a major shock to credit risk which has led to widespread downgrades in corporate debt, including in leveraged loans, which have started to be downgraded and put on negative watch or outlook. (RA.14).

RA.14
Leveraged loan downgrades
EU downgrades accumulate in early 2020



Note: Does not add to 100% due to median calculation and unreported ratings
Sources: Reproduced from Barclays Research (2020), which used data from Kanerai, Intex and Barclays Research.

Deteriorating leveraged loan performance and credit quality directly links with analyses that we have carried out. In particular, our analysis is directly relevant to questions that interest investors and regulators are asking at this time, such as, to what extent leveraged loan rating downgrades (which correlate with loan default probabilities) will lead to downgrades in CLO tranches, and which tranches will be affected and by how much.

There are several links between the analyses above and the COVID-19 context. First, increasing the risk of leveraged loan downgrades is indicative of increasing underlying loan default probability. Chart RA.4 is thus relevant here. It shows that all of the models would increase tranche default risk as the underlying loan credit quality falls. The stressed BET would be more conservative from the outset and it would downgrade tranches sooner than the BET or the Gaussian copula. RA.15 presents this explicitly in terms of ratings. It shows how each model would re-rate the idealised CLO as loan default probability increases.

RA.15
CLO rating sensitivity to loan credit quality deterioration
Mezzanine tranche sensitivity to loan downgrades

Loan default probability (rating)	20% (B+)	22% (B)	24% (B)	26% (B)	28% (B)	30% (B)
Gaussian copula	AAA	AA	A+	BBB+	BBB	BBB−
BET	AA	A+	A−	BBB	BBB−	BB+
Stressed BET	BBB	BBB−	BBB−	BB+[108]	BBB−	BB+

Note: Calculated for the idealised CLO, with loan recovery rate of 50%, intra-sector default correlation of 0.2 and zero inter-sector correlation. Ratings assigned using Fitch rating tables.

This type of analysis provides an answer – in the case of our idealised CLO under the simple models used – to the question of how much might a CLO (here the mezzanine) tranche be affected as the average credit quality of loans in the portfolio deteriorates. Interestingly, the sensitivity of tranche default probability appears relatively high under all three models. It takes only an increase in default loan probability from 20% to 22% to lead to a tranche downgrade.

The table below presents a similar analysis, but for recovery rates (RA.16). It shows that lower recovery rates on underlying loans can also lower CLO ratings, with small falls in expected recovery rates when loans default (e.g. 2% falls) leading to downgrades across the three models.

RA.16
CLO rating sensitivity to lower recovery rate
Mezzanine tranche sensitivity to lower recoveries

Loan recovery rate	50%	48%	46%	44%	42%	40%
Gaussian copula	AAA	AA+	AA−	A	A	BBB+
BET	AA	A+	BBB+	BBB+	BBB+	BBB
Stressed BET	BBB	BBB−	BBB−	BBB−	BBB−	BB

Note: Calculated for the idealised CLO, with underlying loan default probability of 20%, intra-sector default correlation of 0.2 and zero inter-sector correlation. Ratings assigned using Fitch rating tables.

This is particularly relevant in the current context given concerns about 'cov-lite' leverage loans. While the weaker covenants of cov-lite loans may delay the triggering of a loan default, it may worsen recoveries when the default actually occurs (as the default may occur at a point when the loan has deteriorated further). If cov-lite loans' recovery rates are lower than anticipated, then CLO tranche ratings may be affected.

Next, we look at how increases in inter-sector correlation could affect CLO ratings in our idealised model (RA.17). Here we see, in line with RA.12, that very small increases in inter-sector correlation can also lead to rating downgrades for the mezzanine tranche. This has particular relevance in the context of COVID-19 given that we have seen severe economic impacts across sectors that would not normally be expected to be so correlated. Given this, there may well be increases in default correlations for some loans in different sectors which could contribute to CLO tranche downgrades.

RA.17
CLO rating sensitivity to increased inter-sector correlation
Mezzanine tranche sensitivity to correlation

Inter-sector correlation	0	0.01	0.02	0.03	0.04	0.05
Gaussian copula	AAA	AA	AA−	A	A−	BBB+
BET	AA	A−	BBB+	BBB+	BBB+	BBB
Stressed BET	BBB	BBB−	BBB−	BBB−	BB+	BBB−

Note: Calculated for the idealised CLO, with underlying loan default probability of 20%, recovery rate of 50% and intra-sector default correlation of 0.2. Ratings assigned using Fitch rating tables.

Another issue, not explicitly captured above, is how CLO ratings might be affected by multiple parameter shifts. In the COVID-19 crisis, we could see a combination of deteriorating leveraged loan credit quality, lower-than-expected recovery rates, and increases in default correlations. Occurring together, these would have a cumulative impact which could not only lead to more significant and numerous downgrades of CLO tranches, particularly for the junior and mezzanine tranches, but also affect some senior tranches.

In addition, the different models (Gaussian, BET and stressed BET) often rate the same CLO tranche differently. This highlights the risk of the model chosen not capturing the evolving credit dynamics of the COVID-19 crisis well. For

[108] Note that the counterintuitive rating upgrade under the stressed BET model when the loan default probability increases from 26% and 28% is driven by the stress factor falling as the unstressed BET rating falls, which lowers the underlying probability of the loans used to calculate the rating under the stressed BET model. A similar increase is seen in the correlation sensitivity table when the inter-sector correlation increases from 0.04 to 0.05.

example, the stressed BET by adding stresses to the senior and mezzanine tranche might better capture the 'fattening of tails' that can occur in a crisis. If so, then its (original) more pessimistic CLO ratings could prove to more accurate than those of a Gaussian or unstressed BET model with corresponding parameter inputs (i.e. recovery rates, correlations and loan default probabilities).

In practice, ratings are not entirely based on models, so the risks identified in this section will be mitigated to an extent that ratings are informed by other evidence and assessments (from outside the model). In addition, the risks should be mitigated in part by the requirement that structured products have at least two ratings from different CRAs, because the credit assessment of a CLO tranche should then rely on at least two different models.

Conclusion

This paper has outlined some of the main approaches to modelling CLO credit risk by CRAs. Using simplified versions of the kinds of models used by CRAs, we simulated an idealised CLO to explore how tranche credit ratings could vary with different inputs, such as default correlation, and by the type of model used, such as BET or a particular copula. Thus, CLO ratings can vary as a result of small differences in parameter inputs, or when a different model is used.

The COVID-19 crisis is disrupting markets in ways that were impossible to predict when CLO ratings were assigned before the epidemic. It is likely that some CLO ratings will now evolve in response, with downgrades occurring as CRAs revise their views. With this in mind, model analyses like those presented here, but calibrated to the detailed CRA models, could help investors and other market participants understand where downgrades could eventually occur and how extensive they might be. This should help to moderate a possible procyclical impact of ratings from model risk, whereby ratings are subject to large downgrades, as a model's inaccuracies become clear in a stress period.

Indeed, the largest CRAs have recently published some scenario analyses looking at how the COVID-19 crisis might affect CLO ratings for their own models.[109] However, these look at how ratings would change under more detailed specific scenarios, and do not explain how their rating models would systematically change ratings as model inputs change, as attempted here for our simplified CLO.

More systematic and granular information on model inputs and the models themselves could help investors understand better some risks they implicitly take on by relying on ratings when investing in CLOs. For example, it could help to make explicit the extent to which an investment in a CLO tranche is a bet against recovery rates of the leveraged loans in the CLO pool turning out to be lower than originally anticipated. It could also help investors assess how cumulative changes in the different underlying model parameters might influence different CLO tranches.

Without systematic transparency on model risks and their potential impacts, for example, through sensitivity analyses or reverse stress tests, market participants are more likely to overlook some model risks and underprice them. In addition, as was seen in the GFC with CDO ratings and their implicit underpricing of correlation risk in US residential mortgage markets, this can have potentially detrimental impacts if the overlooked risk crystallises and downgrades follow.

This article also complements the findings of ESMA's recent thematic report,[110] which highlighted the importance of CRAs continuing to perform regular stress-testing simulations and to provide market participants with granular information on the sensitivity of CLO credit ratings to key economic variables affected by the COVID-19 pandemic.

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[109] See Moody's (2020) 'Shape of downturn, position in capital structure will influence collateral defaults', and S&P (2020) 'Scenario Analysis: How Credit Distress Owing to COVID-19 Could Affect U.S. CLO Ratings'.

[110] ESMA (2020).

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Financial stability

Interconnectedness in the EU fund industry

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Summary

The COVID-19 turmoil has highlighted the risks of market-wide stress, not least for investment funds. This article assesses the connectedness among EU fixed-income funds. Our empirical results suggest high spillover effects, indicating that funds exposed to less liquid asset classes are more likely to be affected by shocks originating in other markets than funds invested in more liquid assets. Alternative funds are found to be the main transmitters of shocks, while high yield (HY) and corporate bond funds were net shock receivers during the COVID-19 market stress.

Introduction

Since the Global Financial Crisis, the size of the EU investment fund industry has expanded from EUR 5.3tn in 2008 to EUR 17.7tn in 2019. In EU, investors can benefit from the possibility of investing in a wide range of asset classes within advanced regulatory frameworks (UCITS or AIFMD).

The increasing importance of the asset management industry has also put the attention on potential financial stability risks arising from investment funds. This has been a concern during the COVID-19 outbreak as the prospects of a severe economic downturn triggered a significant deterioration of liquidity in some segments of the fixed income markets combined with large-scale investment outflows from investors in the EU investment fund industry.

Funds could present risks to financial stability through two main channels. The first one relates to liquidity mismatch, whereby some funds offer daily liquidity to investors while investing in less liquid asset classes.[112] In the event of large redemptions, fund managers might face difficulties in selling their assets, resulting in potential downward pressure on prices. The second one relates to the market footprint of funds: the sales of securities by funds could move markets owing to the size of the fund holdings compared with the absorption capacity of the market. While the action of one fund is unlikely to have an impact on markets, the simultaneous action of multiple funds could have a large impact (ESMA, 2019a).

In that context, it is crucial to assess contagion risk within the fund sector: if spillovers within the fund industry are high during stressed periods, several funds will have to sell assets at the same time, resulting in potentially large price moves and risks to financial stability. In the context of fallen angels (IG bonds downgraded to HY), ESMA (2020) shows how the sales of corporate bonds by investment funds could result in exerting downward pressure on the underlying assets.

We estimate spillovers within the EU fund industry by focusing mainly on fixed income UCITS: they account for a large share of the UCITS universe, are invested in a broad range of assets with varying degrees of liquidity, are exposed to market shocks, credit risk and are more vulnerable to change in investor sentiment.

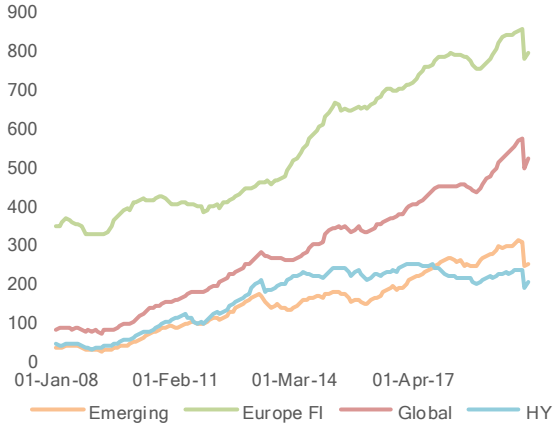
[111] This article was authored by Massimo Ferrari, Monica Gentile (Consob) and Antoine Bouveret. The authors would like to thank Francesco Fancello.

[112] Existing Union rules include specific obligations on fund management companies with respect to liquidity risk management in relation to the funds that they manage, in order to ensure that the liquidity profile of the investment of the fund is coherent with its redemption policy.

The size of the UCITS fixed income fund industry increased from around EUR 500bn at the beginning of 2008 to EUR 1,955bn at the end of January 2020 (RA.1). Over this period, the composition of the fund industry changed with an increase in the proportion of HY and EM bond funds (from 6% to 12%, and from 5% to 16% respectively). During the ongoing low interest rate environment, fixed income funds have also reduced their holdings of cash and cash equivalent assets that provide little or no income in an effort to improve returns.

At the end of March 2020, in the wake of the market turmoil triggered by the COVID-19 outbreak, the size of EU fixed income funds fell to EUR 1,700bn. With respect to the beginning of the year, fixed income net assets decreased by 12% (20% for HY and EM).

RA.1
Fixed income funds
Increase in size over time



Note: NAV of fixed income funds aggregated by style, in EUR bn.
Sources: Morningstar, ESMA.

Interconnectedness and contagion

Interconnectedness and contagion are different concepts. Interconnectedness refers to linkages between financial institutions or markets regardless of market conditions. Contagion is defined as a significant increase in cross-market links owing to a shock occurring in one market or asset (Forbes and Rigobon, 2002; Pericoli and Sbracia, 2003).[113]

Interconnectedness analysis is usually divided into two groups depending on the type of data used: exposure-based analysis and market-based analysis. Exposure-based analyses require granular data showing the interconnectedness between institutions and markets. For example, Clerc et al. (2014) use data on CDS exposures to map the European CDS network. More recently, ESMA (2019b) uses EMIR data to estimate exposures in derivatives markets. The main advantage of exposure-based analysis is to provide a direct overview of the linkages between entities. However, data on exposures are not always available or consistent across institutions, and are not usually timely reported.

As an alternative, market-based measures of interconnectedness uncover indirect linkages between financial institutions and markets based on investor perceptions, which are reflected in prices.

There is an extensive body of literature investigating inter-market transmissions and the relationships among different financial market segments (see Bricco and Xu (2019) for an overview). The existing studies could be loosely divided into two groups, long-run cointegration approaches and short-run GARCH analyses. Cointegration analyses aim to examine the existence of stable relationships in the long run, but are not able to capture the time varying characteristics of shock spillovers when these relationships change.

Within the range of GARCH analyses, the approach developed by Diebold and Yilmaz (2009, 2012, 2014) (DY hereafter) provides a flexible framework that can be applied to investment funds and markets. This methodology allows a large number of variables to investigated simultaneously as well as the rich dynamics of spillovers to be characterized and has some appealing properties:

- Variance decompositions are used to define connectedness measures, showing how much of the future uncertainty associated with the stress in asset i is owing to stress shocks in asset j;
- These measures relate to other widely used risk measures such as CoVaR (Adrian and

[113] An exhaustive description of the different definitions of contagion is provided by Pericoli and Sbracia (2003).

Brunnermeier, 2016) and marginal expected shortfall (Acharya et al., 2017);

— They are relatively fast to adapt to changes in the data owing to their high predictive power (Arsov et al.,2013).

RA.2 provides an overview of the econometric model used to estimate volatility spillovers between markets or institutions. This framework has been used to measure dynamic connectedness across institutions such as GSIBs (IMF, 2017), or banks and insurance (IMF, 2016), as well as across markets (Gentile and Giordano, 2012).

In the next section we use the DY framework and apply it to the fund industry to estimate how EU funds are connected across fund categories in normal times, and to assess whether or not the COVID-19 crisis has led to contagion effects within EU funds.

RA.2
Estimation of interconnectedness
Overview of Diebold and Yilmaz (2012, 2014) framework

Extending their 2009 methodology, DY 2012 examine volatility spillovers by developing a revised spillover measure based on the generalized impulse response approach of Koop, Pesaran, and Porter (1996) and Pesaran and Shin (1998). The forecast error variance decompositions produced by this version are independent to variable ordering. The DY approach is based on three different measures of interconnectedness:

i) Pairwise directional connectedness (interlinkages between two entities or markets);
ii) System-wide connectedness (overall level of connectedness in the systen);
iii) System-wide directional spillovers (how individudal shocks are transmitted to the system and how shocks to the system are transmitted to individual entities).

The authors use a Variance Autoregression model (VAR) based on the standard deviations of the market returns to estimate the different measures of connectedness. The VAR is then used to decompose the volatity forecast error variance: how much of the variation in the volatility of A can be explained by B?

Formally, the VAR model is given by:

$$x_t = \sum_{i=1}^{p} \Phi_i x_{t-i} + \varepsilon_t$$

where x_t is a vector of return volatility.

After estimating the VAR, the generalized forecast error variance is decomposed to identify the contribution of each variable to the other variables.

Variable j's contribution to variable i's H-step-ahead generalised forecast error variance is given by:

$$\theta_{i,j}^{g}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e_i' A_h \sum e_j\right)^2}{\sum_{h=0}^{H-1} \left(e_i' A_h \sum A'_h e_i\right)}$$

where Σ is the covariance matrix for the error vector ε, σ_{jj} is the standard deviation of the error term for the j^{th} equation and e_i is the selection vector with one as the i^{th} element and zeros otherwise.

For the purpose of our analysis, we follow DY (2014) and perform the VAR estimation on a system of log-volatilities of financial indices with automatic selection of the LASSO penalty using cross-validation.

The connectedness measures can then be directly computed:

Total connectedness:

$C^H = \frac{\sum_{i,j=1, i\neq j}^{N} \tilde{\theta}_{i,j}^{g}(H)}{\sum_{i,j=1,}^{N} \tilde{\theta}_{i,j}^{g}(H)}$ [**System-wide** connectedness]

Example: How has connectedness across US and EU equity markets evolved over time?

Inward connectedness:

$C_{i\leftarrow.}^{H} = \frac{\sum_{j=1,\, j\neq i}^{N} \tilde{\theta}_{i,j}^{g}(H)}{\sum_{i,j=1,}^{N} \tilde{\theta}_{i,j}^{g}(H)}$ [Uncertainty of *i* **FROM** the system]

Example: How does a fund category react to shocks from another segment of the fund industry?

Outward connectedness:

$C_{.\leftarrow i}^{H} = \frac{\sum_{j=1,\, j\neq i}^{N} \tilde{\theta}_{j,i}^{g}(H)}{\sum_{i,j=1,}^{N} \tilde{\theta}_{j,i}^{g}(H)}$ [Uncertainty of *i* **TO** the system]

Example: Which market segment contributes more to shocks in other market segments?

Net connectedness:

$C^H = C_{.\leftarrow i}^{H} - C_{i\leftarrow.}^{H}$ [Difference between shocks **TO** and **FROM**]

Pairwise directional connectedness:

$C_{i\leftarrow j}^{H} = \tilde{\theta}_{i,j}^{g}(H)$ [Uncertainty of ***i*** related to ***j***]

Example: How is the German equity market connected to the US market?

Interconnectedness in the EU fund industry

This section describes the data used for our analysis and presents results for connectedness of EU bond and multi-asset UCITS, with a special focus on recent developments during the COVID-19 market crisis.

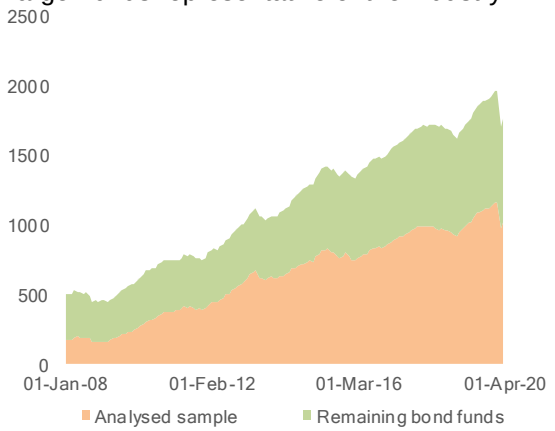
Sample

We use a sample of UCITS fixed income and multi-asset funds sourced from Morningstar. with data from January 2008 to April 2020. Returns and fund values are sampled at a weekly

frequency to avoid day-of-the-week effects. Given the diversity of fixed income UCITS, funds are split into four different categories: HY bond funds, EM bond funds, IG corporate bond funds and government bond funds. Multi-asset funds are included as they also invest in fixed income instruments. These are mixed funds that invest in both equity and bonds, and funds that apply investment strategies that are comparable to hedge funds (alternative UCITS). The latter consist of investment vehicles that may gain exposure to a variety of assets via derivatives, base their investment decisions on market valuations and the macro-economic environment, or eventually profit from changes in the credit conditions in bond markets using derivatives, such as CDS and IRDs, to hedge systematic risk in credit and interest rate markets.

The final sample includes 3,280 funds with a NAV of more than EUR 150mn and with a minimum 12-month track record of performance. Overall, bond funds used in the analysis account for a share of the EU fixed income industry varying from 35% at the beginning of 2008 to 60% in 2020 (RA.3).

RA.3
Fixed income funds' sample
Larger funds representative of the industry



Note: Representativeness of analysed sample over time, EUR bn.
Sources: Morningstar, ESMA.

For each fund category, we build a weekly value-weighted return:

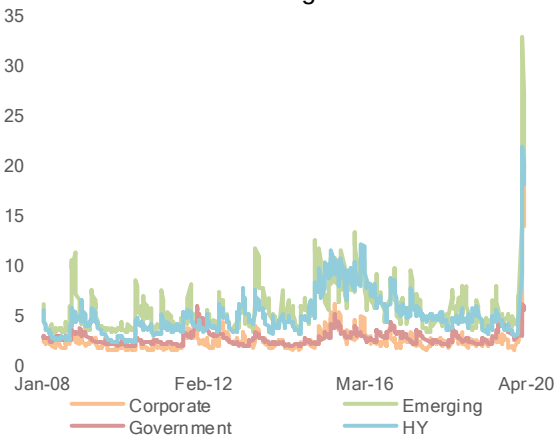
$$r_t^C = \sum_{t=1}^{N} \left(\frac{AuM_{i,t} * Return_{i,t}}{\sum_{i=1}^{N} AuM_{i,t}} \right)$$

where N corresponds to the number of funds per category, and fund values and returns are denominated in euro.

The value-weighted return can then be used to extract the corresponding volatilities and examine their spillover effects using a parsimonious model setting, which also eases the interpretation of results.

The return volatilities are first estimated by filtering the weekly value-weighted fund returns and the Eurostoxx600 with an ARMA(1,1)-GARCH(1,1) model. The returns are then annualised (RA.4)

RA.4
Annualised return volatilities
Extreme movements during COVID-19 crisis



Note: Annualised volatility of fixed income funds, in %.
Sources: Consob, ESMA.

Connectedness across EU funds

The volatility connectedness table estimated following DY (2012, 2014) provides an overview of the average spillover effects across the analysed fund categories over the considered period (RA.5). The estimates of spillovers allow to assess to which extent volatility shocks spread from one fund category and which funds are more likely to receive them.

Table RA.5 displays the following types of connectedness for our sample across the entire period from 2008 to 2020:

- Own-connectedness: the fraction of the estimated volatility of category i that is owing to its own shocks, hence representing the own-connectedness of each fund category. This is represented by the elements on the diagonal of the table (i.e. i = j), e.g. for corporate bond funds this is 34.0%.
- Shock transmission – directional spillover TO others
- Shock receiver – directional spillover FROM others
- Net spillovers – difference between shock transmission and shock reception.

Typically, own-connectedness is the largest individual elements in the table. However, the total directional connectedness, the aggregated connectedness FROM others or TO others, tends to be much larger.

RA.5
Volatility spillover table

	Alternative	Corporate	Emerging	Government	HY	Mixed	Eurostoxx 600	Directional spillovers from others
Alternative	35.9	10.8	10.1	1.1	17.5	18.7	5.9	64.1
Corporate	13.8	34.0	13.0	6.1	18.0	11.1	3.9	66.0
Emerging	12.9	13.6	33.4	2.2	20.5	12.4	5.0	66.6
Government	5.4	15.6	6.1	58.4	4.9	6.1	3.5	41.6
HY	18.8	15.1	17.4	1.3	30.7	13.0	3.8	69.4
Mixed	18.8	9.3	10.0	1.4	11.9	29.9	18.7	70.1
Eurostoxx600	7.8	3.1	5.9	0.7	4.0	30.0	48.5	51.5
Directional spillovers to others	77.5	67.5	62.4	12.8	76.9	91.3	40.8	61.3
Net spillovers	13.5	1.5	-4.2	-28.8	7.6	21.2	-10.7	

Note: Connectedness table of the full sample, in %.
Source: Consob, ESMA.

The total connectedness, or spillovers, for the entire period of analysis indicates the degree of connectedness of the system. As shown in the bottom right corner of RA.5, total connectedness, is 61%, pointing to a high level of interconnectedness in the EU bond fund market. In other words, around 61% of the volatility forecasted can be attributed to spillovers among the different fund categories. The remaining 39% is explained instead by idiosyncratic and external shocks.

The methodology adopted enables us to learn about the direction of volatility spillovers across fund strategies and the stock market. Directional spillovers help to further uncover the transmission mechanism, as we can decompose the total spillovers into those coming FROM (shock reception) or going TO (shock transmission) a particular asset class in the system.

The values in the last column of RA.5, i.e. the total directional FROM connectedness, are the share of volatility shocks received by each of the six categories and the stock index FROM other fund types.[114] The total directional FROM connectedness ranges between 51.6% and 70%, showing that for all fund strategies a relatively high share of variance comes from other markets. In particular, funds exposed to less liquid asset classes (HY, EM or corporate bonds funds) are the most affected by the volatility shocks in other investment funds. In contrast, only 40% of government bond funds volatility is explained by stress from other fund categories.

The values in the 'Spillover TO' row of RA.5 represent the total directional connectedness transmitted from each fund type TO the others. These spillovers differ substantially across fund types. The analysis suggests that mixed, alternative and HY funds are the highest transmitters of spillovers. Government bonds funds appear again at the other end of the spectrum: they seem to transmit relatively little spillovers to other fund categories.

Finally, the last row in RA.5 provides the net total directional connectedness, which results from the difference between total connectedness TO other funds and total connectedness FROM other funds. Mixed, alternative, HY and corporate funds tend to be net transmitters of shocks to the system as their net total connectedness is positive over the reference period with mixed and

[114] The total directional FROM connectedness is equal to 100% minus the own share of the total forecast error variance by definition and represent the percentage of the forecast-error variance that come from other markets.

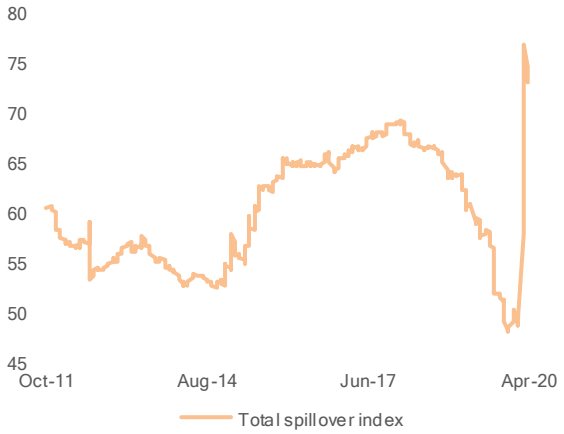
alternative funds showing the highest shock transmission levels at 21% and 14% respectively. The shock transmission of HY and corporate bond funds appears more limited at 8% and 2% respectively. The remaining bond fund types display a negative level of net connectedness, indicating that they are net receivers of shocks.

Time varying spillover indices

The full-sample connectedness table covers the entire sample period and thus does not capture the dynamics of connectedness. A rolling sample framework can be used to create a dynamic total spillover index and assess the variation of volatility spillovers within the system over time.[115]

The dynamic total spillover index shows that large contagion effects occurred in March 2020: while overall spillovers had been declining since 3Q17, spillovers shot up in March 2020 to reach their highest levels observed (RA.6).

RA.6
Dynamic total volatility spillover
Historical maximum in March 2020

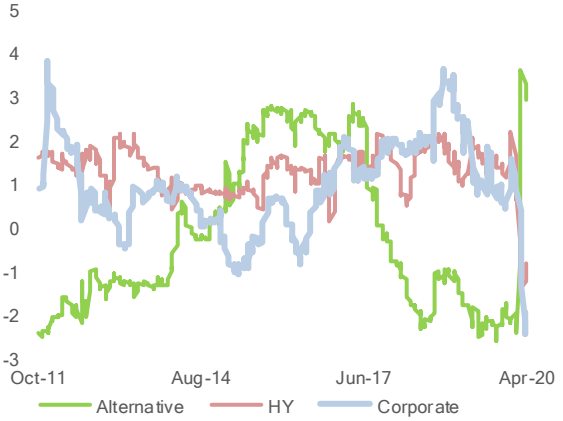


Note: Total dynamic connectedness among EU fixed income funds, mixed funds, funds pursuing alternative-like strategies and Eurosotxx600, in %.
Sources: Consob, ESMA.

The net dynamic directional spillover indices show whether different types of bond funds have tended to be shock transmitters (value >0%) or receivers (value <0%) over the sample period.

The analysis indicates that UCITS pursuing alternative strategies were shock receivers for a large period of time, especially from around mid-2017 to early 2020. However, they became shock transmitters, i.e. their contribution to the propagation of shocks increased drastically, at the start of the COVID-19 related market turmoil. (RA.7). Such high effects could be related to the use of derivatives by alternative funds: liquidity deteriorated quickly in the derivative markets amid high volatility. As funds faced mark-to-market losses on their derivatives positions, they also experienced significant variation margins on those positions, which required funds to raise cash by drawing on their buffers or by selling assets, thereby affecting markets. The net contribution to volatility of HY and IG corporate bond funds somehow shows an opposite pattern as well as a lower degree of variation over the analysed period. Both HY and corporate bond funds were shock transmitters during most of the sample period, however they became shock receivers at the start of the COVID-19 related market turmoil in early 2020.

RA.7
Net dynamic directional spillovers
HY and corporate net receiver during crisis



Note: Net dynamic directional spillovers to others, in %.
Sources: Consob, ESMA.

Conclusion

This article aimed to assess the level of connectedness among EU fixed income funds using a methodological framework based on Diebold and Yilmaz (2012, 2014) that allows to identify which type of funds are shock receivers and shock transmitters.

This has been partly motivated by the acute market stress faced by investment funds during the COVID-19-related market turmoil in March 2020, with high outflows and valuation uncertainty, which has shown that different

[115] In line with prevailing literature, we used a 200-week rolling window (corresponding to about 4 years) with a 10-week-ahead forecasting horizon to capture the dynamics of spillovers.

segments of the EU fund industry can face stress at the same time.

Our empirical results, based on data covering the period from 2008 to 2020 point to high spillover effects, indicating that funds exposed to less liquid asset classes are more likely to be affected by shocks originating in other markets. The evolution of the spillover indices during the COVID-19 market stress suggests that alternative UCITS on average acted as transmitters of shocks, while HY and corporate bond funds tended to be net receivers.

Going forward, this framework can be used for monitoring stress transmission and identifying episodes of intense spill overs within the EU fund industry.

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Investor protection

MiFID II research unbundling – first evidence

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Summary

This article analyses the impact on EU sell-side research of the MiFID II Research Unbundling provisions that require portfolio managers to pay for the research they obtain. In the past, concerns have been raised, based primarily on survey data, that the new rules could have detrimental effects on the availability and quality of company research in the EU. In order to provide a more detailed, data-based contribution to inform this discussion, we examine a sample of 8,000 EU listed companies between 2006 and 2019, and do not find material evidence of harmful effects from these rules. The introduction of MiFID II has not led to a significant difference in the number of analysts producing Earnings per Share (EPS) estimates ('research intensity'). Recent increases in the number of companies no longer being covered by research analysts ('research coverage') appear to be a continuation of a long-term trend. The quality of research has been steadily improving in recent years. SMEs do not appear to be disproportionately affected in terms of research intensity, research coverage, and research quality. The descriptive findings in this article are consistent with the emerging data-based academic literature on the impact of the MiFID II research unbundling provisions and are complemented by a forthcoming ESMA econometric study. Further assessment of the impact of the MiFID II research unbundling provisions on subsets of the EU market for research, such as the impact on sponsored research, will be interesting avenues for further study.

Background

The research unbundling provisions

Since 3 January 2018, firms that provide portfolio management or investment advice on an independent basis must pay for the research that they obtain, either by paying themselves or by passing on that charge to their clients. As a result, entities that, until that date, provided both research and brokerage and other investment-related services to investment firms must now separately identify the cost of the research they provide. In other words, the cost of research is now 'unbundled' from the cost of other services provided to the investment firm (to allow that a firm either absorbs the costs itself or passes on those costs to its clients).

These 'research unbundling' provisions aim to reduce the potential conflict of interest of those investment firms offering both execution and research services. As per Article 27 of MiFID II, investment firms are obliged to execute orders on terms that are the most favourable to their clients ('best execution'). Order execution, in turn, requires interaction with investment banks, brokerage firms, and other similar intermediaries. These same firms often offer research to investment firms, and this provision has often tended to be packaged ('bundled') alongside the order execution services that are provided.

As a result, it can be challenging for investment firms to honour their best execution requirement when research is being offered at the same time and without being charged separately. Theoretically, this could lead to investment firms paying for more order execution services from investment banks, brokerages, and other similar entities than these firms would otherwise have been willing to pay if the cost of research was clearly separated from the cost of order execution services.

The 'research unbundling' provisions also aim to address a second and related topic in the market for financial and economic research: the risk of

[116] This article has been authored by Adrien Amzallag, Claudia Guagliano, and Valentina Lo Passo.

excessive amount of low-quality research. The provision of research can generate more business for an investment bank, brokerage, or other provider of order execution services than would otherwise be the case for simple brokerage services. As a result, these firms are economically incentivized to not only bundle research (i.e. allegedly free of charge) with order execution services, but also to produce more research than would otherwise be needed on particular firms or industries. There are several ways in which this can be manifested, including excessive amounts of research (e.g. multiple research pieces all providing similar recommendations), as well as research that is of lower quality (e.g. poor forecasts). Consequently, the MiFID II research unbundling provisions enable investment firms (and, ultimately, their investor clients) to have clarity on the 'cost' aspect of the 'cost vs. benefit' trade-off they face when assessing whether research is useful to them.

The 'research unbundling' requirements entered into force as part of the revised Markets in Financial Instruments Directive (MiFID II).[117] They were, as a result, widely known in advance.

The provisions apply primarily to investment firms that provide portfolio management services and that have registered with any National Competent Authority (NCA) in the EU, including third-country investment firms operating in the EU according to a passporting arrangement. In addition, the provisions affect the 'sell-side' providers of research services (e.g. investment banks, brokerage firms, and also independent research providers).

The application of these research provisions has generated a substantial amount of commentary and discussion. Market participants, frequently quoting survey data, claim that, since the introduction of these provisions, the total amount of research produced has fallen, that there are fewer analysts producing research on companies, and that the quality of research has worsened (CFA 2019, Hull 2019). Public authorities have also begun investigating the impact of these provisions, also using substantial survey evidence, although their findings are less clear-cut, with some authorities' survey results suggesting little effect (FCA 2019) or more extensive impact (AMF 2020) on amount and quality of research.

Market participants have also identified the possibility that the MiFID II research unbundling provisions may have disproportionately affected small and medium-sized enterprises (SMEs) (Giordano 2019).

On 18 January 2020, the European Commission launched a MiFID II-related consultation, wherein it requested feedback on a number of proposals to foster research coverage on SMEs, including "to increase its production, facilitate its dissemination and improve its quality". Subsequently, the Commission has, on 24 July 2020, issued a consultation on a proposal to introduce a "narrowly defined exception" from the research unbundling provisions for small and mid-cap issuers (defined as companies whose market capitalization has not exceeded EUR 1 billion at any time during the previous twelve months) and for fixed income instruments. In light of this consultation, the research unbundling rules may further evolve in the future.

Trends in EU company listings

When assessing the possible effect of the MiFID II research unbundling provisions on companies being researched/covered by analysts, it is important to be aware of the dynamics in the underlying market, including the number of companies listed in the EU.

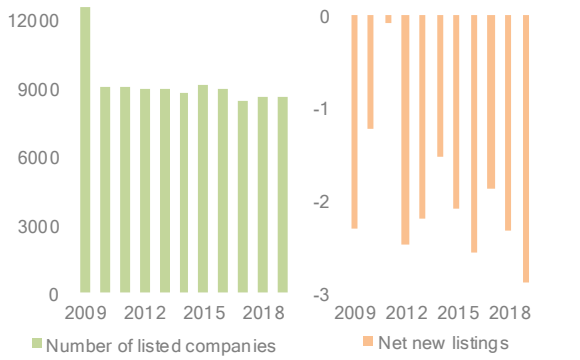
Figure RA.1 below presents the net new listings, i.e. Initial Public Offerings (IPOs) minus delistings from 2009 to 2019 in the EU, both in absolute terms and relative to the total number of companies listed on the EU exchanges in the same year.

Figure RA.1 below illustrates that, since 2009, net new listings in Europe appear to have steadily fallen, reaching its lowest level in December 2019. In other words, the number of listed companies in the EU has steadily fallen since 2009. There may be other factors at play as well, such as certain exchanges (e.g. London Stock Exchange) leaving the data sample (which explains the sharp fall from 2009 to 2010). A further investigation of the reasons for this trend (which may be driven by factors such as liquidity, fixed costs of listing, regulatory uncertainty, and others) is beyond the scope of this article.

[117] See Article 24(7)-(9) of Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 ('MiFID II') and Article 13 of Commission Delegated Directive (EU) 2017/593 of 7 April 2016 ('the MiFID II Delegated Directive').

Nevertheless, as a high-level view, the decreasing number of listed companies nevertheless indicates that the universe of companies which research analysts are covering is shrinking.

RA.1
Steady reduction in the number of EU listed companies



Note: Net new listings are measured as IPOs relative to delistings (in %). Net new listings are also relative to the total number of firms with shares listed on EU exchanges.
Sources: FESE, Refinitiv, I/B/E/S, ESMA Calculations.

Academic literature on the MiFID II research unbundling provisions

MiFID II is a recent piece of legislation, which means that academic studies on this topic are only just beginning. However, as discussed above, the specific 'research unbundling' provisions have sparked substantial debate among market participants and, furthermore, data on analyst research since January 2018 have begun to surface. Therefore, a growing body of academics is assessing the provisions' impact on various outcomes (e.g. analyst coverage, market liquidity, etc.) is emerging. The literature has mainly focused on the impact of MIFID II on the number of analysts following listed companies and on the quality of research.

Overall, research points to a decline in the number of analysts following the entry into force of unbundling provisions. Anselmi and Petrella (forthcoming), Fang et al. (2020), and Guo and Mota (2019) find that the MiFID II research unbundling provisions have, since their date of application, led to an overall reduction in terms of analysts covering a firm by 0.18, 0.44 and 0.65 analysts per firm respectively. According to Guo and Mota (2019), this fall is driven by the fact that large companies on average have more analysts covering them. As a result, investment companies have a greater incentive to reduce any low-quality research on these companies in order to reduce costs. In addition, Anselmi and Petrella (forthcoming) find no significant difference in the impact of MiFID II on small versus large companies. Elsewhere, Lang et al. (2019) analyse specific companies' characteristics and find a significant reduction of analyst coverage of about 0.057 analysts for the largest, oldest, and less volatile (in terms of forecast dispersion) companies.

Regarding the quality of research post-MiFID II, recent studies have concluded that analyst forecasts tend to be on average more accurate after the implementation of MiFID II (Fang et al. (2020), Guo and Mota (2019), and Lang et al. (2019)). In particular, Guo and Mota (2019) find that analysts who remain employed after MiFID II tend to produce better quality research, while analysts that produce less accurate research are more likely to cease their research activities entirely. Fang et al. (2020) conclude that stock recommendations on EU companies post-MiFID II seem to be more profitable and stimulate greater market reactions.

Research on liquidity indicates a moderate negative impact. Lang et al. (2019) suggest that the MiFID II research unbundling provisions have led to a widening in the bid-ask spread for EU companies.

Comparison of survey-based and academic findings

The academic data-based studies and industry surveys mentioned in the previous two sub-sections tend to agree that the introduction of MiFID II research unbundling provisions has led to a general reduction in the number of analysts. Data-based research studies have noted, however, that this reduction appears to be oriented towards larger companies, in contrast to smaller companies, and more precisely towards companies that are older and more 'predictable' (Guo and Mota 2019; Lang et al. 2019).

On the other hand, perhaps the greatest contrast between the academic literature and feedback on the MiFID II research unbundling provisions obtained via industry surveys relates to divergences in research quality.

For example, according to CFA (2019), "*Buy-side professionals mostly believe that research quality is unchanged, but sell-side respondents are generally more pessimistic, with 44% believing that research quality has decreased overall... Less than 10% of both buy-side and sell-side respondents believe research quality has increased.*" At the same time, the apparent

divergence may also be explained by the specific indicator of 'quality'. On the one hand, the academic literature focuses on measures relating to the accuracy of analyst forecasts. On the other hand, surveys, such as the one conducted by AMF (2019) refer to a number of other measures of research quality, including the length of the analysis produced, the extent to which analysis is "substantial" and more or less "neutral" (more neutral implying lower quality according to AMF 2019), the number of companies researched per analyst (greater number implying lower quality according to AMF 2019), and finally a decline in the average length of analysts' experience.

Combining the two overall themes of reduced numbers of analysts per firm, with a concentration in research reductions for larger and more predictable companies, as well as a trend toward maintaining or even improving forecast accuracy, suggests that the reductions in research may be associated with a previous overproduction of research in certain segments of European markets, as further discussed in Anselmi and Petrella (forthcoming).

There are, however, many sub-segments to explore, including the definition of research quality, as well as the impact on sponsored research, on independent research providers, on buy-side vs. sell-side analysts (see also Fang et al. 2020). All of these discussions demonstrate the complexity of this topic and the need for multiple sources of information.

First EU-level evidence

This article contributes to the debate around the impact of MiFID II research unbundling provisions on sell-side analyst research by providing a "bigger picture" of trends in sell-side research on EU companies in the past years pre- and post-implementation of MiFID II. In doing so, this article provides a longer-term perspective that complements already-published and forthcoming academic studies, while also pointing to some areas where further research may be beneficial. An econometric analysis (Amzallag et al. (forthcoming)) will also provide quantitative support for the visualisations provided in this article, and is referenced accordingly throughout the text, where relevant.

The remainder of the article provides high-level visualisations on:

- The quantity of research provided by sell-side analysts on specific companies, pre- versus post-MiFID II.
- The quality of that same research, pre- versus post-MiFID II.

The analysis also distinguishes between SMEs versus large companies, given the extensive interest on MiFID II's possible impact on smaller companies.

Data and methodology

Our dataset comprises 8,000[118] listed companies (active and inactive[119]) headquartered in the 27 European Union (EU) countries and the United Kingdom[120] and covers a period between January 2006 and December 2019. Overall, the data sample includes 60% of listed companies considered as 'active' by the end of December 2019, compared with the total as reported by the "Federation of European Securities Exchanges (FESE)". As mentioned above, the analysis focuses on the impact of MiFID II on sell-side research (i.e. research provided by sellers of investment services) rather than on buy-side research (i.e. research produced in-house by investment funds, and other investors). This orientation is largely driven by the lack of data on buy-side research, as this is generally not published. Firm-level data on research produced by sell-side analysts was collected from I/B/E/S (Refinitiv Datastream) on a monthly basis.

In line with previous studies, such as Anselmi and Petrella (forthcoming), the variable "Earning per Share (EPS) total number of estimates" is used to approximate the *quantity of research* produced by analysts on a specific firm. This variable is the most frequently used estimate for sell-side research on listed companies and, hence, a good measure for analyst's coverage.

Research quality is measured using the "EPS annual surprise percentage difference". This

[118] The initial dataset included c. 24,000 firms, of which only 8,000 appear to have been researched by analysts at any point between 2006 and 2019.

[119] Active firms are defined as those listed on one or more exchanges as at end-2019. Inactive firms are firms that, as at end-2019, were delisted (owing to mergers, bankruptcy, etc.), but were active at an earlier stage in the sample time window.

[120] As UK stopped being a member of the European Union on 31 January 2020, it has been included as part of the EU, given also the date of application of MiFID II starting from January 2018.

variable symbolizes the extent to which analysts' estimates for a firm's annual EPS were different from reality (the "surprise"). In other words, it represents the median surprise across all analysts in the sample. Thus, a zero "EPS annual surprise percentage difference" for a firm in a given year implies that there has been no surprise and therefore analysts' median forecasts for that firm in that year were identical to the result. This variable thus appears to be a reasonable way of measuring the accuracy of an analyst's forecasts and is of a similar nature as the *quantity of research* measure: both variables use the earning per share estimate as a basis for their calculation.

In addition, firm-level (yearly) data on total assets, number of employees, Earnings Before Interest, Taxes, Depreciation, Amortisation (EBITDA), market value (i.e. market capitalisation), Return on Assets (ROA), and other aspects (e.g. economic sector, country of headquarters, delisting date) are included to help describe and analyst the companies in our sample.

The company characteristics also allow entities to be classified as either SME or large, using the criteria set out by the European Commission (2003). Accordingly, a firm is classified as SME if either of the following two conditions is met at any time between 2006 and 2019:

- Number of employees < 250 and total assets ≤ EUR 43m.
- Number of employees < 250 and turnover ≤ EUR 50m.

Turnover is measured using EBITDA. This classification results in c. 3,320 SMEs, 3,920 large companies and 760 companies "not classifiable" owing to information on the above variables not being available.

Table RA.2 below lists the breakdown of companies per EU country and size classification.

RA.2
Breakdown of companies per country and size

Country	SMEs	Large	NC	Total
Belgium	59	80	18	157
Denmark	41	87	9	137
Finland	58	128	17	203
France	357	425	65	847
Germany	427	464	60	951
Greece	40	101	10	151
Italy	136	286	44	466
Netherlands	43	149	16	208
Poland	153	206	39	398
Spain	71	382	16	469
Sweden	460	294	110	864
United Kingdom	1,370	971	287	2,628
Others*	104	351	68	523
Total	3,319	3,924	759	8,002

Note: NC=Not classifiable. Countries with fewer than 100 companies in total have been grouped into 'Others', and include Austria (90 companies), Bulgaria (41), Croatia (22), Cyprus (28), Czech Republic (11), Estonia (24), Hungary (28), Ireland (83), Latvia (8), Lithuania (22), Luxembourg (38), Malta (8), Portugal (51), Romania (51), Slovak Republic (1), and Slovenia (17)
Sources: Refinitiv I/B/E/S, ESMA calculations.

Table RA.3 below presents summary statistics for the data sample, based on a breakdown across firm size (SME, large). As is clear from the table below and as expected given the classification criteria followed, SMEs have fewer staff, assets, and earnings than large companies, as well as smaller market value and return on assets (ROA).

RA.3
Data sample - summary statistics

	SMEs	Large
	Median	Median
Staff	54	1,898
Total Assets	24	453
EBITDA	0.7	52
MV	32	344
ROA	1.01	6.04

Note: The statistics have been generated using data from the first year a given firm is classified as either an SME or a large firm. Companies for which there is insufficient data to determine whether they are SME or large (i.e. 'Not classifiable') are excluded from the table. EBITDA is Earnings Before Interest, Depreciation, and Amortisation. Market value is denoted as MV. Return on Assets is denoted as ROA. Where a firm reported zero employees, this was considered as an empty value. Total assets, EBITDA, and Market Value are in millions of EUR and ROA in percentage. The number of companies for which robust data are available for individual indicators varies between 3,319 and 2,037 for SMEs and between 3,924 and 2,516 for large companies.
Sources: Refinitiv, ESMA calculations.

Table RA.4 below presents the breakdown of companies per economic sector (raw materials,

manufacturing, services, others[121]) and size classification. The majority of companies operate in the 'Services' and 'Manufacturing' sectors with 3,817 and 2,998 companies respectively. Interestingly, SMEs make up a larger proportion of companies in the Raw Materials sectors (64%), but are relatively under-represented in manufacturing and services (36% and 47%, resp.)

RA.4
Number of companies per economic sector

Sector	SMEs	Large	NC	Total
Manufacturing	1,065	1,736	197	2,998
Raw Materials	305	125	49	479
Services	1,784	1,586	447	3,817
Other	165	477	66	708
Total	3,319	3,924	759	8,002

Note: Number of companies, absolute values. NC=Not classifiable.
Sources: Refinitiv, ESMA calculations.

Depending on the specific analysis, this study relies on different sample specifications, as further detailed in the next section.

Empirical findings

Impact on research quantity

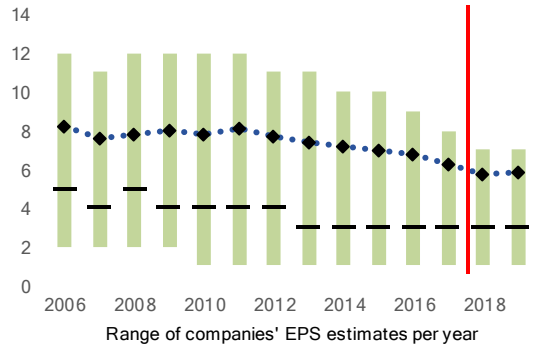
The following sub-section presents results on two ways in which the MiFID II research unbundling provisions could impact the quantity of research produced on EU companies: the *intensity of research* on EU companies and the *research coverage of EU companies*.

The intensity of research is defined as the number of analysts covering a specific firm over the analysed period. The research coverage is a dummy variable equal to one if at least one EPS has been produced for the specific firm over the analysed period and equal to 0 otherwise. Each measure is based upon the "EPS total number of estimates" variable described above in the 'Data and methodology' section.

Figure RA.5 presents findings on trends in the intensity of research, starting in 2006. The figure illustrates the yearly range in the number of analysts covering companies in our data sample.

To provide a picture of the current market structure, we only analyse around 4,870 companies listed on the stock market in late 2019 and having been active at all times between 2006 and 2019.These represent companies that have always been active and had EPS estimates produced by research analysts at all times between 2006 and 2019.

RA.5
Impact of MiFID II on intensity of research for all companies
Stable number of analysts covering each firm before and after MiFID



Note: Sample of 4,870 EU firms that have been in operation at all times bet. 2006 and end-2019, and at all times researched (i.e. have EPS estimates produced) by analysts. Black diamonds (horizontal bars) in each box = average (median) across firms in the year. 25th and 75th percentiles = bottom and top edges in each box. MiFID II date of application = vertical red line.
Sources: Refinitiv, I/B/E/S, ESMA calculations

First, it does not appear that the introduction of MiFID II (see the vertical red line) in January 2018 has led to a significant difference in the number of analysts producing EPS estimates per firm. This is illustrated by the median (black horizontal bar) in each box just before and after the vertical red line staying identical (3 analysts per firm) [122].

Second, the number of analysts producing EPS estimates for the firm at the 75th percentile (the top of the green vertical bars) has declined slightly but, interestingly, this appears to be the continuation of a long-term trend that began as far back as 2012. A similar picture (not shown) can be seen when looking at the 90th percentile of the data sample: among companies with very high number of analyst estimates being produced, there has been a large and steady fall

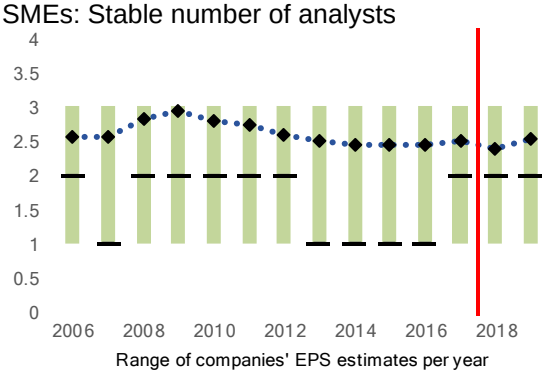
[121] For simplicity, sectors were grouped into four main categories: 'Raw Materials' (mining, quarrying, and oil gas extraction and agriculture, forestry, fishing and hunting), 'Manufacturing' (manufacturing and construction), 'Services' (information, finance and insurance, administrative and support and waste management and remediation services, real estate and rental leasing, professional scientific and technical services, accommodation and food services, management of companies and enterprises, arts entertainment and recreation, health care and social assistance, other services, public administration and educational services) and 'Others' (transportation and warehousing, wholesale trade and, retail trade).

[122] Similar results are found when examining the number of analysts covering a firm, in contrast to the number of analysts producing EPS estimates for a firm.

in the number of these estimates per firm after 2011.

Third, as Figure RA.6 illustrates, data on SMEs suggests that this sub-market has remained largely stable. Indeed, all indicators – the 90th percentile (not shown), 75th percentile, median (50th percentile), and 25th percentile number of analysts covering SME companies – have remained constant since 2010 (standing at 6, 3, 2, and 1 analysts, respectively). This appears to indicate that the long-term slight reduction in research intensity for companies is affecting mainly large companies.

RA.6
Impact of MiFID II on intensity of research for SMEs
SMEs: Stable number of analysts



Note: Sample of 2,100 EU firms that have been in operation at all times bet. 2006 and end-2019, and at all times researched (i.e. have EPS estimates produced). Black diamonds (horizontal bars) in each box = average (median) across firms in the year. 25th and 75th percentiles = bottom and top edges in each box. MiFID II date of application = vertical red line. SMEs defined as per European Commission (2003).
Sources: Refinitiv, I/B/E/S, ESMA calculations.

Taken together, these findings suggest that the research industry has undergone a steady process of consolidation in terms of the amount of research coverage being provided on companies in the EU, and that this trend is concentrated on large companies rather than SMEs.

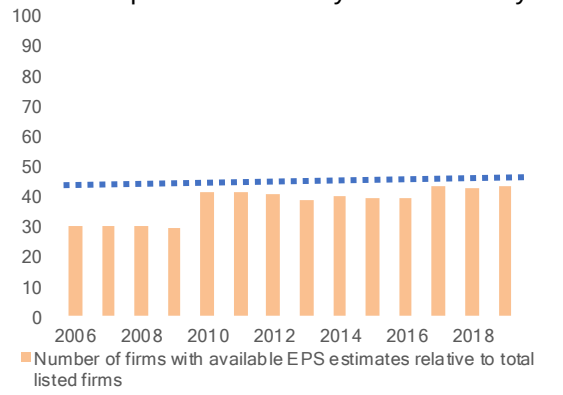
This is in line with pre-MiFID II market participant observations that there were excess amounts of research being provided on certain (presumably larger) companies (Marriage 2019). For example, one research study estimated that "well over 40,000 research notes – from comprehensive reports to minor updates linked to corporate announcements – are sent out every week by the top 15 global investment banks, of which less than 5% are opened" (Kwan and Quinlan 2017).

These visualisations are confirmed econometrically by Anselmi and Petrella (forthcoming), Fang et al. (2020), Guo and Mota (2019), and Lang et al. (2019). Amzallag et al. (forthcoming), also demonstrate that the quantity of available research has declined after MiFID II implementation but that the drop has been more important for large companies than for SMEs. This suggests the possibility of an excessive amount of available research for large companies before MiFID II, as also further discussed in Anselmi and Petrella (forthcoming).

The next step is to examine the possible impact of the MiFID II research unbundling provisions on the second measure of research quantity: research coverage, i.e., whether or not companies have EPS estimates produced by analysts in the analysed period.

Figure RA.7 illustrates the number of European companies with EPS estimates in each year relative to the total number of companies with listed shares in the EU stock market. Our analysis suggests that the share of listed companies covered by analysts has remained broadly stable (at around 40%) since 2010, although there are indications of a small increase starting in 2017. However, as the chart also shows, in 2010 there was a sudden jump in the percentage of listed companies covered by research analysts. This sudden increase is likely to be driven less by the number of analysts covering companies (which remained largely stable, as shown in figures RA.5 and RA.6), but rather by a 25% fall in the number of listed companies from 2009 to 2010. This decrease in the number of companies with listed shares is likely to be one of the consequences of the global financial crisis of 2007-2008.

RA.7
Impact of MiFID II on research coverage
<1/2 of companies covered by research analysts



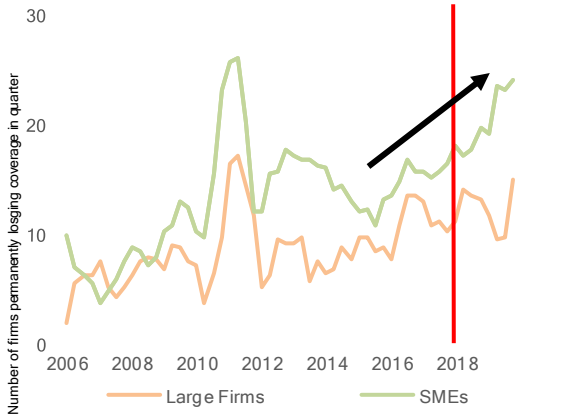
Note: Percentage (%) of firms with available EPS estimates at the end-of-year relative to the total number of firms with listed shares in the EU. The trend line indicates the long-term change in this percentage.
Sources: FESE, Refinitiv I/B/E/S, ESMA calculations,

Figure RA.8 presents the number of companies that had no longer EPS estimates produced by analysts, over the period 2006 to end-2019 — i.e. an indicator of 'loss of coverage'. Information is presented on a quarterly basis for a total of about 6,800 companies, separated into SMEs (c. 3,200 companies), large companies (c. 2,800 companies), and companies that could not be

classified (c. 760). Companies that drop out of the data sample owing to bankruptcies, mergers, or delisting are excluded from the sample. Only companies that continue to be listed and are no longer covered on a permanent basis are included in the figure.[123]

We find that the number of companies losing coverage increases – however this increase began much earlier than the introduction of MiFID II. In particular, since 2012 there has mostly been a steady rise in the number of companies that are no longer receiving EPS estimates from any analyst, which suggests a steady rise in the number of companies losing research coverage. It is likely that this trend is driven by reductions in the number of research analysts. Indeed, recent estimates point to steady reductions since 2012, related in part to rationalisation following a greater use of technology and 'big data', the steady rise in passive alternatives to active asset management, as well as a fall in equity commissions (Noonan 2016, Wigglesworth 2017a, Wigglesworth 2017b, Mayhew 2019).

RA.8
Impact of MiFID II on research coverage
Long-term increase in companies losing coverage



Note: Sample of 6,140 EU firms that have at any time from 2006 to end 2019 permanently ceased to be researched (i.e. have EPS estimates produced) by all analysts. SMEs classified as per European Commission (2003).
Sources: Refinitiv, I/B/E/S, ESMA calculations.

More recently, roughly 270 EU companies were no longer covered by sell-side research analysts during 2019, in comparison to 140 companies losing coverage in 2017. In both years, the proportion of SMEs losing coverage as a share of total companies losing research coverage was roughly constant (55% of companies losing coverage in a year were SMEs).

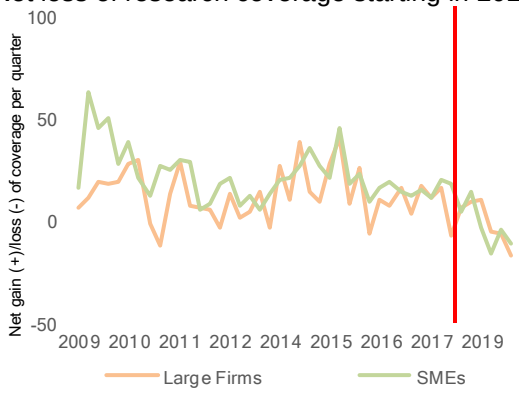
The number of large companies (orange line) losing coverage actually declined for roughly 1.5 years after the introduction of MiFID II, before sharply increasing at the end of 2019[124]. The sharp increase in loss of coverage (both for large companies and SMEs) has only appeared in recent months and it is difficult to conclude that this is a trend that is driven by MiFID II, also since the research unbundling provisions were widely known in advance, as described in the introduction. Similarly, although there has been a sharp increase in the number of SMEs (green line) losing coverage since January 2019, other sharp jumps have been observed in the past, including from mid-2015 to mid-2016.

In addition, it is important to recall that there are also companies that gain coverage at any point in time, and that have not been covered in earlier years. This fact must also be considered when examining the overall impact of the MiFID research unbundling provisions on the quantity of research produced on EU companies. Figure RA.9 subtracts the number of companies losing research coverage from the number of companies gaining coverage in each quarter (starting from 2009)—roughly 6,120 SME or large firm companies are tracked (not classifiable companies are omitted for the sake of brevity).

[123] For firms that lose coverage during 2019, it is challenging to assess whether that loss is temporary or permanent. This is because past data since 2006 indicates that some firms that are no longer covered by analysts in a given time period will subsequently resume to be covered by the same or other analysts in future years. The numbers presented in figure RA.8 include a correction for the average number of firms losing coverage on a temporary basis in each year between 2011 and 2018. The total number of firms deemed to lose coverage in 2019 is reduced by this correction, which has been calculated separately for SMEs, non-SMEs, and not classifiable firms.

[124] It is likely that the large jump in firms losing research coverage during 2010 and 2011 is at least in part driven by brokerages and other research providers reducing their number of research analysts, as part of widespread layoffs in the EU financial services sector during 2009, 2010, and 2011 (see for example Eurostat employment data: series code nama_10_a64_e and industry sector "*Financial service activities, except insurance and pension funding*").

RA.9
Impact of MiFID II on research coverage
Net loss of research coverage starting in 2019



Note: Sample of 6,140 EU firms that have at any time from 2006 to end 2019 either begun or permanently ceased to be researched (i.e. have EPS estimates produced) by at least one analyst. Firms that cannot be classified as either SMEs or Large are excluded.
Sources: Refinitiv, I/B/E/S, ESMA calculations.

Figure RA.9 suggests that both large and SME companies steadily *gained* analyst coverage until around the end of 2018[125]. However, in early 2019, and for the first time since 2006, both SMEs and large companies across the EU began, in net terms, to lose research coverage. Further investigations and more experience with the MiFID II era are needed to identify the drivers of these trends, and to assess the role of the MiFID II research unbundling provisions. For example, it may be that research providers adopted a 'wait and see' stance during 2018 (i.e. the first year of application of the research unbundling provisions) and maintained coverage until contracts with their clients were renegotiated and possible revenue impacts could be better ascertained. On the other hand, there is recent evidence that the COVID-19 pandemic and resulting economic uncertainty has led to a surge in research analyst coverage (Clarke 2020).

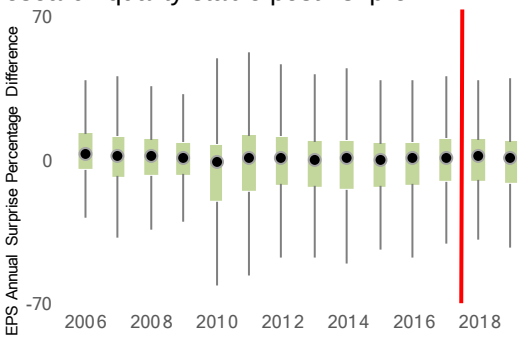
These results are further explored and corroborated econometrically in Amzallag et al. (forthcoming): the probability of losing coverage has increased after MiFID II implementation (in line with the academic literature cited earlier in this article, e.g. Fang et al. (2020)) but this appears to have affected larger companies more than SMEs.

Impact on research quality

The following sub-section analyses the potential impact of the MiFID II research unbundling on the *quality* of research produced on EU companies. As described in the 'Data and Methodology' section, the variable used to measure research *quality* is the "EPS annual surprise percentage difference" across companies.

Figure RA.10 shows the trends in the EPS annual surprise from 2006. The sample on which the chart is based includes approximately 5,200 EU companies tracked from 2006 to 2019.

RA.10
Impact of MiFID II on research quality
Research quality stable post vs. pre-MiFID II



Note: Sample of 5,200 EU firms that have at any time been in operation at all times bet. 2006 and end-2019, and at all times researched (i.e. have EPs estimates produced) by analysts. Black horizontal bars in each box = median across firms in the year. 25th and 75th percentiles = bottom and top edges in each box. Additional lines ('whiskers') = 10th and 90th percentiles. MiFID II date of application = vertical red line.
Sources: Refinitiv, I/B/E/S, ESMA calculations.

The analysis suggests that the quality of EPS forecasts after the implementation of MiFID II has remained broadly stable (see the vertical red line). This is illustrated by the median (black dot), in the two bars after the vertical line, approaching zero (i.e. no surprise in terms of EPS forecasts and therefore good quality).

Interestingly, the 90th and 10th percentiles of the data sample (top of the vertical lines) seem to narrow since 2014. This trend suggests that research quality has been improving in the last years, rather than merely following the application of the MiFID II research unbundling provisions. One reason for this improvement could be that, despite the increase in the number of companies losing coverage, the analysts' continuing to follow the companies are the ones producing more accurate EPS Estimates—which

[125] Additionally, further calculations suggest that, although the cumulative number of firms gaining coverage is overall higher than the one of firms losing coverage entirely, the growth rate of the two go in the opposite directions. In other words, it seems that in the data sample, firms are losing coverage faster than firms are gaining coverage.

appears to be in line with the recent academic studies discussed above.

However, the low market volatility environment which was prevalent for most of the time since the volatility peaks in 2012 (Goedhart and Mehta 2016; ECB 2020) has also created favourable conditions for an improvement in forecast accuracy, in addition to improvements by individual research providers. In other words, when market conditions are 'favourable', it is likely that there will be less dispersion across analyst forecasts.

Finally, research quality appears to improve slightly for large companies. Although the median forecast error approaches zero for both SMEs and large companies, dispersion for SMEs (90th and 10th percentiles) tends to expand after the application of MiFID II. However, there may be other confounding factors behind this as well, such as greater data availability for large companies combined with a trend toward using 'big data' techniques to conduct research.

Overall, these findings suggest that:

- Research *quality* in the EU as measured by EPS forecast accuracy has generally improved since 2012, reflecting long-term trends, but there is little discernible effect of MiFID II (at least at the descriptive level of analysis).
- Large companies might have experienced a greater improvement in research quality than SMEs, when comparing the variation in forecast accuracy in each group.

These visualisations are in line with the academic papers cited above as well, such as Fang et al. (2020) and Lang et al. (2019). The differential impact between large companies and SMEs are further explored econometrically in Amzallag et al (forthcoming).

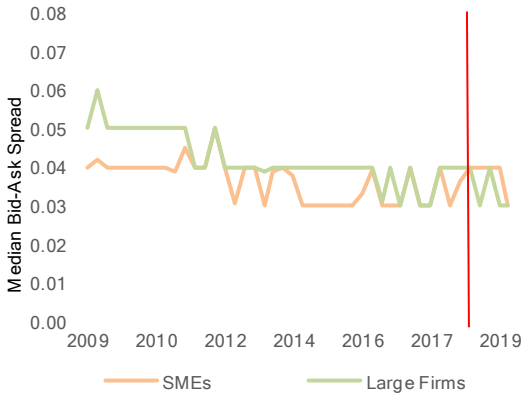
Trends in market liquidity

Since the application of the MiFID II research unbundling provisions, several concerns have been raised regarding potential unintended side effects of a reduction in equity market liquidity. In particular, it is alleged that the increase in the number of companies losing research coverage may be related to a widening of bid-ask spreads of EU companies' moveable assets.

Figure RA.11 presents the quarterly evolution in median bid-ask spread for the companies in the sample. The figure shows that, for both SMEs and large companies in the EU, bid-ask spreads have not substantially changed since 2018, compared with the pre-MiFID II period. This period of relative stability follows a general trend of tightening from 2009 to 2015, again both for large companies and SMEs.

Nevertheless, there are many elements that may influence bid-ask spread (including tick sizes and broader market trends in volatility and trading volumes), and the aim in this section is to provide a first visual interpretation. This topic is further explored econometrically and in greater detail in Amzallag et al. (forthcoming), which explores the possible differential impact of the unbundling provisions on SME liquidity conditions (relative to large companies), using various measures of market liquidity (bid-ask spreads, Amihud ratio and Turnover ratio).

RA.11
Impact of MiFID II on firm liquidity
Liquidity conditions stable post vs. pre-MiFID II



Note: Median bid-ask spread for a sample of 3,320 SMEs and 3,920 large firms that have been covered by research analysts at any point between 2006 and end-2019. MiFID II date of application = vertical red line.
Sources: Refinitiv, ESMA calculations.

Conclusions and next steps

Our analysis, based on a large dataset composed of around 8,000 companies over a long time series (2006-2019), suggests that since the MiFID II research unbundling provisions began to apply in January 2018, there has not been a significant change in the number of analysts producing research on EU listed companies. The reduction in research intensity for companies

appears to mainly affect large companies, rather than SMEs.

Elsewhere, there has also been an increase in the number of EU companies for which no research is produced at all. This increase appears to affect both SMEs and large companies in a similar way — SMEs do not appear to be particularly vulnerable to losing coverage.

At the same time, the fall in research intensity and rise in loss of coverage, continue a trend that began as far back as 2012. Over the analysed period, the research industry has undergone a steady process of consolidation and rationalisation of the amount of research coverage being provided on companies in the EU, and this trend is concentrated on companies that are larger than SMEs.

However, the rate of increase in loss of coverage has increased recently. Indeed, for the first time since 2006, both SMEs and large companies across the EU have, in net terms (i.e. subtracting the number of companies gaining coverage from number of companies losing coverage), begun to lose research coverage. This has begun to be apparent during 2019, i.e. with some delay compared with the MiFID II date of application.

In addition, our analysis shows that the quality of research on EU companies has not worsened since January 2018 and in fact has been improving slightly for large companies. This would be coherent with the above-mentioned possibility of the research industry rationalising its coverage of large companies (i.e. fewer analysts per firm but of greater quality). At the same time, it may also reflect the continuation of a trend also observed since as far back as in 2012, with steady reductions in market volatility (and thus uncertainty) in the background.

The empirical evidence gathered so far and described in this article is consistent with the emerging data-based academic literature on the impact of the MiFID II research unbundling provisions. It is also consistent with the econometric analysis conducted by the authors of this article in Amzallag et al. (forthcoming) and with the recently developed academic studies as Anselmi and Petrella (forthcoming) and Fang et al (2019), while it differs from the studies based on surveys as AMF (2020) and FCA (2019) showing a more negative impact of the unbundling measure.

The main difference between academic data-based and survey-based evidence relates to the impact of the unbundling provisions on research quality. As explained in the article, there are various definitions of research quality. This leads to a potential for disagreement, as results may vary depending on the metric chosen to measure the impact of the MiFID II research unbundling provisions (for example, whether research quality is measured in terms of forecast accuracy, in terms of research report length, or in terms of 'neutrality' of the research piece).

The MiFID II research unbundling provisions may also have had differential impacts on subsets of the EU market for research, such as on buy-side analysts in contrast to sell-side analysts, as well as on different types of research like unsolicited research versus sponsored research, as well as independent research providers. These areas, in particular the possible impact on sponsored research and on independent research providers, were not considered in this article owing to limitations in data availability. However, they are noted here as interesting avenues for further research.

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Investor protection

Costs and performance of potential closet index funds

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Summary

Closet indexing' refers to the situation in which asset managers claim to manage their funds in an active manner while in fact tracking or staying close to a benchmark index. Panel regressions using annual fund-level data for the period 2010-2018 suggest that investors face lower expected returns from closet indexers than from a genuinely actively managed fund portfolio. At the same time, potential closet indexers are only marginally cheaper than genuinely active funds. Overall, the net performance of potential closet indexers is worse than the net performance of genuinely active funds, as the marginally lower fees of potential closet indexers are outweighed by reduced performance.

Introduction

Benchmark indices may play a role in the management of a fund in different ways. For example, an active fund may aim to outperform its benchmark or may use its benchmark to define its investment universe. Passive funds aim to track or stay close to a benchmark index.

'Closet indexing' refers to the situation in which asset managers claim to manage their funds in an active manner while in fact passively managing the fund. An economic incentive to do so is that fees for funds with an active mandate tend to be higher than those for passive funds. Closet indexing is a form of misconduct that has been criticised by supervisors and investor advocacy groups on numerous occasions in recent years. A major concern is that investors are being misled about a fund's investment strategy and objective and are not receiving the service that they have paid for.[127]

In recent years, ESMA and NCAs have worked to identify potential closet indexers by examining metrics on fund composition and performance and by conducting follow-up detailed supervisory work on a fund-by-fund basis. ESMA recognises that such metrics, while imperfect screening tools, are a useful source of evidence to help direct supervisory focus.

This article does not aim to identify particular closet indexers. Rather, it analyses how closet indexing relates to the costs and performance of EU-domiciled equity funds.[128] In so doing, it aims to contribute to the understanding of closet indexing in the EU.

Policy context

If a fund manager does carry out closet indexing, this has consequences for investor protection (ESMA 2016). An immediate concern is that, by definition, closet indexing involves misinforming prospective and current investors. Additional concerns include the following.

- Investors could be making investment decisions based on an inaccurate expectation of receiving a more active fund management service than the one they will actually receive.
- Investors may be exposed to a different risk/return profile from the one they had envisaged.
- Investors may also be subject to higher fees than those they would pay for a passive fund

[126] This article was authored by Lorenzo Danieli, Alexander Harris and Giorgia Pichini.

[127] See e.g. ESMA (2016), Central Bank of Ireland (2019), Better Finance (2019a).

[128] This article summarises the detailed results and discussion in Danieli, Harris and Pichini (2020).

that explicitly tracked a given benchmark index.

Among funds that pursue active strategies, some may materially underperform their benchmarks. In other words, they would have received higher returns from index-tracking. However, other genuinely active funds may outperform. Closet indexing does not offer the same ex-ante risk profile that investors should expect from genuine active management. In particular, it does not offer scope for strongly positive alpha (i.e. performance above the risk-free rate that is not attributable to market exposure).

To help investors protect themselves against poor fund performance and excessive fees, ESMA has published its Annual Statistical Report on Performance and Costs of Retail Investment Products in the EU (ESMA 2020). The report provides extensive comparative statistics on an annual basis about gross and net returns of fund products sold in the EU, which can serve as an important point of orientation for investors. The report also presents yardsticks for the performance of funds over several time horizons.

Related literature

This section introduces several metrics of closet indexing that have been developed in the literature. It then turns to studies of costs and performance of closet index funds in comparison with genuinely active funds.

Metrics for potential closet indexing

For a given fund and benchmark, the two main sources of data that can be used to try to identify closet indexing are the portfolio composition of the fund versus its benchmark and the fund's performance versus that of its benchmark. Neither source of data yields perfect identification of closet indexing for two reasons.

First, the portfolio composition and returns of potential closet indexers will in general differ from those of their benchmarks to varying extents, as a perfect index replication is not generally feasible. Additionally, some managers may follow a strategy of partial index replication, while retaining some degree of active management, possibly to a varying extent over time.

Second, active funds may pursue strategies that do not simply aim to replicate an index but that nonetheless closely match the benchmark in terms of portfolio composition or returns. As a result, any metric used to identify potential closet indexers is likely to yield false positives.

Different metrics have been developed to help identify potential closet indexers. We will focus on Active Share (AS), Tracking Error (TE), Style Shifting Activity (SSA), R^2 and Beta.

The main portfolio-based measure is AS, introduced by Cremers and Petajisto (2009). Intuitively, AS is the part of a fund's portfolio that cannot be decomposed into a benchmark component.[129] AS is a useful way of indicating the potential for outperformance.

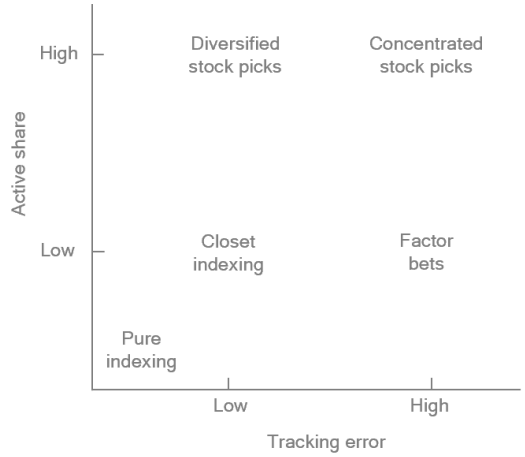
AS can be complemented by performance-based metrics, a prominent example of which is TE, the standard deviation of the difference in fund returns and benchmark returns over time.[130]

Cremers and Petajisto (2009) note that TE is sensitive to strategic decisions around factors such as momentum or value, which involve a fund manager taking correlated active positions. In contrast, AS weights all active positions equally regardless of the extent to which they are diversified. For this reason, it is likely to be more suitable as a proxy for undiversified stock picking. To the extent that TE and AS reflect these two fundamental approaches to active fund management, they are complementary (RA.1).

[129] More precisely, any fund can be decomposed into a benchmark component plus its AS, which is a residual that comprises a zero net-investment long-short portfolio.

[130] Alternative measures of TE are based on the residuals of regressions of fund returns on investment factors such as those in Fama and French (1993) and Carhart (1997).

RA.1
Relation of active management styles to AS and TE
Different metrics capture different styles



Source: Reproduced from Cremers and Petajisto (2009).

Another performance-based approach is SSA, developed by Hermann et al (2016). SSA measures the extent to which a fund changes its quarterly aggregate exposure to the investment factors of market exposure, value, size and momentum. [131] Intuitively, the 'factor bets' style of active management (RA.1) involves changes in exposure to such factors in response to a changing investment environment. Closet indexers, in contrast, might be expected to have low SSA values as closet indexing by definition involves benchmark replication.

Other performance-based metrics arise from regressing fund returns on factors. Following Fong (2016), we define a fund's R^2 to be the coefficient of determination from the Capital Asset Pricing Model (CAPM), i.e. a time series regression of fund returns on benchmark returns plus a constant. R^2 is therefore a measure of how far variations in benchmark performance explain variations in fund performance. A related measure is beta, the coefficient on the benchmark returns in the same regression, which gives a performance-based measure of a fund's benchmark exposure.

In a study published by the Autorité des Marchés Financiers (AMF), Demartini and Mosson (2018) calculate measures of SSA, TE and R^2 for a sample of nearly 800 French funds invested in European equities. They show that the three metrics are complementary in that they exhibit a high degree of covariance within the sample.

Costs and performance literature

A theoretical framework for understanding the average returns of active funds versus benchmarks is found in Sharpe (1991). Sharpe argues that the aggregated holdings of equity funds in a given market should equal the market benchmark as a whole. For this reason, performance before costs of all actively managed portfolios, taken together, should equal benchmark performance. Taking costs into account, actively managed funds should on average therefore underperform their benchmarks. Several empirical studies have supported this hypothesis. [132]

If Sharpe's hypothesis is correct and assuming that closet indexers manage to replicate their benchmarks closely, gross returns for closet indexers in a given market should approximately equal those of genuinely active funds.

Importantly however, the framework in Sharpe (1991) rests on certain assumptions that may not fully hold in a given market. The assumption that active funds' aggregate holdings equal the market as a whole may not hold if sizeable direct equity holdings that differ in aggregate from the overall portfolio held by investment funds in the market exist.[133] Another reason is that time lags in updating equity indices, to reflect changing valuations, may prevent them from accurately representing the market as a whole. In such cases, there is scope for closet indexers to outperform or underperform genuinely active funds. Overall, empirical studies have tended to show that closet indexers have slightly underperformed genuinely active funds.

Empirical studies in the academic literature on how closet indexing relates to performance have focused largely on US equity funds. An exception

[131] For a formal definition of SSA, see Herman et al (2016).

[132] The degree of empirical support for the hypothesis appears to vary across years. A recent example is Morningstar Research (2019), based on a sample of US funds representing 64% of the overall market. The study compares performance of active funds with that of passive funds, as opposed to the performance of benchmark indices, thereby taking into account the costs involved in passive management when assessing relative performance. According to the results, 48% of active U.S. stock funds survived and outperformed their average passive peer for the period July 2018 to June 2019, compared with only 37% in the previous 12-month period.

[133] Fama and French (2010) find that the assumption does hold in US equity markets, i.e. the aggregate portfolio of active funds closely matches the market as whole.

is Morningstar Research (2016), which focuses on Europe-domiciled funds investing in large cap equities, using data from 2006 to 2015. The study finds that large cap equity funds in the top quintile of AS tended to enjoy higher average benchmark-adjusted returns than other funds.[134] Using a sample of international funds, Cremers et al (2016) find that explicit indexing and closet indexing are associated with countries' regulatory and financial market environments.

A common pattern is that among US equity funds with an active mandate, greater activeness is associated with higher returns. Cremers and Petajisto (2009) find that US equity funds with the highest AS persistently outperform their benchmarks. Petajisto (2013) reports similar findings. Among another sample of US equity funds, Amihud and Goyenko (2013) find that the R^2 measure predicts returns in excess of the benchmark. However, Cremers and Pareek (2015) have a more qualified result: AS is associated with higher performance only among funds whose holding duration exceeds 2 years.[135] Finally, Frazzini et al (2016) find, contrary to previous studies, that although higher-AS funds performed better than their lower-AS counterparts after controlling for benchmarks, the difference was not significant.

Turning to the issue of costs, Cremers et al (2016) find that actively managed funds are more active and charge lower fees when they face more competitive pressure from low-cost (explicitly) passive funds. Amihud and Goyenko (2013) find that among funds with active mandates, activeness measured by R^2 is associated with slightly higher fees.

Empirical approach

Our empirical strategy is to investigate how several complementary measures of potential closet indexing – AS, TE, R^2 and Beta – relate to costs and performance. Unlike in a supervisory context, our aim is not to identify precisely which funds in the sample carry out closet indexing, but rather to investigate the likely in-sample impact of closet indexing on investor outcomes.

In addition to examining the relationship of the variables taken individually with performance and costs, we also investigate how the variables together relate to these outcomes. Interdependence of the variables would complicate a joint regression of the untransformed variables and its interpretation.[136] A tractable way to address this problem is to combine different metrics in a single, binary variable, allowing us to test whether the metrics are jointly associated or not with directional effects on investor outcomes.

In common with the prevailing approach in the literature, including Cremers and Petajisto (2009) and Amihud and Goyenko (2013), we run pooled OLS regressions, including time fixed effects.[137] This approach, in contrast to a model including fund fixed effects, enables us to identify relationships among variables measured across (rather than within) entities, which is the intended focus of our analysis. As such, we identify differences in variables of interest (such as fund alpha) between potential closet indexers and the rest of the population of active funds, controlling for observed characteristics.

We define a combined indicator of potential closet indexing, denoted $potCI_{i,t}$, for fund i in year t, to take the value 1 when the following three conditions are met:

i. $TE_{i,t} < 3\%$
ii. $R^2_{i,t} > 95\%$
iii. $\beta_{i,t} \in (0.95, 1.05)$

and to take the value 0 otherwise. Recall from the discussion of metrics in the literature review that the incidence of closet indexers is expected to decrease in TE, increase in R^2 and to be greater in the region of beta values close to one.

The choice of threshold values for TE and R^2 is guided by ESMA (2016). In the case of the combined metric, the share of false positives among funds classified as potential closet indexers can be expected to decrease as the relevant thresholds are made stricter. In choosing the threshold values for the core specification of the metric $potCI_{i,t}$ as above, we therefore calibrate thresholds that are strict enough to allow

[134] Better Finance (2019b) includes a regression of Jensen's alpha on TE, benchmark returns and costs for a sample of funds in Belgium, France and Luxembourg. The study funds a positive relationship between TE and alpha.

[135] This finding suggests that measures of activeness such as SSA may neglect a relevant source of alpha among funds that pursue active strategies.

[136] Another complication is that closet indexing is expected to be non-monotonic in Beta, since funds with beta that is significantly higher or lower than 1 may deviate significantly from their benchmarks.

[137] Amihud and Goyenko also include style fixed effects, encoded by a category variable in which each fund is identified by one of nine different management styles.

for directional effects to be identified when we subsequently study how the combined metric relates to cost and performance, to complement our study of how the individual components of the metric relate to these outcomes.[138]

In Danieli et al. (2020), we establish that the combined returns-based indicator is a significant predictor of AS in our sample.

To examine the extent to which potential closet indexers are associated with higher or lower performance and costs, we regress

$$Y_{i,t} = \beta_0 + \beta_1 C_{i,t} + \beta_2 X_{i,t} + \beta_3 W_{i,t} + \sum_{t=1}^{8} \delta_t T_t + u_{i,t} \quad (1)$$

where, according to the specification, $Y_{i,t}$ denotes (Jensen's) alpha or Total Expenses Ratio (TER) and $C_{i,t}$ denotes $AS_{i,t}$, $TE_{i,t}$, $R^2_{i,t}$ or $potCI_{i,t}$. The other variables are as follows: $X_{i,t}$ is a set of fund-level characteristics such as size and age, $W_{c,t}$ is a set of country-level characteristics and time dummies T_t are included to control for one-off shocks on an annual basis.

There does not appear to be an obvious prediction for the sign of β_1 in equation (1) when (gross) returns are the dependent variable. If the theoretical framework of Sharpe (1991) approximately holds, one would expect the coefficient to be small in magnitude.

Finally, when TER is the dependent variable in equation (1), one would expect β_1 to be: (i) non-positive for $C_{i,t} \in \{AS_{i,t}, TE_{i,t}, potCI_{i,t}\}$ and non-negative for $C_{i,t} = R^2_{i,t}$, assuming closet indexing is not related to pricing power; and (ii) small in magnitude. The latter hypothesis is based on the theoretical observations that setting significantly lower prices would lower the economic incentive to do closet indexing although some undercutting on price (facilitated by the fact that closet indexers would bear lower economic costs than those that active strategies entail) may win market share.[139]

Data description

We use yearly data from 2010 to 2018 for a sample of about 5,400 funds.[140] Sample selection is guided by the specification in ESMA (2016). The sample comprises EU-domiciled UCITS equity funds not categorised as index-trackers that had management fees of more than 0.65% of fund NAV.

The measures of potential closet indexing included in our dataset are AS, TE, R^2 and Beta (RA.2). While the latter three measures are available as reported by funds, AS is the result of a calculation that combines, at the fund level, a fund's portfolio and its benchmark index. Furthermore, the dataset includes many fund-specific characteristics such as fund size and age, returns (net of costs and gross, benchmark-adjusted and unadjusted), alpha and TER. Finally, the dataset includes time-varying macro-level data such as inflation and market volatility.

AS is calculated against technical benchmarks assigned by the data provider, rather than the benchmark that a fund reports in its prospectus. An advantage of using AS based on technical benchmarks is that it has higher coverage; the sample size would be around one quarter lower if we were to use AS based on the prospectus benchmark. A disadvantage is that the technical benchmark does not form part of the information disclosed to investors.[141]

The micro-level data originate from three commercial data terminals. Data on TER and net returns are from Refinitiv Lipper, as reported by funds. All other figures on fund characteristics and performance are from Morningstar Direct, as

[138] In Danieli et al. (2020), we find that a notable property of the metric is that the directional effects on investor outcomes are preserved as the metric is 'tightened' by making the thresholds stricter. This consistency property suggests that in the region of the joint distribution of the component metrics TE, R^2 and beta where false positives are sufficiently low to permit meaningful analysis, the inferred impact of potential closet indexing is qualitatively the same as that for the metrics studied individually. Furthermore, our key qualitative results do not appear sensitive to the choice of thresholds within this region of meaningful analysis.

[139] A related theoretical constraint on optimal price-setting from the perspective of a closet indexer is that setting fees sufficiently low may reveal to the market that the manager faces lower economic costs than those that active strategies typically entail, thereby revealing that the fund is not genuinely active.

[140] This includes annualised values of TE, R^2 and Beta, which are calculated based on monthly returns

[141] As a robustness check, we ran our regressions using AS calculated against prospectus benchmarks. The main difference was in the case of the performance (alpha net of costs) regression, in which AS was significant at the 5% level in the absence of controls but lost significance in the presence of controls. However, AS was significantly associated (at the 1% level) with performance measured by gross returns

reported by funds. Finally, macroeconomic data (inflation, VSTOXX, etc) are from Refinitiv Eikon.

One issue encountered in constructing the dataset was missing observations. Following the deletion of missing or suspect observations, the final sample amounted to 3,206 UCITS funds. [142] The final sample has a total size of EUR 1.41tn.

Most variables are expressed in percentage form. To guarantee some degree of stationarity, trending variables such as VSTOXX were transformed in first differences.

RA.2
Descriptive statistics
Summary of key variables

	Obs.	Mean	Min	Max	St. dev
CI metrics					
Beta	25,426	1.0	-1.2	3	0.2
R^2	25,426	82.9	0	100	16.7
AS	25,889	76.9	9.1	100	18
TE	25,426	5.1	0.1	35.2	2.9
Fund characteristics					
Fund size	28,683	443	0	13,100	914
Net flows	26,093	1.3	-7,790	5,230	216
Alpha	24,423	9.7	-65.9	138.3	15.2
TER	24,002	1.7	0	10	0.6
Age	26,168	13.1	0	85.0	9.8

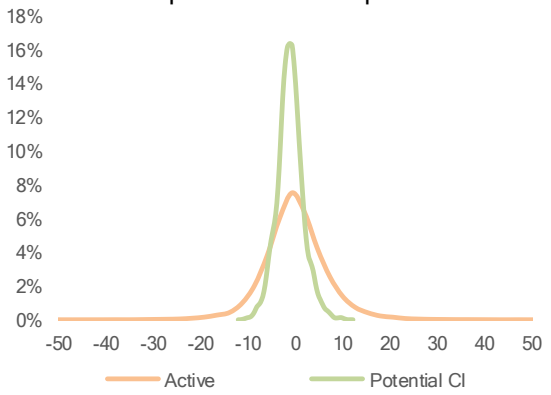
Note: R^2, AS, TE, alpha and TER in percentage points. "Alpha" = Jensen's alpha for a fund at year-end based on a 36-month trailing calculation. Fund size and net flows in EUR mn. Age in years. "Obs." = Total observations. "P10"=Value of variable at top of first decile; subsequent columns analogously defined.

The *potCI* metric – i.e. the indicator variable that combines the returns-based metrics of Beta, R^2 and TE, as defined above – has some time variation ranging from a high of around 11% of funds in 2018 to a low of around 5% in 2017.[143] This variability appears to be driven by a relatively small subpopulation of funds that is 'marginal', in the sense that their returns-based metrics (R^2 and TE in particular) are close to the threshold values. As a result, potCI is sensitive to market conditions for these funds.[144]

Excess returns, defined as gross fund returns minus gross benchmark returns, are a variable of interest as managers' performance is often judged relative to the market in which they invest. In keeping with the literature, however, we use alpha as our primary measure of performance as it also adjusts for risk from benchmark exposure.

An alpha for funds that meets our combined metric for potential closet indexing show far less variability than the rest of the population (RA.3). A similar result holds for excess returns.

RA.3
Jensen's alpha distributions by *PotCI* value
Concentrated performance for potential CIs



Note: Kernel density in % (y-axis) of Jensen's alpha (x-axis) of the two identified groups. "Potential CI"=Funds satisfying the PotCI indicator variable in a given year, "Active"=other funds in the sample.
Sources: Morningstar Direct, ESMA

Closet indexing, similar to explicit passive investing, is generally much less costly to implement than are genuinely active strategies. A major concern however is that investors in closet index funds nonetheless pay the higher fees associated with active management compared with passive management (RA.4).[145]

[142] Funds with missing values of AS, TE and R^2 were excluded. Outliers that were deleted from the sample included cases in which AS for some funds vastly exceeded 100%, even though none of the funds in the sample were heavily leveraged.

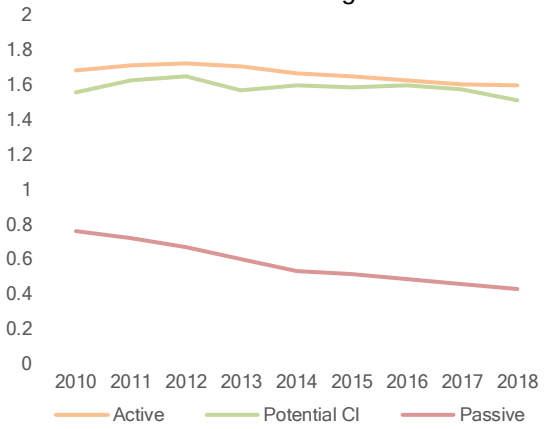
[143] The incidence of potential closet indexing according to the *PotCI* metric shows a similar pattern to that measured by the indicator set out in Box T.76. The latter indicator has been developed in the context of identifying potential CI rather than studying the effects of the phenomenon, as we do in this article. The indicator in Box T.76 has the advantage of being calculated on a higher-frequency basis (quarterly rather than annual), allowing for a more detailed time series. This feature, together with some differences in the samples used, means the implied incidence of time is not identical for the two indicators.

[144] The apparent sensitivity of potCI to market conditions among the subpopulation in question was another reason to investigate the effect of 'tightening' the threshold values of R2, TE and beta used to define the potCI indicator. As reported above, our key qualitative results are insensitive to the precise choice of thresholds.

[145] Our main dataset does not contain data on passive funds. Data on TER of passive funds have been extracted from

To investigate this issue, we complemented our dataset with data on TER of passive equity funds. As expected, potential CIs cost investors much more than passive funds, showing a TER only very slightly lower than other funds with active mandates. Average TER among the sample of funds with an active mandate had only a slight downward trend over the period 2010-18, in contrast to TER among passive funds, which decreased steadily and substantially. [146]

RA.4
TER by *potCI* values and passive funds, 2010-2018
Potential CIs and active charge similar costs



Note: Evolution of average total expense ratio, % (y-axis) over time (x-axis) of Active, Potential CIs and Passive funds.
Sources: Refinitive Lipper, ESMA

Results

Regressing the different potential closet indexing metrics on alpha (RA.5) strongly shows significant relationships under all specifications. [147] The sign of the coefficients consistently shows that potential closet indexers tend to have significantly lower performance, in keeping with much of the empirical literature.[148]

The fact that this relationship is consistently observed across portfolio-based and returns-based measures suggests that different approaches to active management – e.g. factor bets, diversified stock picks and correlated stock picks – are positively associated with higher performance among our sample of equity funds.

Turning to costs, the results suggest that potential closet indexers are slightly cheaper than the wider population of truly active funds (RA.6). Significant effects can be found via return-based metrics for potential closet indexing in both the single and the combined regressions. Specifically, TE, R^2 and *potCI* are valid predictors at the 1% significance level. In terms of magnitude, potential closet indexers are 0.06 pp (i.e. 6 bp) cheaper than truly active funds. Similarly, funds with a higher tracking error (truly active) have a higher TER on average. The effect of a decrease of 1pp in R^2 is associated with a decrease in TER of less than a tenth of a basis point.

RA.5
Regression results
Impact of potential closet indexing on alpha

	Alpha	Alpha	Alpha	Alpha
TE	0.198***			
R^2		-0.072***		
potCI			-0.880***	
AS				0.013***
Controls	Yes	Yes	Yes	Yes
N	21,254	21,254	21,254	21,254
N cluster	2,847	2,847	2,847	2,847

Note: Annual observations from 2010 to 2018. R^2 = coefficient of determination obtained from CAPM regression of fund returns on benchmark returns, which is then used as an independent variable in regression reported in the table. N = number of observations. "N cluster" = number of observations clustered by fund ID. All specifications include time dummies. ***p<0.01, **p<0.05, *p<0.1 .

Refinitiv Lipper to ensure a meaningful comparison across costs. TER values might differ slightly from those in other ESMA publications owing to differences in methodology and sample selection.

146 The slight downward trend in TER across the population of active funds as a whole may be owing to increasing competitive pressure from passive funds, as documented for example in Cremers et al (2016).

147 For the reasons set out above, we run unlagged pooled OLS regressions of the models specified in equation (1). Varying our specifications respectively to include fund fixed effects, and lagged x-variables and replacing alpha with other performance metrics yields qualitatively similar results in most cases. Throughout, we control for fund characteristics and macroeconomic factors, and cluster standard errors by funds.

148 We find that the results are qualitatively similar when unadjusted gross returns are used as the dependent variable instead of alpha. The same is true for excess returns measured simply as the difference between net returns and benchmark returns.

RA.6
Regression results
Impact of potential closet indexing on TER

	TER	TER	TER	TER
TE	0.017***			
R^2		-0.001**		
potCI			-0.075***	
AS				0.001*
Controls	Yes	Yes	Yes	Yes
N	19,884	19,884	20,327	20,327
N cluster	2,686	2,686	2,735	2,735

Note: Annual observations from 2010 to 2018. R^2 = coefficient of determination obtained from CAPM regression of fund returns on benchmark returns, which is then used as an independent variable in regression reported in the table. N = number of observations. "N cluster" = number of observations clustered by fund ID. All specifications include time dummies. ***p<0.01, **p<0.05, *p<0.1 .

Conclusion

Closet indexing can be defined as a practice whereby asset managers claim to manage their funds in an active manner while in fact passively managing them. As ESMA has previously highlighted, closet indexing is a major investor protection concern in its own right, as it involves misrepresenting information to investors.

We investigate how potential closet indexing – as measured by a range of different metrics – relates to performance and costs of EU equity funds. We find evidence that demonstrates that the potential closet indexing metrics we study are associated with lower alpha. This result is in line with several recent studies of US equity funds. Similar results hold for simpler performance measures such as unadjusted returns. Turning to costs, we find that potential closet indexers are associated with a slightly lower TER than active funds generally. Although closet indexing funds enjoy much lower economic costs than other active funds, they only pass on a small proportion of these savings to consumers on average, rather than competing strongly on price to win market share.

A possible topic for future work, building on the present study, would be to further broaden the set of closet indexing metrics still used.

In summary, our results suggest investors in closet indexing funds on average have worse outcomes than investors in genuinely active funds. Investors face lower expected returns from closet indexers than from what they are promised, namely an actively managed fund portfolio. In other words, as well as being a form of misconduct, closet indexing makes investors worse off ex-ante. Even though potential closet indexers are marginally cheaper than genuinely active funds, this difference is outweighed by reduced performance: potential closet indexers perform worse even when fees are taken into account. More generally, our results provide strong confirmation of the concerns of supervisors and investor advocacy groups that investors in closet indexing funds face an unjustifiably high level of costs, far in excess of those for explicitly passive funds.

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Annexes

TRV statistical annex

In addition to the statistics presented in the risk-monitoring and risk analysis sections above we provide extensive and up-to-date charts and tables with key data on the markets under ESMA's remit in the TRV Statistical Annex, which is published jointly with the TRV and can be accessed from https://www.esma.europa.eu/market-analysis/financial-stability.

List of abbreviations

€STR	Euro short-term rate
1H(Q)20	First half (quarter) of 2020
AI	Artificial intelligence
AIF	Alternative Investment Fund
AIFM	Alternative Investment Fund Manager
AIFMD	Directive on Alternative Investment Fund Managers
AMF	Autorité des Marchés Financiers
AS	Active share
AuM	Assets under management
BET	Binomial Expansion Technique
bps	Basis points
CA	Cryptoasset
CAPM	Capital asset pricing model
CBDC	Central bank digital currency
CBOE	Chicago Board Options Exchange
CCP	Central counterparty
CDS	Credit default swap
CDO	Collateralised Debt Obligation
CFD	Contract for differences
CII	Closet index indicator
CLO	Collateralised Loan Obligation
CNAV	Constant net asset value
Consob	Commissione Nazionale per le Società e la Borsa
CRA	Credit rating agency
CPMI-IOSCO	Committee on Payments and Market Infrastructures-International Organization of Securities Commissions
CSD	Central securities depository
CSP	Cloud service provider
DLT	Distributed ledger technology
EA	Euro area
EBA	European Banking Authority
ECB	European Central Bank
EEA	European Economic Area
EIOPA	European Insurance and Occupational Pensions Authority
EM	Emerging Market
EONIA	Euro Overnight Index Average
EPS	Earning per share
ESA	European Supervisory Authority
ESG	Environmental, Social and Governance
ESMA	European Securities and Markets Authority
ESTER	Euro short-term rate
ETF	Exchange-traded fund
ETS	Emissions-trading system
EU	European Union
Euribor	Euro Interbank Offered Rate
FCA	Financial Conduct Authority
FinTech	Financial technology
FSB	Financial Stability Board
FVC	Financial vehicle corporation
GDP	Gross domestic product
GM	Growth market
GSCs	Global stablecoins
HY	High yield

ICE	Intercontinental Exchange
ICMA	International Capital Market Association
ICO	Initial coin offering
ICT	Information and communication technology
IG	Investment grade
IMF	International Monetary Fund
IPO	Initial Public Offering
IRD	Interest-rate derivative
ISIN	International Securities Identification Number
KIID	Key Investor Information Document
LMT	Liquidity Management Tool
LVNAV	Low-volatility net asset value
MiFID II	Directive on Markets in Financial Instruments repealing Directive 2004/39/EC
MiFIR	Regulation on Markets in Financial Instruments
ML	Machine learning
MMF	Money market fund
MTF	Multilateral trading facility
NAV	Net asset value
NCA	National Competent Authority
NFC	Non-financial corporates
OECD	Organisation for Economic Co-operation and Development
OFI	Other financial institution
OTC	Over the counter
ppt	Percentage point
PRIIP	Packaged Retail and Insurance-based Investment Product
RegTech	Regulatory technology
SEC	Securities and Exchange Commission
ROA	Return on assets
SEF	Swap execution facility
SI	Systematic internaliser
SIB	Social impact bond
SMEs	Small and medium-sized enterprises
SSA	Style shifting activity
SSM	Single Supervisory Mechanism
STRESI	Stress simulation
STS	Simple, transparent and standardised
SupTech	Supervisory technology
TE	Tracking error
TER	Total expenses ratio
TRV	Report on trends, risks and vulnerabilities
UCITS	Undertakings for Collective Investment in Transferable Securities
VAR	Variance autoregression
VNAV	Variable net asset value

Currencies and countries abbreviated in accordance with ISO standards

esma European Securities and Markets Authority