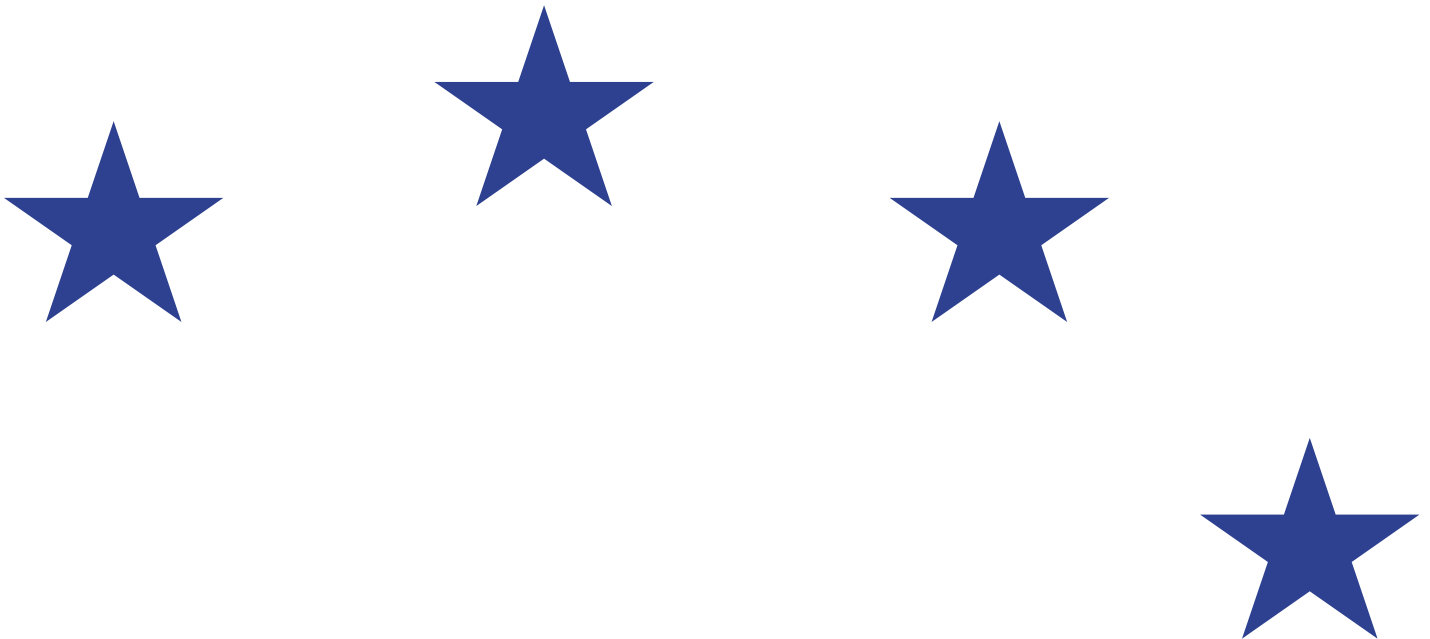




TRV

ESMA Report on Trends, Risks and Vulnerabilities

No 1, 2021



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Executive summary

Market monitoring

ESMA risk assessment

Risk summary

EU financial markets recovered from the significant COVID-19 related market stress in 2H20, in the light of notable public policy interventions, the announcement of new vaccines available in the short term and the reduction of Brexit-related uncertainty at the end of the reporting period in the EU. However, risks in markets under ESMA's remit remained very high. The significant rebound of equity markets and the valuation of debt indices, which reached pre-crisis levels across all segments, contrast with the weak economic fundamentals. The main risk we see for EU financial markets is that this ongoing decoupling leads to a reversal in investor risk assessment and a sudden market correction in a context where investors remain sensitive to events, exposing less-liquid markets to disorderly sell-off episodes. Prices of non-regulated cryptoassets at all-time highs imply significant risks for investors. Credit risk is likely to increase further because of significant corporate and public debt overhang. The extent to which these risks will further materialise will critically depend on three drivers: the economic impact of the pandemic, market expectations of monetary and fiscal support measures, and any occurrence of additional external events in an already fragile global environment.

ESMA remit	Risk categories		Risk drivers				
	Level	Outlook	Level	Outlook			
Overall ESMA remit	Red	→	Liquidity	Red	→	Macroeconomic environment	→
Securities markets	Red	→	Market	Red	→	Interest rate environment	→
Infrastructures and services	Orange	↘	Contagion	Orange	↗	Sovereign and private debt markets	↗
Asset management	Red	→	Credit	Orange	↗	Infrastructure disruptions	→
Consumers	Orange	↗	Operational	Orange	↗	Political and event risks	→

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 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: Macroeconomic conditions improved in 2H20, which was reflected by improved GDP forecasts amid continued very high uncertainty related to the future economic impact of the COVID-19 pandemic. Despite this uncertainty, asset prices – with the exception of commodities – recovered close to or above pre-crisis levels, thus highlighting a continued risk of decoupling from economic fundamentals. Concerns around the profitability of banks and insurers resurfaced and contributed to the underperformance of financial sector stocks. Central banks maintained their accommodative policy stance and asset purchase programmes, while government support measures continued to help mitigate the impact of the crisis. The December Brexit deal agreement has avoided the risk of cliff-edge effects and reduced political risks in the short term.

Securities markets: During 2H20, equity and fixed income markets continued their recovery from the massive market corrections in 1Q20. Equity valuations in the EU increased by 10% during 2H20, remaining slightly below pre-COVID-19 levels amid significant divergence between Member States and between sectors. If the end of the UK transition period had no discernible stability impact on securities markets, the implementation of the EU share-trading obligation is changing the European trading landscape. Linked to major monetary policy support, valuations in fixed income markets continued to increase across all sectors and ratings, especially during 3Q20. Riskier segments such as high-yield corporate bonds and emerging markets debt now have valuations above pre-COVID-19 levels, reflecting investors' renewed search for yield. Higher sovereign and corporate debt levels point to sustainability issues in the medium to long term.

Infrastructures and services: Equity-trading volumes stabilised to pre-crisis levels in 2H20, and the distribution of volumes across trading types remained broadly unchanged, with the share of lit trading stable at 46 % for 3Q20. Outages on European venues raise concern about over-reliance on third-party services. The launch of several new EU-based entities from UK groups in 4Q20, and the planning of an important merger are modifying the trading venue landscape in the aftermath of Brexit. EU and UK CCP initial margins decreased slowly but consistently throughout 2H20 following the sharp increase in March and April amid the COVID-19-related market stress. Settlement fails receded from their March peak although they remained above their pre-crisis level for equities. Rating downgrade numbers continued

their post-April downward trend, but corporates and structured finance products exposed to corporates continued to be more affected by negative rating actions, with fallen angel vulnerabilities remaining. Benchmark reform is still under way, with large exposures to legacy benchmarks on derivatives markets remaining, and the potential impact of credit downgrades on fixed income indices.

Asset management: The fund industry continued to expand in 2H20, reflecting strong flows and valuation effects. Following the significant outflows experienced during the COVID-19-related market stress, bond funds recorded the highest inflows, partly reflecting higher performance than equity funds. As stress receded, bond funds have reduced their cash holdings, while the credit risk profile of investment-grade bond funds has slightly deteriorated. The size and composition of EU MMFs remained stable, while liquidity buffers plateaued at high levels, substantially above regulatory requirements. The size of alternative investment funds remained stable in 3Q20, while EU-domiciled hedge funds reduced their leverage through derivatives but increased their financial leverage through borrowings.

Consumers: Following the market stress linked to the first wave of the COVID-19 pandemic, investor sentiment ameliorated amid continuing uncertainty, and the performance of retail investor instruments, such as EU UCITS funds, improved. Analysis of retail investor behaviour during the COVID-19-related market stress showed that new retail investors invested in equity markets during this period. The extent to which the phenomenon of increased retail equity trading is positive or negative from the perspective of investor protection depends on the situation of the individual investor and whether the investment is driven by long-term investment or speculative motives.

Market-based finance: During 2H20, primary markets mostly recovered from the COVID-19-related market stress earlier in 2020. The share of capital markets financing for non-financial corporates improved from its lowest point in the first phase of the crisis. Primary equity markets reopened but showed signs of differentiation between incumbent firms and new entrants. Corporate fixed income market issuance remained at high levels, but slowed down after touching record highs in 2Q20, with issuance quality slightly deteriorating towards BBB-rated bonds. Increasing corporate indebtedness raises concerns of debt overhang in the medium to long term. Access to capital markets for SMEs continues to be limited. Nevertheless, SME share trading improved in the second half of the year, especially on SME growth markets. Market-based credit intermediation decreased owing to valuation losses. On the other hand, wholesale funding increased thanks to bank deposits motivated by precautionary savings.

Sustainable finance: Against the backdrop of new pledges from the largest greenhouse gas-emitting countries to aim for future carbon neutrality, EU sustainable debt markets continued to expand at a brisk pace in 2H20 (+ 32 % from 1H20, EUR 508 bn), linked to robust supply from the corporate sector and massive public-sector financing needs to support the EU's economic recovery. The performance of environmental, social and governance (ESG) equity benchmarks was mixed. This mainly reflected the negative (positive) impact of COVID-19-related vaccine announcements on sectors that had performed well (poorly) during the crisis, such as healthcare (transport), and are overweight (underweight) in ESG portfolios. ESG equity funds attracted high net flows again, as ESG-related communication by asset managers paid off.

Financial innovation: The wider COVID-19 impacts continue to fuel digitalisation, with positive outcomes for consumers and firms but at the same time challenges and risks, especially related to cyber-resilience. In the crypto space, Bitcoin price is at all-time highs, fuelled by strong investor demand, positive news reports and the expectation that cryptoassets will ultimately achieve mainstream acceptance. Developments around global stablecoins continue to be under regulatory scrutiny, while sentiment towards central bank digital currencies is shifting positively.

Risk analysis

Vulnerabilities in money market funds: The acute market stress period of March 2020 showed that EU money market funds remain vulnerable to liquidity risk on their asset and liability sides. This article identifies a series of structural risks. The evidence related to these risks can serve as input to the currently ongoing discussions on MMF regulatory reforms. On the asset side, non-public debt MMFs have very high and concentrated exposures to private money markets that have low liquidity, making MMFs highly vulnerable to a symmetric liquidity shock as in March 2020. Regulatory constraints might also make some MMFs more vulnerable to runs from investors, as a result of concerns related to redemption fees and gates, or of tight constraints on net asset value deviations. Finally, MMF ratings also add to the constraints on managers, by restricting their eligible assets and penalising the use of liquidity management tools provided in the Money Market Fund Regulation (MMFR).

Fund portfolio network – a climate risk perspective: Within the EU financial sector, investment funds are more exposed to climate-sensitive economic sectors than banks, insurers and pension funds. However, few climate-related financial risk assessments of investment funds have been conducted. This article provides a first attempt to fill this gap, using a data set of EUR 10.7tn of European investment fund portfolio holdings. Funds whose portfolios are tilted towards more polluting assets (brown funds) distribute their portfolios over a larger number of companies than funds with cleaner portfolios (green funds). This apparent diversification hides a concentration risk: brown funds are more closely connected with each other (have more similar portfolios) than green fund portfolios, which tend to ‘herd’ less (have less similar portfolios to those of other green funds). This suggests that widespread climate-related financial shocks are likely to disproportionately affect brown funds. A preliminary climate risk scenario exercise confirms this: besides total system-wide losses of EUR 0.5tn to EUR 1.3tn, most brown funds’ losses range from about 8 % to 19 % of affected assets, in contrast to green funds’ losses, which usually range from 3 % to 7 %. In addition, brown funds have more systemic impact: they contribute more to total system-wide losses (by virtue of their greater interconnections within the fund universe) than green funds. These findings provide support for ongoing EU regulatory and supervisory initiatives on sustainable finance.

Fund stress simulation in the context of COVID-19: During the COVID-19-related market stress in 1Q20, investment funds faced a significant deterioration of liquidity in some segments of the fixed income markets combined with large-scale investment outflows from investors. In May, the ESRB issued a recommendation to ESMA requesting a focused supervisory engagement with investment funds exposed to asset categories that were affected by the liquidity stress. This joint supervisory exercise between ESMA and the ESRB took the form of a data-driven assessment of the impact of the liquidity crisis on funds, and an assessment of funds’ preparedness for future shocks, involving Stress Simulation exercises (STRESI) under several assumptions. This article presents the results of the stress simulation: while funds have been resilient to the market stress, the fund simulation also highlights existing vulnerabilities. In its response to the ESRB, ESMA concluded that funds needed to enhance their preparedness.

54 000 PRIIPs KIDs – How to read them (all): This article presents recent ESMA work to apply natural language-processing techniques on a unique data set of 54 000 Key Information Documents produced under the Packaged Retail Investment and Insurance-Based Products Regulation. This work – an application of ‘SupTech’ – aims to illustrate how these techniques can produce useful measures for European supervisors, policymakers and risk analysts. Information extracted from text opens up new possibilities for supervisory assessments, for example with respect to legal requirements that a document be comprehensible to investors. In addition, text-based information is uncorrelated with (i.e. complementary to) numerical information, which can help policymakers determine if the legislation is working as intended. Lastly, text-based information can identify new sources of financial risks to investors.

ESG ratings – status and key issues ahead: As sustainable investing gains traction, ESG ratings are growing in importance for investors and issuers, while gaining attention from global media. This article describes the market for ESG ratings, including types of ratings and key providers, and presents several use cases. In the absence of a regulatory framework, several issues and risks reduce the potential benefits of these ratings. The lack of a common definition and of comparability, together with transparency issues, could be ultimately detrimental to the transition towards a more sustainable financial system. To illustrate the impact of these issues on investors, our analysis focuses on the specific case of ESG benchmark construction.

Market monitoring

Market environment

Summary

Macroeconomic conditions improved in 2H20, which was reflected by improved GDP forecasts amid continued very high uncertainty related to the future economic impact of the COVID-19 pandemic. Despite this uncertainty, asset prices – with the exception of commodities – recovered to pre-crisis levels, thus highlighting a continued risk of decoupling from economic fundamentals. Concerns around the profitability of banks and insurances resurfaced and contributed to the underperformance of financial sector stocks. Central banks maintained their accommodative policy stance and asset purchase programmes, while government support measures continued to help mitigate the impact of the crisis. The December Brexit deal agreement has avoided the risk of cliff-edge effects and reduced political risks in the short term.

Macroeconomic conditions improved in 2H20, with a strong economic rebound in 3Q20 as COVID-19 containment measures were gradually lifted in the EU. The resurgence of the COVID-19 pandemic in 4Q20 has again led to very high economic uncertainty despite progress in the development and availability of vaccines from 2021. In its autumn forecast the EU Commission revised its EU GDP growth forecast slightly upwards for 2020, to – 7.4 % (up from – 8.3 %). Despite further predicted GDP recovery in 2021 (+ 4.1 %) and 2022 (+ 3 %), it is not expected to reach pre-COVID-19 levels until 2022 ⁽¹⁾.

Macroeconomic uncertainty was generally not reflected in asset valuations (T.1) and market volatility (T.2), which recovered close to or above pre-crisis levels, thus highlighting a continued risk of decoupling from economic fundamentals. **Commodity prices** were stable during 2H20, but with the exception of gold still declined by 30 % year on year, owing to the impact of the weak global demand on energy prices. Market confidence increased in 2H20, although remaining below its pre-crisis level (T.3).

Central banks maintained their **monetary stance** unchanged. The ECB expected key rates to remain at their present levels or lower until there are signs of resurgence in inflation ⁽²⁾. In a further response to the COVID-19 crisis, the ECB increased its Pandemic Emergency Purchase Programme (PEPP) of buying private and public sector securities, to EUR 1.85tn, and extended it until at least March 2022.

The profitability of **banks and insurers** is expected to remain weak, although their solvency is significantly higher than in the Global Financial Crisis. Banks faced pressure on profitability amid a subdued lending activity and the risk of increased credit losses, which could materialise with a lag due to public support measures. Banks are also facing long-term challenges from the ongoing margin compression in a low-yield environment. Insurers' profitability is affected by both lower revenues and higher claims resulting from the lockdowns. These concerns contributed to the underperformance of financial sector stocks.

In the medium term, risks related to debt overhang may surface, as corporate and government debt levels increase. Government support measures played an important role in mitigating the impact of the crisis but also led to a sharp increase in **government debt**. The existence of contingent liabilities, such as credit guarantees, further increases the risks from public indebtedness. At the end of 3Q2020, the government debt-to-GDP ratio in the EU stood at 89.8 %, compared with 79.7 % in 2019, driven by both new debt issuance and GDP decreases.

The December Brexit deal agreement reduced short-term **political uncertainty**; no cliff-edge effects materialised in January 2021.

There were small net **investment flows** into the EA in 2Q20, driven by EA debt purchases by non-EA investors (T.5). Because of high issuance levels, debt securities held by MFIs surged in 2Q20 (T.6).

⁽¹⁾ See European Commission (2020), 'Autumn 2020 economic forecast', 5 November.

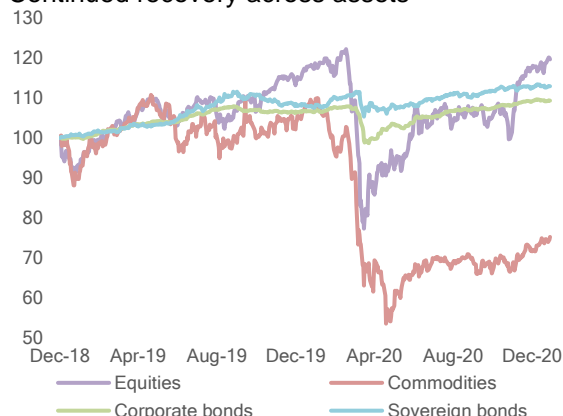
⁽²⁾ See ECB (2020), 'Monetary policy decisions', 29 October.

Key indicators

T.1

Market performance

Continued recovery across assets

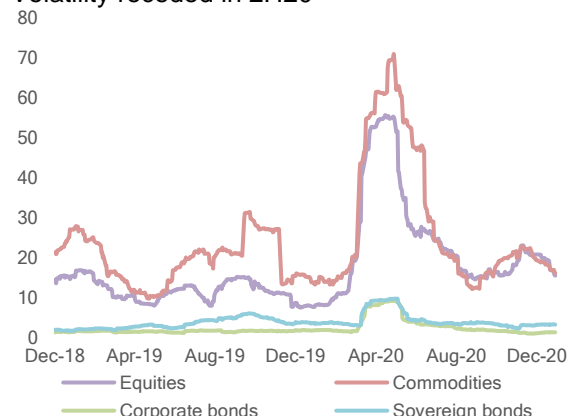


Note: Return indices on EA equities (Datastream regional index), global commodities (S&P GSCI) converted to EUR, EA corporate and sovereign bonds (iBoxx EUR, all maturities), 01/12/2018=100. Sources: Refinitiv Datastream, ESMA.

T.2

Market volatilities

Volatility receded in 2H20

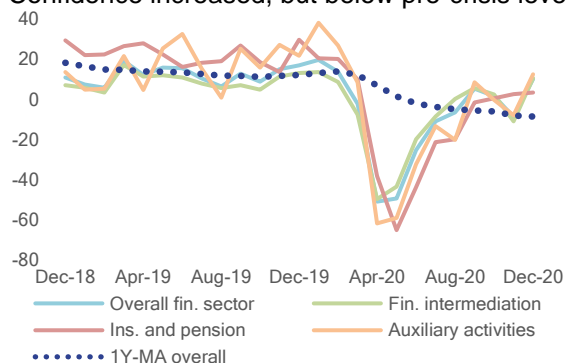


Note: Annualised 40D volatility of return indices on EA equities (Datastream regional index), global commodities (S&P GSCI) converted to EUR, EA corporate and sovereign bonds (iBoxx EUR, all maturities), in %. Sources: Refinitiv Datastream, ESMA.

T.3

Market confidence

Confidence increased, but below pre-crisis level

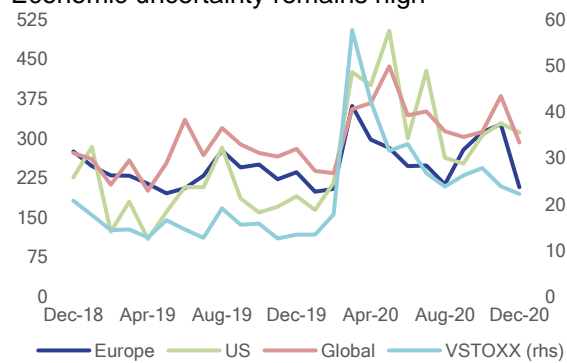


Note: European Commission survey of EU27 financial services sector and subsectors (NACE Rev.2 64, 65, 66). Confidence indicators are averages of the net balance of responses to questions on development of the business situation over the past three months, evolution of demand over the past three months and expectation of demand over the next three months, in % of answers received. Fin.=financial. Ins.=insurance. Sources: European Commission, ESMA.

T.4

Economic policy uncertainty

Economic uncertainty remains high

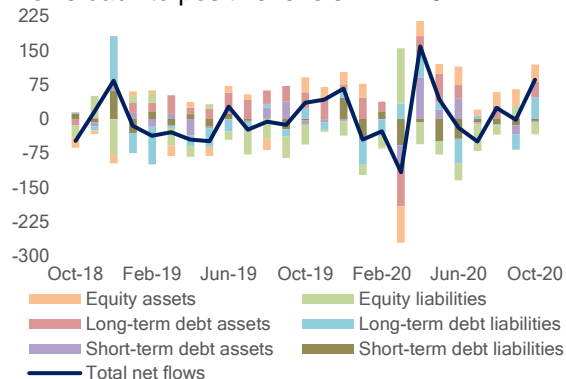


Note: Economic Policy Uncertainty Index (EPU), developed by Baker et al. (www.policyuncertainty.com), based on the frequency of articles in European newspapers that contain the following triple: "economic" or "economy", "uncertain" or "uncertainty" and one or more policy-relevant terms. Global aggregation based on PPP-adjusted GDP weights. Implied volatility of EURO STOXX 50 (VSTOXX), monthly average, on the right-hand side. Sources: Baker, Bloom, and Davis 2015; Refinitiv Datastream, ESMA.

T.5

Portfolio investment flows from and to the EA

Flows back to positive levels in 2H20

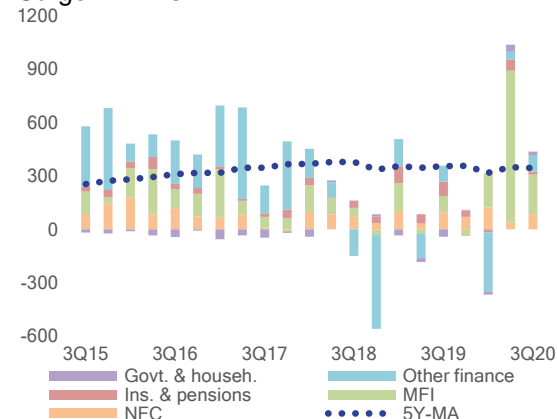


Note: Balance of Payments statistics, financial accounts, portfolio investments by asset class, EUR bn, Assets=net purchases (net sales) of non-EA securities by EA investors. Liabilities=net sales (net purchases) of EA securities by non-EA investors. Total net flows=net outflows (inflows) from (into) the EA. Sources: ECB, ESMA.

T.6

Investment flows by resident sector

Surge in MFIs



Note: Quarterly Sector Accounts. Investment flows by EA resident sector in equity (excluding investment fund shares) and debt securities, EUR bn. 5Y-MA=five-year moving average of all investment flows. Sources: ECB, ESMA.

Market trends and risks

Securities markets

Trends

During 2H20, equity and fixed income markets continued their recovery from the massive market corrections in 1Q20, leading to continued concerns about the decoupling of valuations from economic fundamentals. Equity valuations in the EU increased by 10 % during 2H20, remaining slightly below pre-COVID-19 levels amid significant divergence between Member States and between sectors. If the end of the UK transition period had no discernible stability impact on securities markets, the implementation of the EU share-trading obligation (STO) is changing the European trading landscape. Linked to major monetary policy support, valuations in fixed income markets continued to increase across all sectors and ratings, especially during 3Q20. Riskier segments such as high-yield corporate bonds and emerging market debt now have valuations above pre COVID-19 levels, reflecting investors’ renewed search for yield. Higher sovereign and corporate debt levels point to sustainability issues in the medium to long term.

Risk status

Risk level ■

Outlook ➔

Risk drivers

- COVID-19 pandemic impact on long-term economic prospects
- Market correction and risk reassessment
- Corporate sector indebtedness and deteriorating credit quality
- Sovereign risk sustainability
- Timing and management of the exit from public support

Equity: decoupling continues

Global **equity markets** continued their recovery during 2H20 – albeit at a slower pace than the rapid recovery after the COVID-19 related market stress of March 2020. Still, EU equity valuations increased by 10 % in 2H20. Outside EU most regional indices reached higher than pre-crisis levels at the end of December (T.7). The 2H20 market recovery continued to be supported by fiscal and monetary support, as well as by the pick-up in economic activity during the summer with the easing of containment measures. However, sensitivity to news reports remained, as evidenced by sharp price decreases of around – 5 % and heightened volatility in October, linked to the impact of the second COVID-19 wave on the real economy, as well as uncertainty about the US presidential election outcome. These were quickly reversed, driven by positive news related to the development of coronavirus vaccines.

The elevated asset market valuations observed at the end of 2020 continue to raise concerns about the sustainability of the market rebound, in the context of a deep recession and continued

uncertainty around the speed and size of the economic recovery. Furthermore, longer-term prospects remain uncertain, with the possibility of the post-pandemic environment entailing structural changes in the economic distribution among sectors, or of lasting weaker economic outcomes.

T.7

Equity prices by region

European equities below global levels



Note: Equity prices, 2020-02-20 = 100. Sources: Refinitiv Datastream, ESMA.

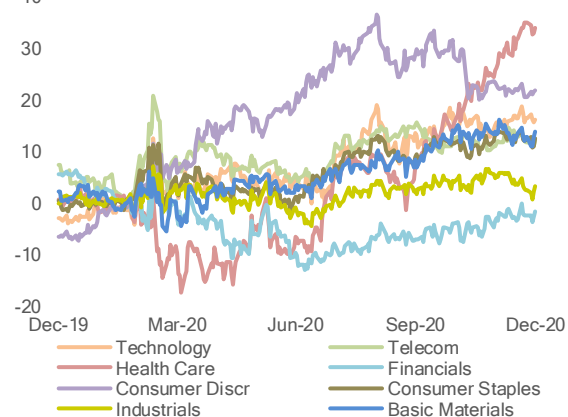
European valuations remain lower than their regional counterparts, with equity prices still 7 % below pre-crisis levels at the end of the year (18 % below global levels), even as bid–ask spreads and volatility declined. However, levels of price earnings ratios are above long-term averages (A.13). The recovery is uneven among sectors and countries, being stronger for the sectors that appear to have benefited from the crisis, such as technology or consumer discretionary, while financials and telecom remain behind. Furthermore, most EU sectors remain below US sectoral valuations (T.8). If the financial sector remains comparably behind pre-crisis levels in the EU and in the US, the EU healthcare and consumer discretionary sectors have performed worse than their American counterparts (respectively 34 % and 21 % below the US levels since the crisis).

The **dispersed impact** of the crisis on European countries is also observed through significant variations in market performance across Member States, ranging from + 18 % in DK to – 19 % in ES. (T.19). The dispersion reflects how economies were affected by the pandemic and the associated containment measures, but also their fiscal capacity and sectoral specialisation.

T.8

Difference between US and EU equity prices by sector

Largest performance differential for healthcare



Note: Difference between S&P equity prices by sector and their equivalent in Euro STOXX index, both rebased at 20/02/2020=100.
Sources: Refinitiv Datastream, ESMA.

With weak profitability prospects, European **bank valuations** remain low (T.20). The increased lending to non-financial corporations during the

pandemic (see also the market-based finance article) may turn into additional credit risk exposures and a growth in losses with a lag relative to the economic recovery, especially for banks with a considerable legacy of non-performing loans weighing on their balance sheets ⁽³⁾.

At the end of the year, the end of the transition period for the UK had no discernible stability impact on securities markets, thanks to the December Brexit agreement. However, the implementation of the EU STO in January appears to be gradually changing the European trading landscape, especially for on-exchange trading (T.9). The long-term impact of further trading migration will be monitored in the following months.

In January, a number of struggling US companies such as the videogame retailer Gamestop and the cinema company AMC saw their equity prices soaring amid jumps in trading volumes and volatility. The surge in equity prices, initially driven by massive purchases by retail investors using leverage, has also been amplified by forced buying from short sellers and underwriters of options. Although the rally came to a halt in early February, volatility remained high, amid concerns about an extension of this type of trading strategies that are disconnected from the economic fundamentals of the underlying, to other heavily shorted shares or other instruments such as commodities, e.g. silver. ESMA will continue monitoring this type of trading activities and possible spillovers to EU financial markets ⁽⁴⁾.

T.9

Equity trading

Impact of the European Share Trading Obligation

The share trading obligation (STO) was introduced by MiFIR ⁽⁵⁾ in order to move over-the-counter share trading onto platforms providing market transparency. If not for infrequent or exceptional trades that do not contribute to the price discovery process, investment firms that undertake trading in shares have to ensure that trading takes place on a regulated market, multilateral trading facility or systematic internaliser, or a third-country trading venue assessed as equivalent.

To mitigate potential adverse effects of a trading obligation without a third-country equivalence decision for UK venues by the European Commission, ESMA has issued several public statements preparing for this possibility. Shares with

⁽³⁾ See European Banking Authority (2020), 'First evidence of the use of moratoria and public guarantees in the EU public sector', November.

⁽⁴⁾ To this end, ESMA issued on 17 February 2021 a [Statement](#) urging retail investors to be careful when

taking investment decisions exclusively on the basis of information from social media and other unregulated platforms, if the reliability and quality of that information cannot be verified.

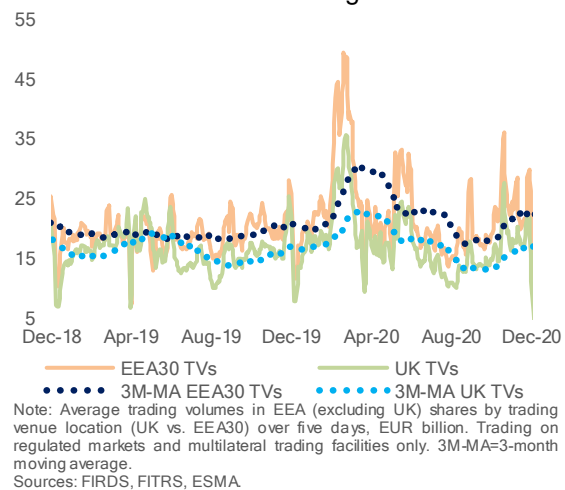
⁽⁵⁾ Article 23 of Regulation (EU) No 600/2014.

legal entity in the EEA (excluding UK) remained heavily traded in the UK in 2020, even though the share of trading on UK venues decreased from 46 % in 2019 to 43 % in 2020 (T.10).

T.10

EEA equity trading volumes by TV domicile

Gradual decline of EU trading on UK venues



In order to minimise uncertainty, ESMA already informed market participants in 2019 of its approach to the application of the STO in the absence of an equivalence decision and refined it in October 2020 ⁽⁶⁾. All EEA shares ⁽⁷⁾ are within the scope of the STO, with an exception for EU investment firms trading EEA shares on UK trading venues in pounds sterling (GBP). All UK ISINs are outside the scope of the EU STO. This confirms that EEA shares, deemed to have their main pool of liquidity in the EEA, will have to be traded on EEA or equivalent third-country venues, while allowing flexibility to the limited number of EEA shares (fewer than 50) under the specific circumstances of trading on a UK trading venue in local currency. The combination of ESMA and FCA positions ⁽⁸⁾ ensures no conflicting requirements.

A related approach also applies to the derivatives-trading obligation (DTO), which requires investment firms to conclude transactions in some derivatives (notably fixed-to-float interest rate swaps), on regulated markets, multilateral trading facilities, organised trading facilities or third-country trading venues established in jurisdictions for which the European Commission has adopted an equivalence decision. In November, ESMA issued a statement clarifying that the DTO will continue to apply without changes, so EU counterparties are required to use EU trading venues or eligible trading venues in third countries. The UK DTO requires UK counterparties to use a UK-authorized or recognised non-UK trading platform. After the transition period, UK branches of EU investment firms are likely to be subject to the DTOs of both the EU and the UK. So, in the absence of a European Commission equivalence decision for

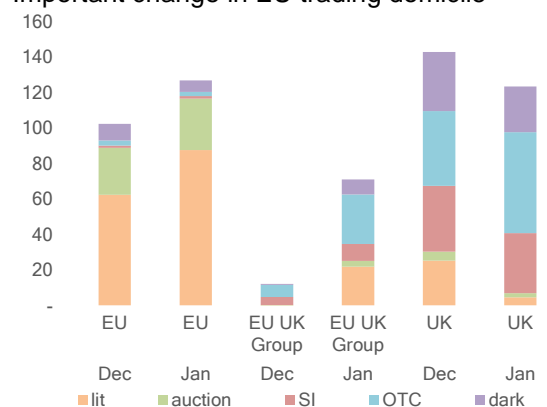
UK trading venues, UK branches of EU investment firms may need to change their current business practices to ensure compliance with EU law after the end of the transition period ⁽⁹⁾.

Analysing the development of trading for a sample of the 25 most traded EU shares in December 2020 and January 2021 shows that the expected shift in trading domicile took place in January. Most on-exchange trading moved to EU venues, with the share of lit trading on EU venues going from 71 % in December to 96 % in January, and auction trading from 84 % to 93 %.

T.11

European equity-trading volumes by entity domicile

Important change in EU trading domicile



In January, most off-exchange trading remained in the UK, but the share of EU entities, and notably of EU entities from a UK group, went up. The total share of volumes traded on EU entities grew from 39 % in December to 40 % in January, and that of EU entities from UK groups from 5 % to 22 %. Most of these EU entities from UK groups are recent entities ⁽¹⁰⁾, which saw their share of EU trading go up sharply in January across trading types, particularly for OTC (from 13 % in December to 32 % in January), lit trading (from 0 % to 19 %) and dark trading (from 1 % to 21 %).

Furthermore, to check the attractiveness of the remaining possibilities of trading EU shares in GBP on UK venues, the change in trading domicile for a sample of shares trading partly in GBP was also analysed. For the 20 most traded of those shares, their share of trading on UK entities proposing GBP went down in January: lit trading on EU venues went up from 58 % in December to 70 % in January, while trading on UK venues proposing GBP trading went down from 42 % to 30 %.

Since the first weeks of trading in January show the impact of the regime change as well as other possible factors, a longer period of analysis will be needed to

⁽⁶⁾ See ESMA (2020), 'Final position on share trading obligation', and public statements in March 2019 and May 2019.

⁽⁷⁾ Shares with an International Securities Identification Number (ISIN) starting with a country code corresponding to an EU Member State, Iceland, Liechtenstein or Norway.

⁽⁸⁾ See FCA (2020), 'FAC sets out its approach to the share trading obligation', November.

⁽⁹⁾ See ESMA (2020), 'Public statement', November.

⁽¹⁰⁾ See the infrastructures article for a presentation of the development of the EU infrastructure landscape after Brexit.

assess the development of trading in the EEA and the impact of the STO.

Fixed income: strong rebound

In line with other asset classes, **fixed income markets** continued to recover in 2H20. In contrast to equity developments, strong valuation increases were observed over the summer, for investment-grade (IG) debt as well as for riskier segments such as emerging market and high yield (HY), all ending the year with valuations well above pre-crisis levels. This major and swift recovery can also be seen when comparing the impact of the COVID-19-related market stress on bond indices with previous crises, such as the global financial crisis or the European debt crisis (T.12).

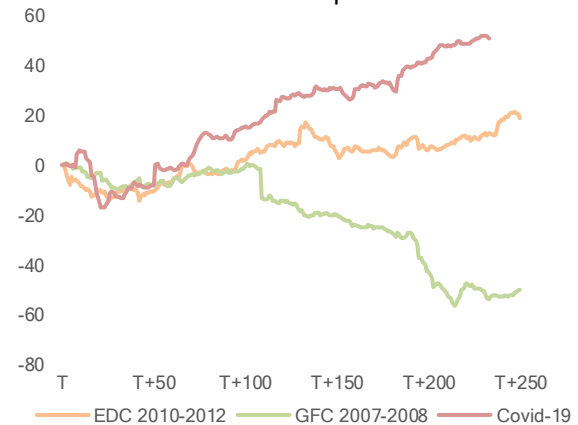
Whereas the grim economic outlook and increase in credit risk could have weighed on debt markets, this rebound is linked to the massive and ongoing monetary and fiscal policy support in response to the COVID-19 pandemic. Most central banks expanded their balance sheets by launching targeted asset purchases and increasing liquidity operations. In the EA, the ECB's PEPP reached EUR 757 bn of cumulative net purchases in December.

At the same time, the extension of fiscal support measures and the necessity for companies to meet their liquidity needs, combined with the continuing low interest rate environment, drove increased sovereign and corporate debt issuances in 2H20 ⁽¹¹⁾.

However, for fixed income markets too, the large valuation increases raise concern about a decoupling of bond market performance from the macroeconomic situation. Moreover, in the medium to longer term, higher sovereign and corporate debt levels point to sustainability issues, leading to potential reassessment of credit risk going forward ⁽¹²⁾.

T.12

Market value of global HY corporate bond index
HY valuations 50 % above pre-COVID-19 levels



Note: Change in market value of BoAML global HY corporate bond index, in %. Start dates: GFC (01/01/2008), EDC (03/05/2010), Covid-19 (19/02/2020). Sources: Refinitiv Datastream, ESMA.

In **sovereign bond markets**, both EA sovereign yields and CDS spreads have continued to decline after the ECB's announcement of the PEPP and the agreement of the EUR 750 bn EU recovery fund package in July, financed by jointly issued EU debt that will replace some of the national debt issuance. Countries that were more affected by the crisis, such as Spain and Italy, saw the biggest declines (T.21). Narrowing bid-ask spreads mirrored these developments.

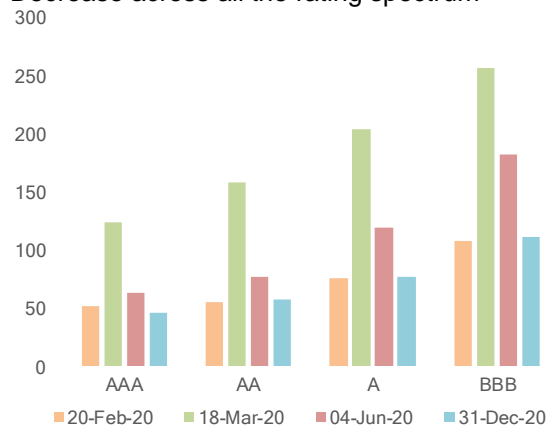
Corporate bond spreads in the EA continued their decline across sectors and across the rating spectrum (T.13). Amid continuous corporate bond issuance in 2H20, yields continued their decline across all rating categories to go below their pre-pandemic levels, indicating renewed search-for-yield behaviour. A strong indicator is the move to constant negative yields for the highest corporate bond ratings since October (T.22). At the same time, overall credit quality remained stable, with the share of corporate outstanding amounts with no rating or a rating of BBB or lower at 50 % in 2H20 (T.23).

⁽¹¹⁾ See the market-based finance article for more detail.

⁽¹²⁾ See IMF (2020), [GFSR: Bridge to recovery, October](#).

T.13

Corporate bond spread by rating category Decrease across all the rating spectrum



Note: ICE BofAML EA corporate bond option-adjusted spreads by rating, in bps.
Sources: Refinitiv Datastream, ESMA.

T.14

Securities-lending transactions by asset type Slow decrease after March spike



Note: number of daily transactions, in thousands, in securities lending markets for instruments primarily traded in the EEA30. Equities on the rhs.
Sources: FIS Astec Analytics, Quandl, ESMA.

Securities lending, short selling: normalisation

Following heightened levels reached in March 2020, **securities lending activity** decreased in the second half of the year (T.14). The level of **short-selling** positions increased slowly into 4Q20, indicating persisting uncertainty about market developments, before decreasing towards the end of the year (T.17).

Securities-lending transactions levels remain slightly above their pre-crisis levels at the end of the year, again indicating lingering uncertainty about market developments. They decreased, however, in December 2020 by 10 %, 3 % and 13 % since their peak in March 2020 for equity, sovereign and corporate instruments respectively (**Error! Reference source not found.**14). These developments have been mirrored by volumes on loan and utilisation rates, which both went down from March's elevated levels, with a marked contraction for equity instruments (A.57).

Increased securities-lending activity during the market stress in 1Q20 came with reduced average tenures for equity and corporate bond loans; tenures mostly recovered during the second part of the year (T.15).

T.15

Average tenure by asset type Normalisation of tenure after crisis episode



Note: average tenure of loans for instruments primarily traded in the EEA30. Tenure is measured in days and weighted by the market value of the loan.
Source: FIS Astec Analytics, Quandl, ESMA

T.16

Short-selling activity in 2H20 Slow growth of short-selling positions until November, followed by news-driven drop

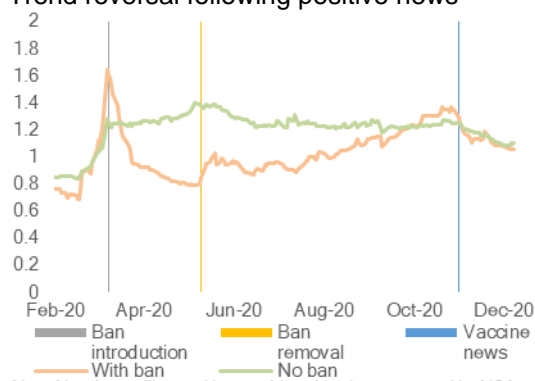
As a consequence of the increased market volatility and the rising level of short-selling positions linked to the COVID crisis downturns, six Member States (BE, EL, ES, FR, IT, AT) introduced short-selling bans in an effort to stabilise price movements from mid-March to mid-May. Especially, the short selling activity had been sharply increasing in the group that decided to impose bans. In countries where bans were not imposed, the

increase in short selling activity was lower and followed a broadly stable development from March onward (T.17).

To support market monitoring, on 16 March ESMA modified the reporting threshold of net short positions on shares, lowering it to 0.1 % of the issued share capital; this decision was then renewed for 3-month periods in June, September and December.

After the removal of the bans, short-selling activity in some EU countries slowly built up over the course of 2H20. Net short-selling positions in countries where bans were implemented experienced significant increases, catching up with the levels of those countries where bans were not imposed but not exceeding them as initially. However, in early November, short-selling activity declined as equity market performance became positive.

T.17
Net short-selling positions
Trend reversal following positive news

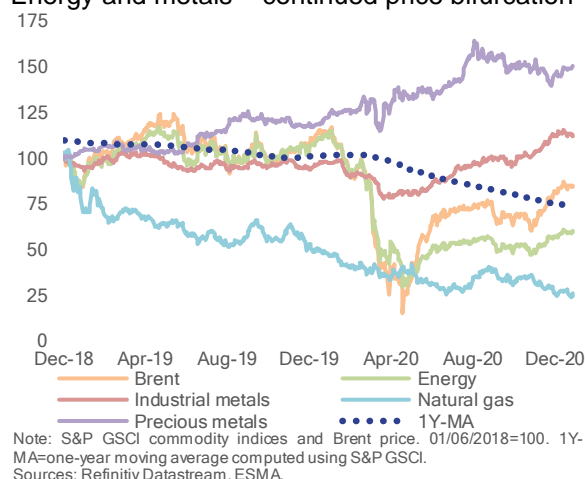


Note: Net short selling positions on blue-chip shares reported by NCAs under Article 5 of SSR as % of total issued share capital of shares listed on a EU Regulated Market. Average by countries with ban and without ban. Applied issued share capital for reference as of 10-Feb-20. The chart covers net short 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

Commodities: bifurcation of prices

On **commodities markets**, the bifurcation between energy and metals, which started during 1Q20, continued through 2H20.

T.18
Commodity prices
Energy and metals – continued price bifurcation



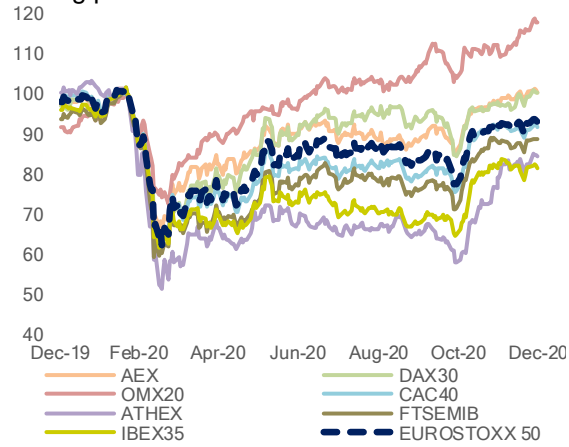
Price increases were most marked for gold, with prices peaking close to all-time highs during August 2020 (T.18), confirming the demand among investors for defensive assets, with large inflows into gold ETFs supporting the rally. In the meantime, despite increasing by 16 % during 2H20, energy prices remained 42 % below pre-crisis levels at the end of December, as price developments for energy continue to be driven by underlying demand. This has been most pronounced for gas prices.

After the rapid recovery during 2Q20 from long-term lows, **oil prices** continued to grow slowly until the end of August, as energy demand recovered amid economic recovery in 3Q20. In 4Q20, with renewed COVID-19 containment measures again weighing on demand, prices were supported by restrictions on the supply side, with OPEC+ countries improving their rate of compliance with the production agreement in September, and agreeing in December to maintain the production curbs close to current levels into the first quarter of 2021. Overall, oil prices at the end of 2020 remained at – 15 % compared with their pre-crisis levels.

Key indicators

T.19

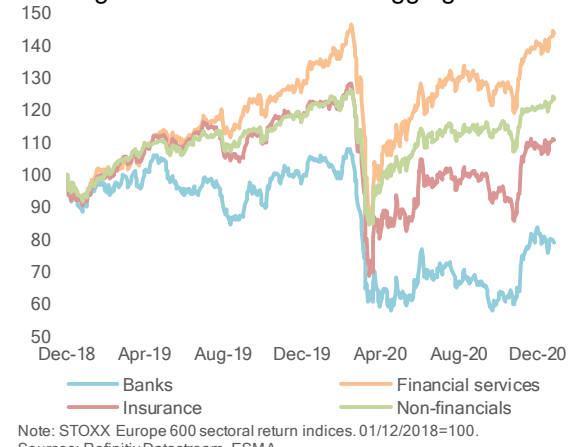
National equity indices from selected EU-27 countries
Strong performance differential across EU-27



Note: National equity indices from selected EU27 countries. 20/02/2020=100.
 Sources: Refinitiv Datastream, ESMA.

T.20

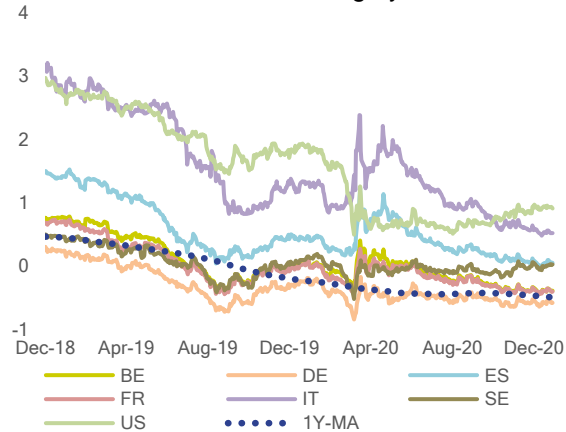
European financials return indices
Banking sector valuations still lagging behind



Note: STOXX Europe 600 sectoral return indices. 01/12/2018=100.
 Sources: Refinitiv Datastream, ESMA.

T.21

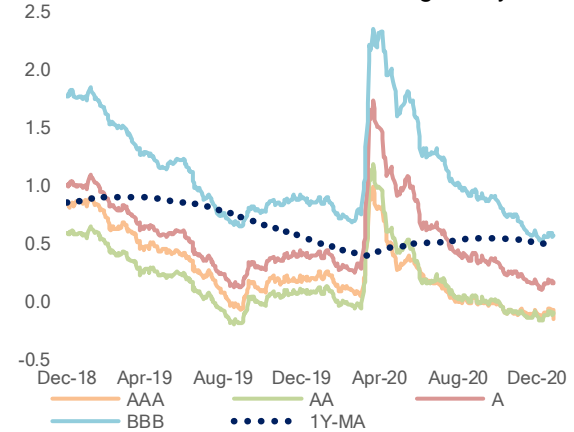
10Y sovereign bond yields
Further decline of EA sovereign yields



Note: Yields on 10Y sovereign bonds, selected countries, in %. 1Y-MA=one-year moving average of EA 10Y bond indices computed by Datastream.
 Sources: Refinitiv Datastream, ESMA.

T.22

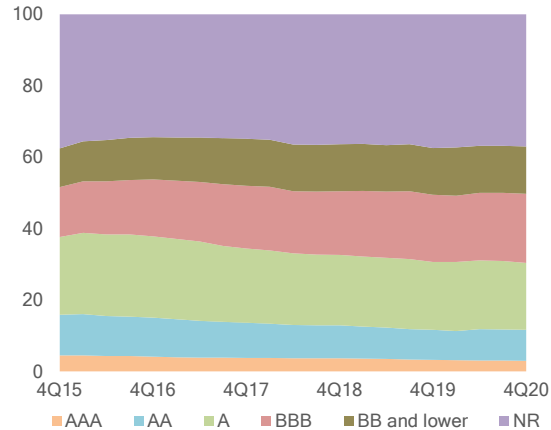
EA corporate bond yields
Further reduction, AAA/AA with negative yields



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

T.23

Long-term corporate debt outstanding distribution
Share of BBB and lower > 50 %



Note: Outstanding amount of corporate bonds in the EEA30 as of issuance date by rating category, in % of the total. Maturities < 12 months are excluded.
 Sources: Refinitiv EIKON, ESMA.

T.24

Oil and gold price development
Continuing bifurcation in commodities prices



Note: Gold and Crude oil, 31/12/2018= 100.
 Sources: Refinitiv Eikon, ESMA

Market trends and risks

Infrastructures and services

Trends

Equity-trading volumes stabilised to pre-crisis levels in 2H20, and the distribution of volumes across trading types remained broadly unchanged, with the share of lit trading stable at 46 % for 3Q20. Outages on European venues raise concern about over-reliance on third-party services. The launch of several new EU-based entities from UK groups in 4Q20 and the planning of an important merger are modifying the trading venue landscape in the aftermath of Brexit. EU and UK CCP initial margins decreased slowly but consistently throughout 2H20 following the sharp increase in March and April amid the COVID-19 related market stress. Settlement fails receded from their March peak although they remained above their pre-crisis level for equities. Rating downgrade numbers continued their post-April downward trend, but corporates and structured finance products exposed to corporates continued to be more affected by negative rating actions, with fallen angel vulnerabilities remaining. Benchmark reform is still under way, with large exposures to legacy benchmarks on derivatives markets remaining, and the potential impact of credit downgrades on fixed income indices.

Risk status

Risk level ■

Outlook ▼

Risk drivers

- Higher occurrences of trading venue outages, raising concerns over reliance on third-party services, especially in the COVID-19 context
- Geopolitical and event risks, notably uncertainty regarding the development of the COVID-19 pandemic and possible market correction

Trading venues: outage concerns

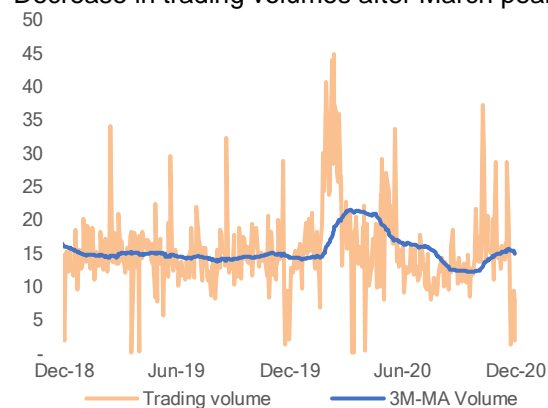
Following a peak of activity in March, equity **trading volumes** stabilised until summer before declining in August across all trading types, reaching lower levels than before the COVID-19 crisis (T.25). Reflecting higher volatility observed around positive vaccine news and a cyclical intensification of activity towards the end of the year, average daily trading volumes reached levels slightly above their 2019 average in 4Q20.

The repartition of equity trading across trading types came back to pre-crisis distribution (T.38). Volumes on regulated markets and multilateral trading facilities (MTFs) receded after their surge in 1H20, from 47 % to 45 %. The share of systematic internalisers amounted to 5 % of equity trading in 2H20, in line with its 2019 average, and OTC trading accounted for 48 % of overall trading volumes. Dark pool trading on EU entities was stable and accounted for 0.8 % of total volumes in 2H20 ⁽¹³⁾.

T.25

Trading of equity and equity-like instruments

Decrease in trading volumes after March peak



Note: Daily and 3M-MA of trading volumes on 29 EEA30 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. Sources: Morningstar Real-Time Data, ESMA.

With lower market volatility during 2H20, the number of **circuit breaker** trigger events declined significantly from the record levels of 1Q20 (3 300 per week) to an average of fewer than 80 per week in 3Q20. However, amid

⁽¹³⁾ Dark pool trading is defined here as trading on an EU entity identified as a dark pool, and does not consider dark trading on other venues, for instance under

waivers. Since there are few entities identified as dark pools in the EU, the volumes remain small in comparison with other definitions of dark trading.

surging volatility, the second week of November showed a leap in circuit breaker trigger events, which rose to more than 500 before normalising (T.39). The share of circuit breakers triggered for banks decreased to an average of 21 % of the total over the period July–December (6 pps lower than its average for 1H20), while for healthcare it grew to 28 % over the same period (5.5 pps higher, A.86).

A series of **technical outages** affected trading venues during the second half of 2020. On 1 July, trading in several exchanges using the XETRA technology was hampered by an outage caused by a software glitch. Similarly, as a result of a software failure, most Euronext marketplaces suffered a trading interruption on the morning of 19 October, lasting 3 hours and preventing the closing auction from successfully taking place. Outside the EU, comparable technical malfunctions led the Tokyo Stock Exchange to halt trading for the full day on 1 October, and the Australian Securities Exchange for 4 hours on 16 November. Other disruptions include the outage of European STOXX indices on 2 November, which caused a delay that negatively affected the pricing of derivatives and ETFs based on those indices.

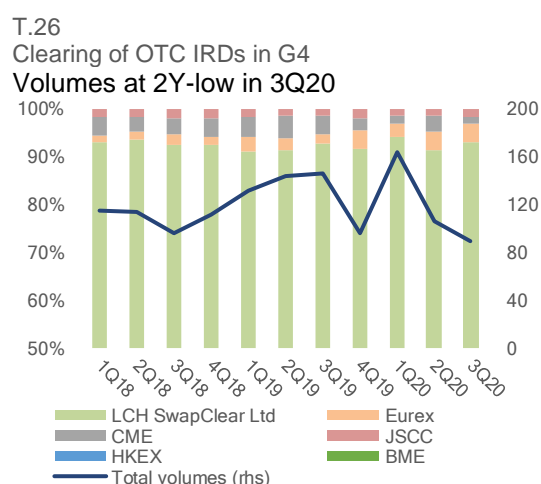
The technological issues that affected venues in 2020 highlighted potential concerns over the concentration of software providers and other technical infrastructures under the same platforms. Even though these episodes were not caused by cyberattacks, the increasing reliance on third-party data or software providers, and cloud services, may pose threats to the orderly functioning of a network of venues in instances of technological failure ⁽¹⁴⁾.

During 2H20, the **redistribution** of EU trading venues accelerated in preparation for the end of the Brexit transition period. In November, the London Stock Exchange (LSE) opened a European hub of its MTF Turquoise in Amsterdam, where Cboe had previously launched its European equity exchange. Goldman Sachs opened its Paris-based MTF in December 2020. In early January, those entities already represented a substantial part of EU equity trading (see T.9 on the EU STO). However, a longer period of analysis will be needed to assess the structural impact of the trading migration in the aftermath of Brexit. Finally, the

proposed acquisition of Borsa Italiana by Euronext from the LSE may imply that around one quarter of European equity trading on regulated markets will be taking place on the same platform ⁽¹⁵⁾. The transaction is conditional on the execution of LSE's proposed acquisition of Refinitiv, which was conditionally approved by the European Commission in January 2021.

CCPs: margins slowly returning to lower levels

Central clearing volumes on products subject to clearing obligations in the EU continued to come back to lower levels in 3Q20 after the higher clearing volumes amid a more general surge in volumes for interest rate derivatives (IRDs) and CDSs in March and April 2020. For IRDs in G4 currencies, volumes cleared were actually below their pre COVID-19 levels in 3Q20 at EUR 90tn, back from almost twice this amount in 1Q20 (EUR 164tn, T.26). The share of these products cleared globally by EU CCPs continued to increase while still remaining at low levels, with EU CCPs making up 4 % (from 1 % in 1Q18) and UK CCPs 93 % of the market.



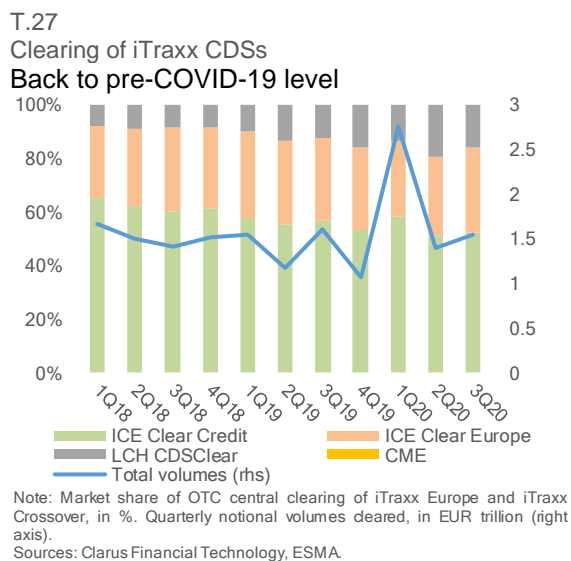
Note: Market share on OTC central clearing of basis swaps, fixed-to-float swaps, forward rate agreements and overnight indexed swaps in EUR, USD, JPY or GBP, in %. Quarterly notional volumes cleared, in EUR tn (rh axis).
Sources: Clarus Financial Technology, ESMA.

For CDS indices, volumes followed similar patterns, with EUR 1.5tn of iTraxx Europe and iTraxx Crossover cleared in 3Q20 (against EUR 2.6tn in 1Q20). For these indices the share

⁽¹⁴⁾ See for instance Financial Stability Board (FSB) (2019), 'Third-party dependencies in cloud services: Considerations on financial stability implications', December.

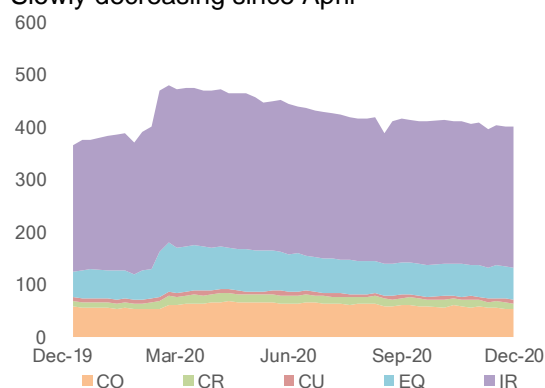
⁽¹⁵⁾ See the numbers for European equity-trading volumes in ESMA (2020), *EU Securities Markets – Annual statistical report*, November.

of clearing by EU CCPs stood at 47 % in 3Q20, up from 34 % in 1Q18 and 41 % in 1Q20 (T.27).



EU and UK CCP **initial margins** (both required and excess margins) decreased slowly but consistently throughout 2020 following the sharp increase in March and April and the COVID-19-related market stress. The bulk of the margins received were related to the main products cleared (IRDs), but the asset classes with the highest price volatility during the COVID-19-related market stress, equity (EQ) and currency (CU) derivatives, saw their share in the total margins receding with the lower volatility in 2H20. Initial margins related to EQ and CU made up 15 % and 1.6 % of the total in 2H20, down from 16.4 % and 1.8 % in 1H20. IRDs, commodities and credit derivatives increased their share or remained at the same level, with 66 %, 16 % and 3 % respectively in 2H20, from 65 %, 15 % and 3 % in 1H20.

T.28
EU and UK CCPs IM (required and excess)
Slowly decreasing since April



For variation margins, the pattern was different, with a sharp increase during the crisis, mainly caused by equity derivatives positions, and a sharp decrease after the volatility receded.

In September, a non-financial entity operating in the gas market defaulted at one EU CCP. The impact of this event on mutualised pre-funded resources was limited and there were no systemic implications.

T.29
CCP Public Quantitative Disclosures (PQD) indicators
Client vs house clearing

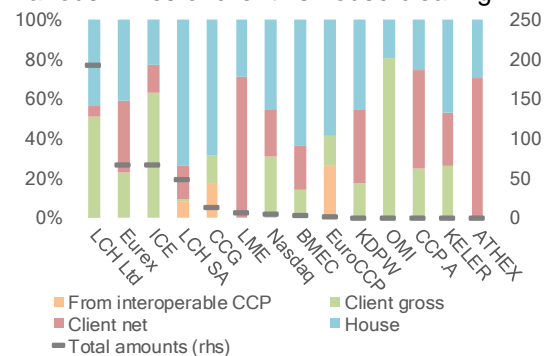
The CPMI-IOSCO PQD framework encompasses quarterly reporting by CCPs on their internal risk management practices, making it possible to build risk indicators for EU and UK CCPs on client vs house margining and on internal CCP stress test results.

CPMI-IOSCO data collect CCPs' initial margins by type of services they are linked to. In 2Q20 46 % of the IM were related to clearing members' house positions, i.e. positions not conducted on behalf of their clients but rather resulting from proprietary derivatives positions. Client net margins represent margins collected from clearing members, except for positions of clients in omnibus accounts where positions from different clients are netted. These positions resulted in 17 % of the margins. Client gross margins are positions from clients where margins are posted for single clients' positions on a segregated and non-netted basis. They made up another 40 % of the total. Finally, margins are also exchanged between CCPs that have interoperability arrangements (1 %).

T.30

Initial margin requirements

Various mixes of client vs house clearing



Note: Total initial margin required, split by house accounts (participants positions on their own account), client gross (when initial margin for the positions of indirect participants must be provided for each indirect participant's own position) and client net (when positions are netted within a group of clients), in %. Total amounts in EUR bn (rhs).

Sources: Clarus Financial Technology, CPMI-IOSCO PQD, ESMA.

Moreover, the chart shows that these practices, and for example the importance of client clearing, vary significantly across CCPs.

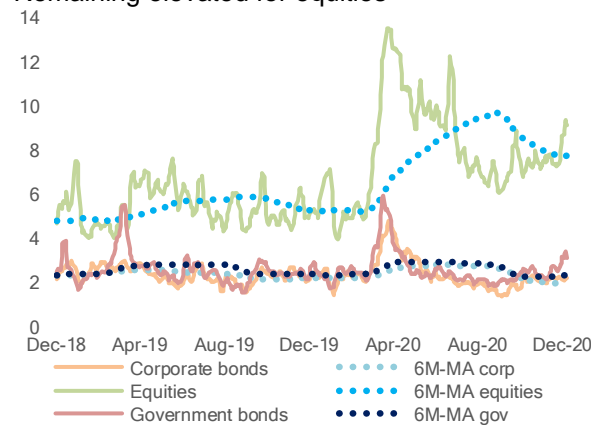
CSDs: still high level of fails for equities

Settlement fails receded from their all-time peak reached in March. Nevertheless, for equities, settlement fails are still more frequent than before the COVID-19-related market stress, especially as of early November amid higher volumes and volatility, and at the end of the year amid more seasonal variations. On average, the rate of settlement fails for equities (in value) was 7.4 % in 2H20, below the 8.6 % of 1H20 but still higher than 2H19 levels (5.2 %). For corporate and sovereign bonds, the rates of settlement fails during 2H20 were on average 1.9 % and 2.3 % respectively, around longer-term averages, but also slightly increasing towards the end of 2H20 (T.31).

T.31

Settlement fails

Remaining elevated for equities



Note: Share of failed settlement instructions in the EEA30, in % of value, one-week moving averages.

Sources: National Competent Authorities, ESMA.

Following a temporary equivalence decision from the European Commission, ESMA also announced that Euroclear UK & Ireland Limited would be recognised as a third-country CSD after the end of the UK's transition from the European Union and until 30 June 2021, in order to prevent Brexit disruptions, in particular regarding Irish securities.

CRAs: rating activity stabilises further

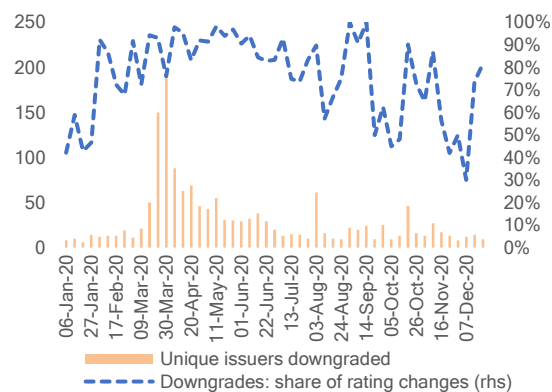
In the second half of 2020, credit rating activity continued the stabilisation pattern established following the dramatic spike in downgrades in March and April 2020. From late spring, the pace of **downgrades slowed** and then levelled later in 2020, as shown below for corporates (T.32). This reflected an improving credit risk outlook, following the unprecedented fiscal and monetary actions taken earlier in 2020, and the relaxation of confinement measures in many jurisdictions over the summer and the associated recovery in economic activity.

The chart also shows that the ratio of downgrades to all rating changes, while remaining positive – with downgrades continuing to outpace upgrades – continued to trend downwards in late 2020. In other words, numbers of **upgrades continued to recover** relative to downgrades. However, levels of downgrades among corporate issuers still remained higher and more volatile in October and November than in the period immediately preceding the crisis in January 2020, reflecting continuing uncertainty about the possibility, extent and timing of future waves of the pandemic and the extent to which economic

activity will be able to return to more normal levels, particularly in more vulnerable sectors.

Corporate rating activity continues to show strong **differences across sectors**. For example, in an August 2020 scenario-modelling analysis of European corporate credit risk, S&P identified the energy, metals and mining sectors as particularly vulnerable, with pharmaceuticals, utilities and real estate industries expected to maintain a less risky credit profile ⁽¹⁶⁾.

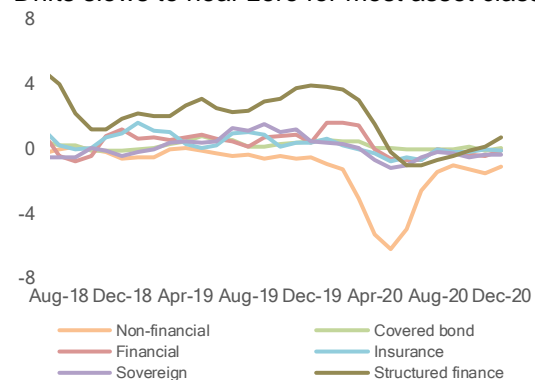
T.32
Corporate downgrade ratio and levels
Downgrades levels fall but higher than pre-crisis



Note: Number of EU27+UK corporate issuers with at least one bond downgraded, and ratio of downgraded corporate issues over upgrades and downgrades (rhs). First and final weeks of 2020 omitted due to very limited rating activity in those weeks.
Sources: ESMA, RADAR

The fall in downgrades relative to upgrades was also seen in asset classes other than corporates. All asset classes initially experienced a sharp fall in ratings drift in early spring, but from June onwards experienced a **recovery in ratings drift**. By late 2020, ratings drift recovered to near or above zero for all asset classes, except non-financial corporates. As shown in T.33, the close-to-zero drift indicates that for sovereigns (including public ratings), structured finance and financial firms the pace of upgrades and downgrades was similar.

T.33
Ratings drift
Drifts slows to near zero for most asset 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

The unprecedented fiscal actions of 2020 have added significantly to public borrowing, and risk weakening debt sustainability. Despite this, **sovereign rating activity has remained subdued** in Europe with few downgrades in late 2020 ⁽¹⁷⁾. Nonetheless, there has been an increase in sovereign ratings on negative outlooks, indicating that eventually there may be an increase in downgrades ⁽¹⁸⁾.

In **structured finance**, products with underlying instruments vulnerable to the corporate sector have been particularly affected. Commercial mortgage-backed securities (CMBS) experienced by far the most significant downgrades among the structured finance products in 2020, as shown in the distributional chart below (T.34). The significant numbers of CMBS downgrades reflect growing defaults in the commercial mortgages, as a result of the severe business impacts of the pandemic and of government confinement measures.

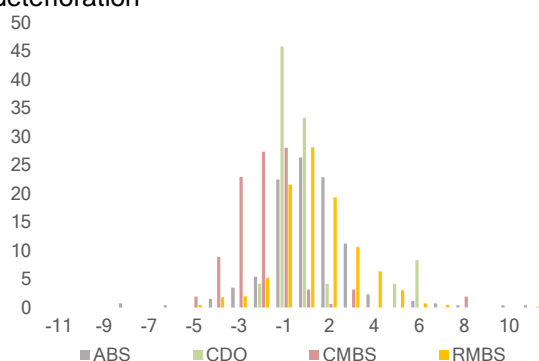
⁽¹⁶⁾ See S&P Global (2020), [eu-corporate-credit-risk-outlook](#)

⁽¹⁷⁾ Recent sovereign downgrades included a downgrade of the United Kingdom by Moody's and a downgrade of France by DBRS in October. Many sovereigns have had ratings affirmed, for example Croatia, Italy, Malta, Portugal and Sweden by Fitch Ratings. See: <https://www.fitchratings.com/search?filter.sector=Sove>

[reigns&filter.language=English&filter.reportType=Rating%20Action%20Commentary](#).

⁽¹⁸⁾ According to Reuters, S&P had 31 sovereign ratings on negative outlook compared with 2 on positive outlook in mid-October 2020. See Reuters (2020), 'Exclusive: Second sovereign downgrade wave coming, major nations at risk – S&P Global'.

T.34
Structured finance rating change distribution
CMBS experience most significant credit deterioration

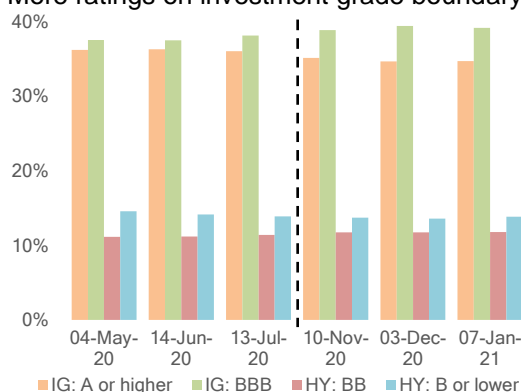


Note: Distribution of rating changes on structured finance products by number of notches (y-axis shows number of ratings that changed, x-axis shows number of notches for the changes). Long-term ratings only. ABS=asset-backed securities; CDO=collateralised debt obligations; CMBS=commercial mortgage-backed securities; RMBS=residential mortgage-backed securities. ABS excluding CDO, CMBS and RMBS. .
Sources: RADAR, ESMA

Since April 2020, indicators on **collateralised loan obligations** (CLOs), whose portfolios of leveraged loans experienced significant downgrades in early spring, have shown a continuing slow decrease in credit risk. The median weighted average rating factor of CLOs in Europe and the US has continued to fall gradually ⁽¹⁹⁾, indicating slow improving credit risk in the underlying loans on average. The share of CCC-rated leveraged loans in European CLO portfolios remained high, still significantly up from pre-COVID-19 levels, but has also been gradually falling from its peak earlier in the year ⁽²⁰⁾.

The increase in rating downgrades led to **fallen angels** and continues to do so, especially in corporates. Partly as a result of downgrades, we can observe a growth in the number of corporate ratings that are just IG (BBB) and just HY (BB) (T.35). The shift is also partly due to relatively high proportions of BBB-rated debt issuance in recent months. The growth in ratings at the BBB level presents a continuing vulnerability of additional fallen angels in the future.

T.35
Distribution of non-financial corporate ratings
More ratings on investment grade boundary



Note: Distribution of outstanding corporate non-financial instrument ratings (by number) where rated by the big 5 CRAs (Fitch, Moody's, S&P, DBRS, Scope). IG - investment grade, HY - High yield. Dashed line included to represent 4 month break in x-axis between July and November.
Sources: RADAR, ESMA.

Overall, continuing uncertainty on the further economic impacts of the COVID-19 pandemic means short-term credit risks remain significant, even with more favourable post-COVID-19 signs over the medium term. To the extent that risks materialise, there could be further increases in downgrades, particularly in corporates and in structured finance products exposed to corporates, and both could drive increases in fallen angels.

Benchmarks: ongoing transition

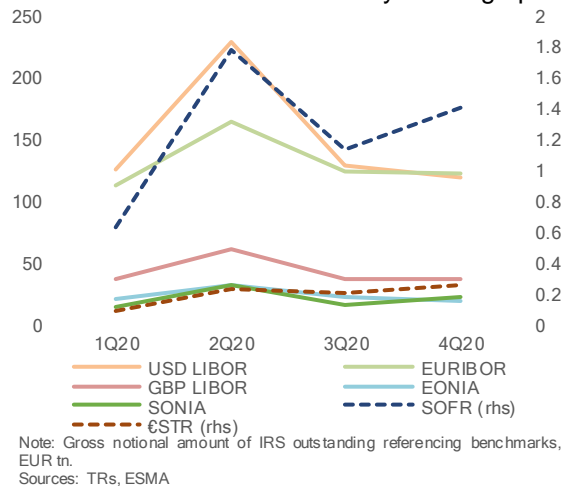
With the global benchmark reform ongoing and LIBOR and EONIA planned to be discontinued at the end of 2021, it is important to assess the extent to which market participants are ready to move from these to the new reference risk-free rates. In the EU, a significant share of derivatives contracts, in particular IRS, are still referencing some of these benchmarks. In 4Q20, according to EMIR data, EUR 182tn of IRS gross notional outstanding was referencing LIBOR in the EU and the UK, including EUR 119 bn for the dollar LIBOR and EUR 36 bn for the sterling LIBOR, only slightly below the 1Q20 levels (EUR 125 bn and EUR 36 bn respectively). Euribor gross notional amounted to EUR 121tn in 4Q20, up from EUR 112tn in 1Q20, while amounts for EONIA decreased from EUR 20tn in 1Q20 to EUR 18tn in 4Q20. More recent reference rates such as SONIA, the euro short-term rate (€STR)

⁽¹⁹⁾ See Barclays Credit Research's November 2020 CLO & Leveraged Loan Monthly Update, figure 25.

⁽²⁰⁾ See S&P Global (2020), *EMEA Structured Finance Surveillance Chart Book*, November, p. 26.

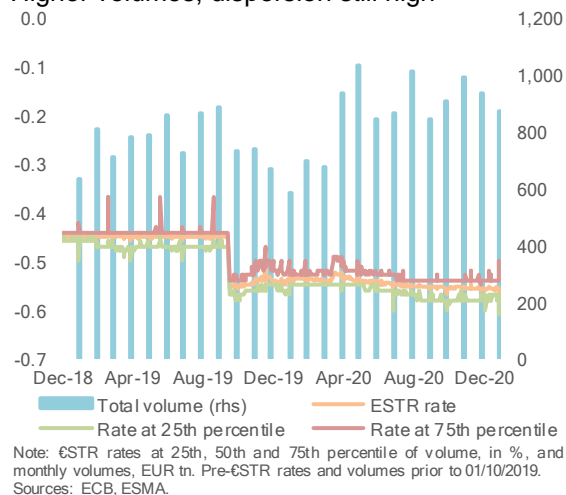
and the secured overnight financing rate (SOFR) are significantly gaining traction, with EUR 22tn, EUR 1.4tn and EUR 247 bn of IRS gross notional outstanding in 4Q20, up from EUR 13tn (+ 70 %), EUR 0.6tn (+ 125 %) and EUR 89 bn (+ 177 %) in 1Q20 respectively (T.36).

T.36
IRS referencing benchmarks
€STR and SOFR volumes slowly building up



The new overnight **reference risk-free rate** €STR (previously ESTER) experienced a more volatile fixing during March–April 2020 and the COVID-19 related market movements. During this period, dispersion also surged, as rates at 25 % and 75 % of the volumes diverged. Since then, volumes of interbank transactions used for the fixing have increased, but the dispersion has remained higher than before COVID-19, potentially reflecting the continued uncertainties exhibited more globally by EU markets and especially by banks.

T.37
€STR rates and volumes
Higher volumes, dispersion still high



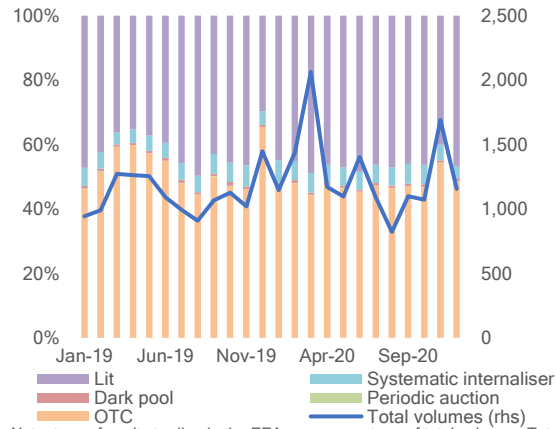
Other widely used market benchmarks such as fixed income indices used by active and passive fund managers to benchmark their performance are also facing risks related to potential credit rating downgrades. Indeed, many indices include credit ratings as a criterion for index inclusion. During the March COVID-19 related market stress, several indices postponed their rebalancing in order to avoid the removal of a large number of fallen angels. These indices are now facing an increased risk of more bonds being excluded in the next rebalancing, with the potential to trigger fire sales.

Key indicators

T.38

Equity trading volumes

Back to pre-COVID-19 levels before year-end increase

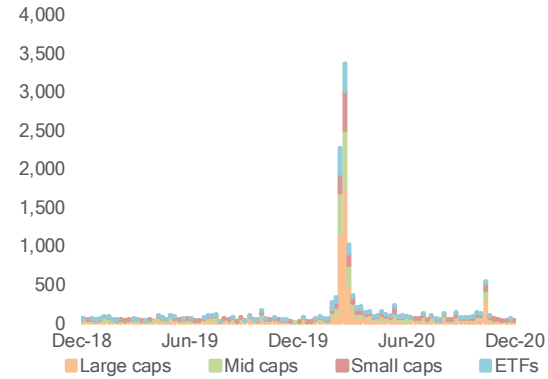


Note: type of equity trading in the EEA as a percentage of total volumes. Total equity trading volumes in EUR billions (right axis). OTC data includes volumes relative to the UK. Last available data point is December 2020. Sources: FIRDS, FITRS, ESMA.

T.39

Circuit breakers

Normalisation of circuit breaker events in 2H20

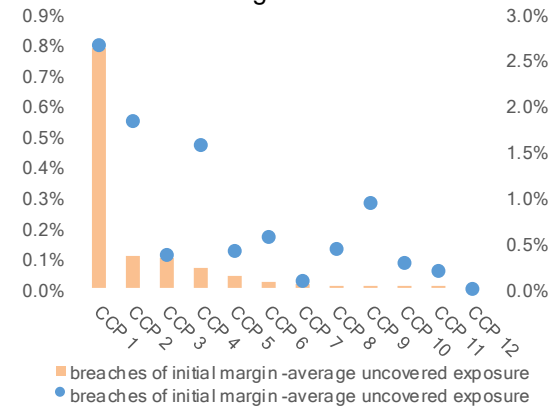


Note: Number of daily circuit-breaker trigger events by type of financial instrument and by market cap registered on 34 EEA31 trading venues for all constituents of the STOXX Europe Large/Mid/Small 200 and a large sample of ETFs tracking these indices or some of their subindices. Results displayed as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

T.40

Margins breaches

Peak breaches during COVID-19

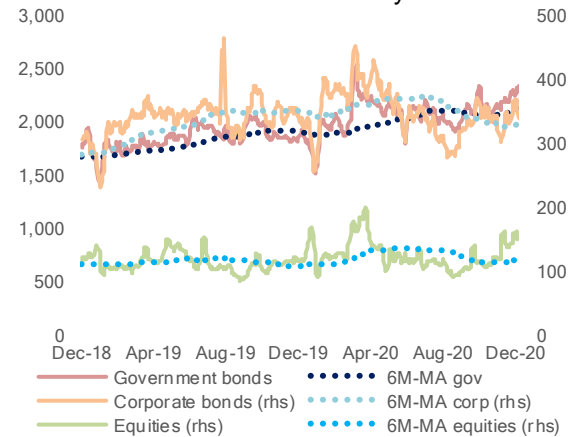


Note: Average and maximum margin breach size over the past 12 month at selected EU CCPs, as a percentage of the total margin held, as of 30 September 2020. Sources: Clarus Financial Technology, PQD, ESMA.

T.41

Settlement activity

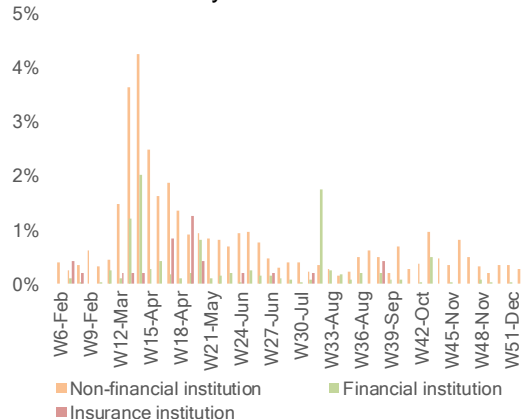
Increase towards the end of the year



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.42

Share of issuers with at least one bond downgraded
Non-financial corporation downgrades continue, albeit more slowly

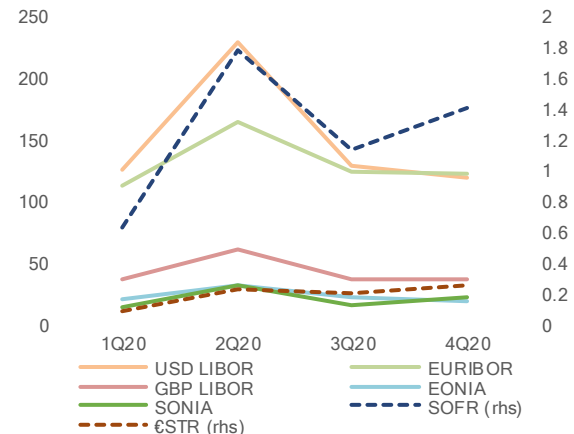


Note: Percentage of issuers with at least one bond downgraded over the total of outstanding issuers of that institution rated by the big 5 CRAs (Fitch, Moody's, S&P, DBRS, Scope). Sources: ESMA, RADAR

T.43

IRS referencing benchmarks

€STR and SOFR volumes slowly building up



Note: Gross notional amount of IRS outstanding referencing benchmarks, EUR tn. Sources: TRs, ESMA

Market trends and risks

Asset management

Trends

The fund industry continued to expand in 2H20, reflecting strong flows and valuation effects. In contrast to the significant outflows experienced during the COVID-19 related market stress, bond funds recorded the highest inflows, partly reflecting higher performance than equity funds. As stress receded, bond funds have reduced their cash holdings, while the credit risk profile of IG bond funds has slightly deteriorated. The size and composition of EU MMFs remained stable, while liquidity buffers plateaued at high levels, substantially above regulatory requirements. The size of alternative investment funds remained stable in 3Q20, while EU-domiciled hedge funds reduced their leverage through derivatives but increased their financial leverage through borrowings.

Risk status

Risk level ■
 Outlook ➔

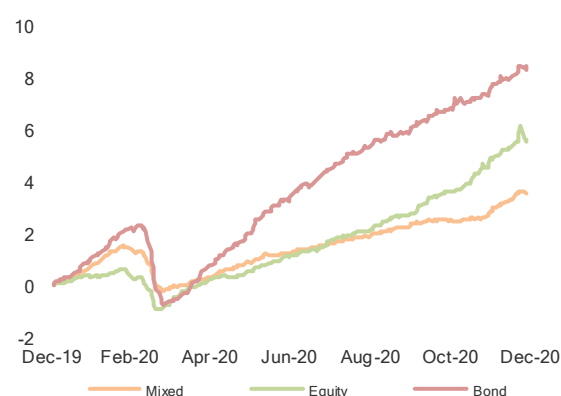
Risk drivers

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

Fund flows: continued strong inflows

The asset management industry continued to see **high inflows** in 2H20 across fund types (T.44). Cumulative flows during 2020 into bond funds amounted to 8.3 % of NAV (4.9 % in 2H20), compared with 5.6 % for equity (4.5 % in 2H20) and 3.6 % for mixed funds (2.4 % in 2H20).

T.44
 Fund flows
 High inflows, especially for bond funds

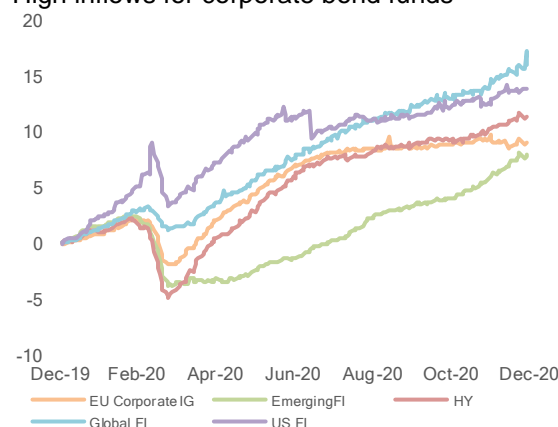


Note: Cumulative flows into UCITS, in % of NAV
 Sources: Morningstar, ESMA.

Within bond funds, **corporate bonds funds** recorded high inflows, with close to 16 % for fixed income funds investing in corporate and government bonds (global fixed income

category), 11.4 % for HY and 9 % for IG bond funds in 2020. US fixed income funds recorded inflows of 13.7 %, while for EM bond funds the recovery lagged slightly behind, at 7.9 %, although they saw 9.4 % in inflows in 2H20, after -1 % in 1H20 (T.45). After the trough observed in March, cumulative flows reached 10.8 % for IG corporate bond funds and around 17.1 % for HY corporate bond funds.

T.45
 Bond funds
 High inflows for corporate bond funds



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

Highly volatile flows in corporate bond funds during 2020 highlighted the importance of managing fund liquidity risk. Against this background, liquidity risk in corporate bond funds

was particularly investigated in response to a Recommendation issued by the ESRB (T.46) ⁽²¹⁾

T.46

Liquidity risks in corporate debt and real estate funds Key results of ESMA report

On 6 May 2020, the General Board of the ESRB adopted a Recommendation to ESMA to coordinate with NCAs a focused supervisory engagement with investment funds that have significant exposures to corporate debt and real estate, in order to assess their preparedness for potential future redemptions and valuation shock.

The exercise included the following:

- i. analysis of how funds have reacted since the onset of the COVID-19 pandemic (between February and March 2020);
- ii. analysis of their situation in June 2020;
- iii. estimation of their resilience to a future shock (stress testing);
- iv. consideration of whether additional actions are needed to foster the asset managers' preparedness.

ESMA published the results of this supervisory engagement in November ⁽²²⁾. It includes an assessment of corporate bond funds' resilience to a future shock based on ESMA's fund stress simulation framework (STRESI) ⁽²³⁾.

Main findings

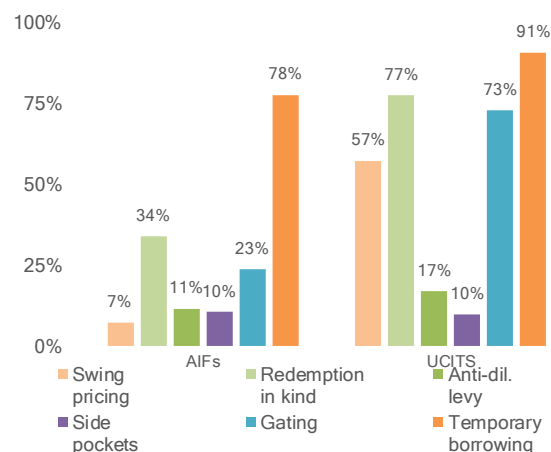
UCITS and AIFs exposed to corporate debt and real estate funds under review managed to adequately maintain their activities overall when facing redemption pressure and/or episodes of valuation uncertainty. However, the results should be interpreted with caution, since the redemption shock was concentrated over a short time, amid significant government and central bank interventions.

Some vulnerabilities emerged, especially the following.

- **Liquidity risk and management.** Some funds presented potential liquidity risks and deficiencies in liquidity risk management or valuation processes; only a few funds have adjusted liquidity processes in the light of the COVID-19 related market stress.
- **Asset valuation.** Concern over valuation of portfolio assets has clearly emerged, especially for real estate funds with a significant impact over the longer term.
- **Liquidity management tools (LMTs).** Availability varies considerably (T.47) across EU jurisdictions, depending on national rules and adoption by the funds. In addition, the adoption of LMTs by real estate funds is more limited, and additional risks

from loan covenants have been identified.

T.47 Availability of LMTs in the sample of corporate BF



Note: Availability to analysed funds of main LMTs (liquidity management tools)
Sources: NCAs, ESMA

Policy priorities

Five policy priorities have been identified to further enhance the preparedness of funds:

- i. supervision of alignment of fund investment strategy, liquidity profile, redemption policy;
- ii. supervision of liquidity risk assessment;
- iii. need for additional specifications for liquidity profiles and reporting;
- iv. increase in the availability and use of liquidity management tools;
- v. supervision of valuation processes in a context of valuation uncertainty.

The difference in flows across fund types can be partly explained by the **relative performance** of the strategies. In 1H20, the performance of fixed income markets was higher than that of equities, whereas it was the reverse in 2H20, with higher equity returns and high inflows into equity funds (T.48). For EM and HY bond funds, inflows have been substantially higher than what would be expected based on returns. One factor could be that the flow–return relationship might be stronger for riskier funds ⁽²⁴⁾.

⁽²¹⁾ ESRB (2020), 'Recommendation 2020/4 on liquidity risks in investment funds', May.

⁽²²⁾ ESMA (2020), 'Report – Recommendation of the European Systemic Risk Board (ESRB) on liquidity risk in investment funds', November.

⁽²³⁾ See the risk analysis article 'Fund stress simulation in the

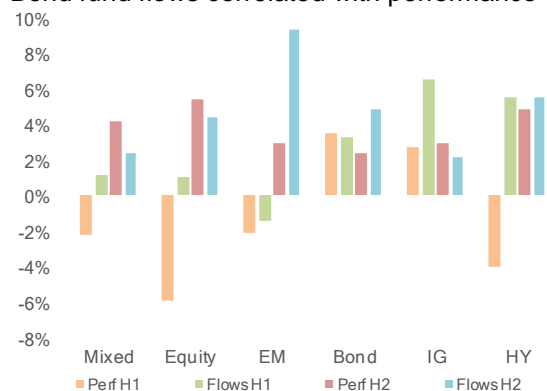
context of COVID-19', below.

⁽²⁴⁾ ESMA (2019), *Stress Simulation for Investment Funds*, found that a 1 % increase in returns leads to close to 2 % of inflows for HY bond funds, compared with less than 1 % for mixed funds.

T.48

Fund flows and performance

Bond fund flows correlated with performance



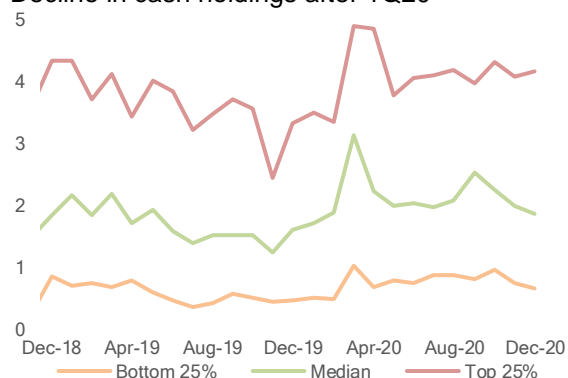
Note: 2020 performance (in %) of markets and bond fund flows by types (in % of NAV). Performance based on Datastream world equity index (equity), Bank of America Merrill Lynch Global HY, IG and EM index. Mixed fund performance based on 60% equity/40% bond portfolio. Sources: Morningstar, Refinitiv Eikon, ESMA.

After surging during the period of acute market stress in March 2020, corporate bond funds' cash holdings declined from April 2020 into 2H20 (T.49), while remaining higher than at the start of 2020. The decline can be explained by the normalisation of volatility and flows, reducing the need for funds to keep cash buffers to meet future redemptions or variation margins (T.50). In the current environment of low interest rates, substantial cash holdings can particularly affect fund returns. Reflecting search-for-yield behaviour, the share of high-quality liquid assets held by bond funds declined in 2H20 (T.62).

T.49

Corporate bond funds' cash holdings

Decline in cash holdings after 1Q20



Note: Median, top and bottom 25% value of cash held by EU corporate bond funds, in % of portfolio holdings (%). Short positions can have a negative value.

Sources: Refinitiv Lipper, ESMA.

T.50

Fund cash holdings

Multiple purposes of cash holdings

Funds can use cash holdings for several purposes, posing challenges in interpreting the development of fund cash buffers.

- Redemption buffers: cash can be used by the fund to meet redemptions without having to sell assets.
- Margin buffers: funds might keep cash in order to meet variation margins on derivatives exposures without having to sell assets.
- Transitory factors: cash holdings might rise when some instruments expire or when the fund issues shares and the fund manager has not yet invested the cash in new instruments.
- Operational uses: funds could keep cash to cover operating expenses.

In the absence of regulatory reporting, there could be reporting issues in commercial databases, as, firstly, cash holdings might include cash posted as collateral by the fund (and hence no longer available) and, secondly, in some cases funds report negative cash positions.

To assess whether fund deposits are held for operational reasons or can be used for other purposes, supervisory data from funds' depositary banks could be used. According to liquidity regulations, banks have to identify deposits as either operational deposits or non-operational deposits, since the types of deposits have different outflow rates when computing the Liquidity Coverage Ratio (LCR) ⁽²⁵⁾.

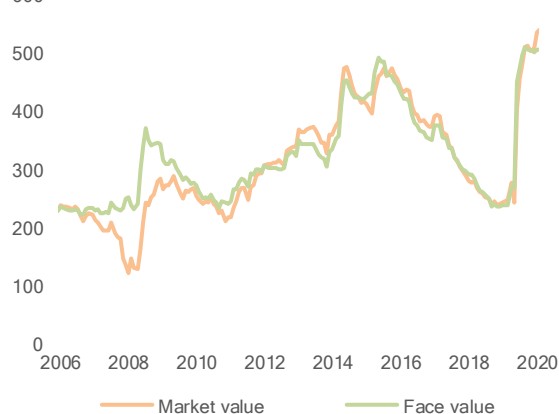
Corporate bond fund **credit risk deteriorated** slightly in 2020H2 for IG bond funds, while it improved for HY bond funds (T.61). Such diverging trends can be explained by fallen angels (former IG issuers downgraded to HY, in most instances from BBB to BB) given the surge in the size of the fallen angel universe in 2020 (T.51). Bond funds keeping downgraded bonds in their portfolio or increasing their exposures to lower-rated issuers will automatically see a deterioration in the credit quality of their holdings. At the same time, since the HY market outperformed the IG market in 2020, valuation effects will increase the value of such HY holdings, further contributing to an observed deterioration of the credit risk profile of IG bond funds. For HY bond funds, the increase in the credit quality partly reflects an improvement due to fallen angels as well: as a consequence of the increase in fallen angels, the share of BB issuers in HY indices has increased from 55 % a year ago to 61 % as of December 2020. As a result, HY funds using indices as benchmarks would tend to

⁽²⁵⁾ For further details on funds' cash holdings, see A. Bouveret (2017), 'Liquidity stress tests for investment

funds: A practical guide', IMF Working Papers, No 17/226, and ESMA (2019).

increase their exposures towards BB issuers, thus improving their credit risk profile.

T.51
Fallen angels
Surge in amounts and value of fallen angels

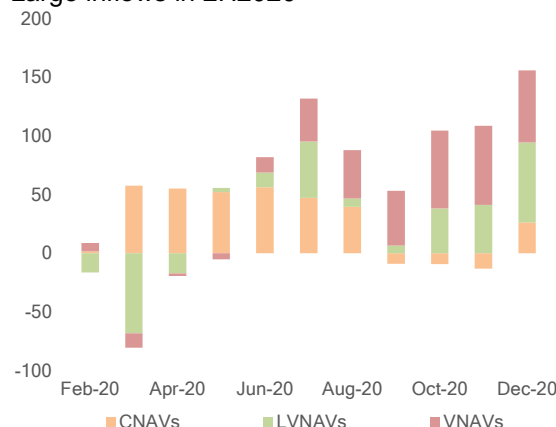


Note: Market and face value of the Bank of America Merrill Lynch Global fallen angel index, in USD bn.
Sources: Refinitiv Datastream, ESMA.

MMFs: increase in liquid assets

After experiencing sharp changes in composition and size in the first half of 2020, the size of the MMF sector stabilised at around EUR 1 400 bn at the end of 2020 according to ECB data. As of end-December 2020, LVNAVs and VNAVs were around EUR 100 bn higher than in early 2020, and CNAVs increased by around EUR 26 bn because of large inflows in December (T.52) ⁽²⁶⁾. MMFs offering redemption at par (CNAVs and LVNAVs) continue to account for the largest share of the market (respectively 10 % and 58 %), while VNAVs amount to 32 % of the EU MMF universe. By currency, MMFs in EUR represent 46 % of the market, followed by USD (30 %) and GBP (22 %).

T.52
EU MMF by type
Large inflows in 2H2020



Note: Change in MMF assets compared to Jan 2020, in EUR bn.
Sources: Refinitiv Lipper, ESMA.

Since end-March 2020, MMFs have substantially increased their **liquid assets**, with weekly liquid assets hovering around 50 % for LVNAVs, against regulatory requirements of 30 % (T.53). A similar trend was also observed for VNAVs, with WLAs around 40 % of NAV compared with a requirement of 15 % ⁽²⁷⁾.

T.53
MMF LVNAV liquid assets
High levels in 2H20 compared with requirements



Note: Median Weekly Liquid Assets (WLA) for LVNAVs, in % of NAV.
Sources: Crane, ESMA.

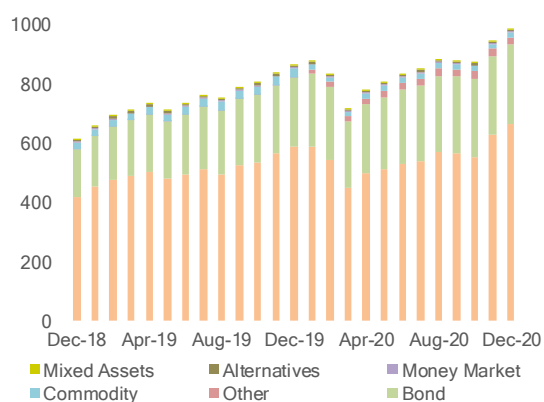
⁽²⁶⁾ Figures on MMF by regulatory type are based on a sample of MMFs covering around 80 % of the NAV of EU MMFs (EUR 1 088 bn as of December 2020). Figures on MMFs by currency are based on a sample

covering around 95 % of EU MMFs (EUR 1 397 bn as of December 2020).
⁽²⁷⁾ For a discussion of vulnerabilities within EU MMFs, see 'Vulnerabilities in money market funds', below.

ETFs: market size at new highs

After experiencing a sharp drop in NAV in March 2020 due to valuation effects and outflows, **the size of EU ETFs** expanded in 2020 to reach new highs at EUR 985 bn at the end of December (T.54). Equity ETFs remain the largest segment (67 % of NAV), followed by bond ETFs (27 %), while the other categories account for a marginal part of the market.

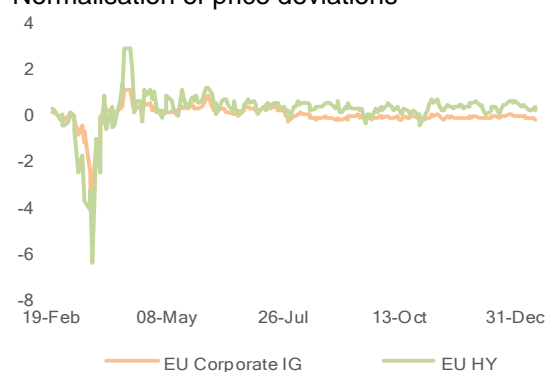
T.54
EU ETFs
New peak in NAV
1200



Note: NAV of EU27 ETFs by asset type, EUR bn.
Sources: Refinitiv Lipper, ESMA

During the period of acute stress in March 2020, corporate bond ETFs experienced large deviations between the price of the ETF and the price of the underlying basket of bonds (called ETF premium or discount). Since then, the deviation has normalised, indicating a close correspondence between the price of the ETFs and the underlying bonds, as market liquidity bounced back (T.55).

T.55
Corporate bond ETFs
Normalisation of price deviations



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

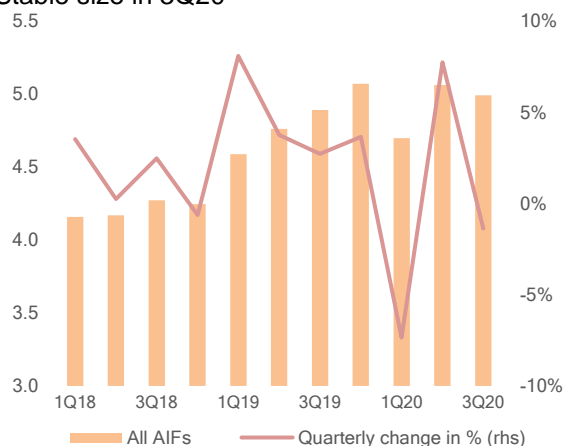
Alternative Investment Funds: stable size

After experiencing sharp changes in NAV in the first half of 2020, the size of **Alternative Investment Funds** (AIFs) remained stable in 3Q20 (T.56), at close to EUR 5tn (for AIFs reporting quarterly under the AIFMD reporting requirements)⁽²⁸⁾. In terms of AIF types, funds of funds accounted for 15 % of the NAV, followed by real estate funds (12 %), while 'Other AIFs' remained by far the largest category, representing 66 % of NAV. The size of private equity funds remained relatively low, with a NAV close to EUR 110 bn. The size of the EU AIF hedge fund sector stayed small too, with a NAV of around EUR 70 bn, as most hedge funds sold in the EU are managed outside the EU (primarily in the UK).

⁽²⁸⁾ Under the AIFMD, Directive 2011/61/EU, the reporting frequency is based on the size of the AIF. Only AIFs with (regulatory) assets under management above

EUR 1bn report on a quarterly basis. At the end of 2019, the NAV of all AIFs was EUR 6.8tn, compared with EUR 5.1tn for AIFs reporting quarterly.

T.56
EU AIFs
Stable size in 3Q20



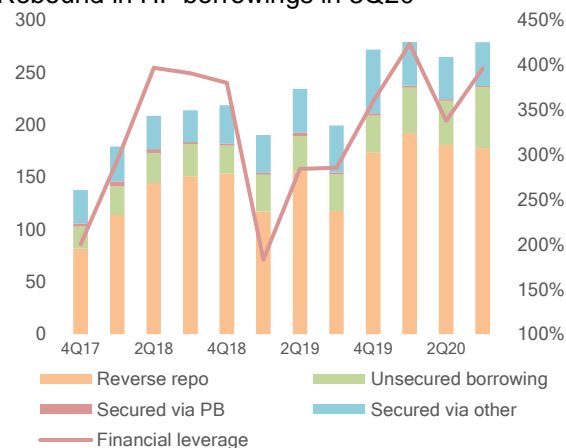
Note: Net asset value of AIFs by types, (excluding UK AIFMs), in EUR tn. The sample only includes AIFs reporting at a quarterly frequency.
Sources: AIFMD database, National Competent Authorities, ESMA.

Levels of **leverage** of the overall AIF industry remained limited in 3Q20, with the median adjusted leverage (gross leverage excluding interest rate and FX derivatives) across all AIF types hovering around 102 % (T.57). This measure of leverage includes balance sheet leverage (through borrowings) and synthetic leverage (through derivatives). In contrast, hedge fund adjusted leverage declined significantly to reach 130 % of NAV (from 185 % at the end of 2019), its lowest value since 2017. The drop was concentrated among the highest leveraged hedge funds: the adjusted leverage for the third quartile plummeted to 240 %, from 415 % at the end of 2019.

Hedge fund borrowings rebounded in 2020Q3 to reach EUR 280 bn (T.58), after declining in the previous quarter. Repo remains the main source of funding (around 64 % of the total), while unsecured borrowings increased sharply (21 % of the total against 13 % a year ago). Financial leverage grew by 60 pps to reach 400 % in 3Q20, close to the highest level, 420 %, observed in 1Q20.

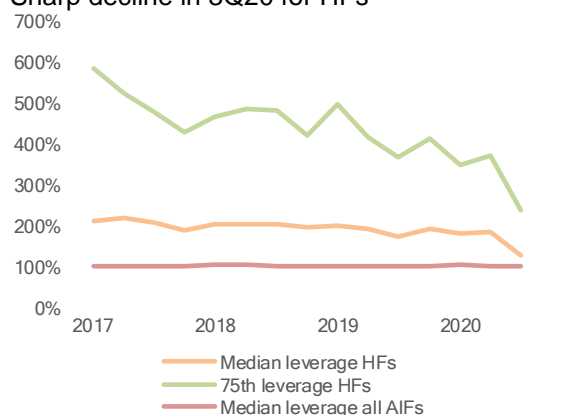
The diverging patterns for hedge funds observed across leverage measures, with declining adjusted leverage and rising financial leverage, imply that hedge funds reduced their derivatives exposures in 3Q20.

T.58
EU hedge funds' financial leverage
Rebound in HF borrowings in 3Q20



Note: Hedge fund borrowing by source, in EUR bn and financial leverage (borrowing to NAV), in %.
Sources: AIFMD database, National Competent Authorities, ESMA.

T.57
EU AIFs adjusted leverage
Sharp decline in 3Q20 for HFs

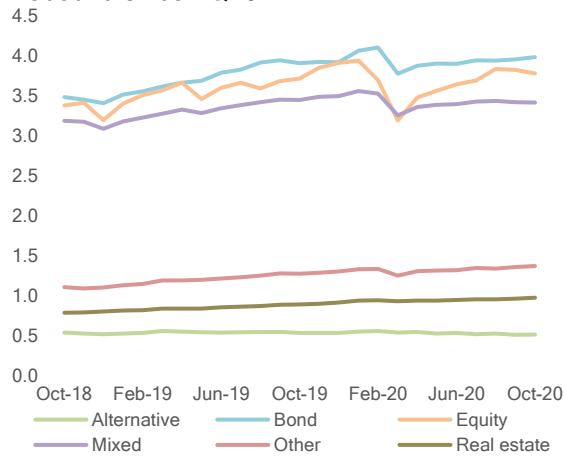


Note: Adjusted leverage (ratio of gross exposures excluding IRDs and FX derivatives to NAV), in % of NAV. The sample only includes AIFs reporting at a quarterly frequency.
Sources: AIFMD database, National Competent Authorities, ESMA.

Key indicators

T.59

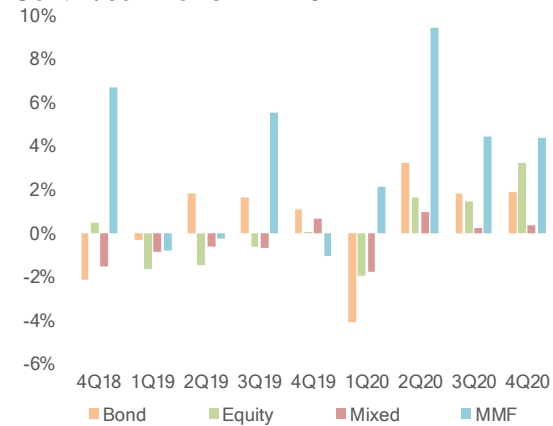
Assets under management by market segment
Rebound since 1Q20



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

T.60

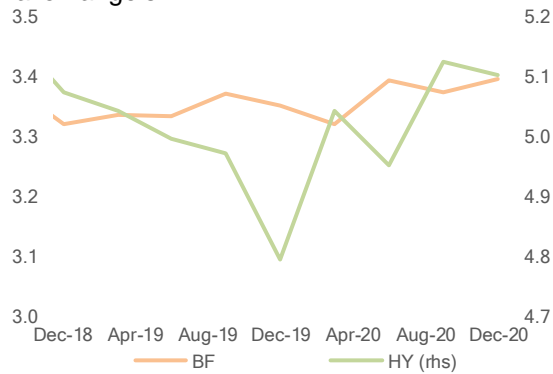
Fund flows by fund type
Continued inflows in 2H20



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

T.61

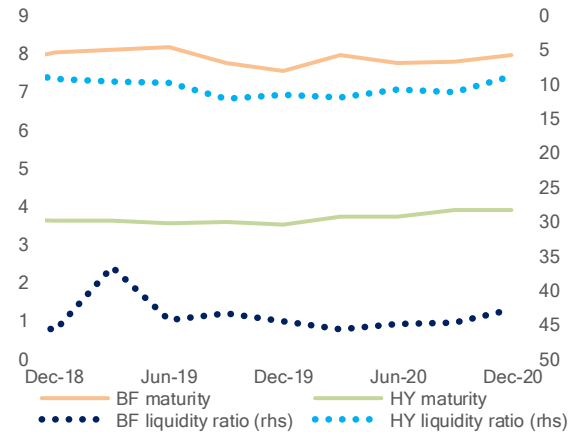
Credit risk
Diverging trends for BF and HY funds due to fallen angels



Note: Average credit quality of assets held in investment grade bond funds (BF) compared with high yield bond funds (HY) based on S&P ratings; 1=AAA, 4=BBB, 10=D).
An increase implies a deterioration of the credit quality.
Sources: Refinitiv Lipper, ESMA.

T.62

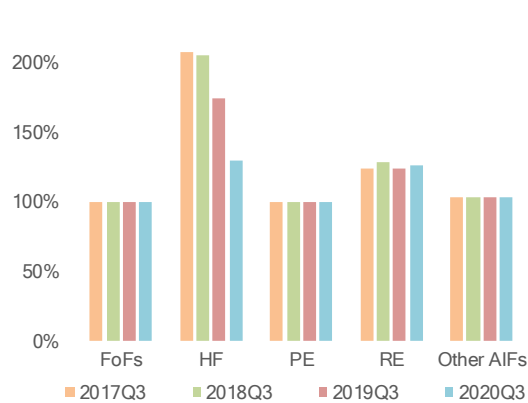
Maturity and liquidity risk profile
Decline in liquidity across funds



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

T.63

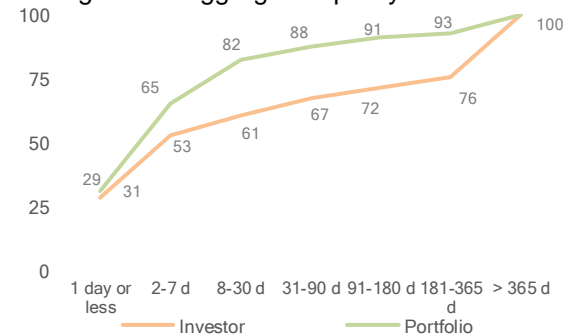
AIF adjusted leverage
Leverage concentrated in hedge funds



Note: Median adjusted leverage by AIF type.
Sources: AIFMD database, National Competent Authorities, ESMA.

T.64

AIF liquidity profile
No significant aggregate liquidity mismatches



Note: Portfolio and investor liquidity profiles of AIFs managed and/or marketed by authorised EU AIFMs, end of 2019. Portfolio liquidity defined as the percentage of the funds' assets capable of being liquidated within each specified period; investor liquidity defined as the shortest period for which investors can redeem. EU and non-EU AIFs by authorised EU AIFMs marketed, respectively, w/ and w/o passport. d= Days. Data for 27 EEA countries.
Sources: AIFMD database, National Competent Authorities, ESMA.

Market trends and risks

Consumers

Trends

Following the market stress linked to the first wave of the COVID-19 pandemic, investor sentiment ameliorated amid continuing uncertainty, and the performance of retail investor instruments, such as EU UCITS funds, improved. Analysis of retail investor behaviour during the COVID-19 related market stress showed that new retail investors invested in equity markets during this period. The extent to which the phenomenon of increased retail equity trading is positive or negative from the perspective of investor protection depends on the situation of the individual investor and whether the investment is driven by long-term investment or speculative motives.

Risk status

Risk level 

Outlook 

Risk drivers

- Short term: increased trading by retail investors during periods of high volatility; lingering uncertainty in the financial and economic outlooks
- Longer term: low participation in long-term investments, linked to a lack of financial literacy and limited transparency around some products

Improved confidence amid continuing uncertainty

Following the sharp drop in asset prices during the COVID-19 related market stress, **household financial resources** recovered along with asset prices. Whereas in 1Q20 the value of listed shares and investment fund shares had fallen by – 12 % from 4Q19, in 2Q20 there was a strong rebound of about 8 %, compared with the previous quarter (A.163). Growth in asset values continued in 2H20, albeit at a slower pace.

While still remaining negative, consumer confidence in current market conditions, as measured by **investor sentiment**, significantly increased. Confidence in future market conditions strongly picked up in 2Q20, stabilised in positive territory and significantly increased in December 2020. Overall **investor sentiment** in 2H20 regarding current and future conditions was stronger for institutional than retail investors (T.66). The increase in investor sentiment at the end of 2020 reflects improvements in macroeconomic conditions and GDP forecasts within an environment of lingering uncertainty related to the COVID-19 pandemic.

The effect of lockdown measures as well as households' uncertainty about future income was reflected in a very large increase in **household savings**, more than 17 % at the end of 3Q20 against a stable rate of about 12 % over the last

5 years (A.159). One driver of higher savings is that opportunities for discretionary spending declined as a result of lockdowns. Another was increased uncertainty about future economic outlook and, therefore, future income, leading to precautionary savings.

Net financial asset flows for households increased overall, in particular for deposits, which, at 8.1 % in 3Q20, reached their highest share of disposable income in 10 years. An increase was also observed for equity and investment funds shares (+ 2.3 % in 3Q20). The only exception concerned flows in debt securities, which continued to decrease (–0.3 %) at the end of 3Q20 (A.165).

The geographical heterogeneity in the **distribution of products to consumers** remained. The main underlying reasons include differences in consumer preferences, industry and regulatory differences, different cost treatments, and variability in investor risk aversion, trust and financial literacy.

Retail investment: improved performance

Following the sharp drop in **performance** in 1Q20, gross returns improved during the remainder despite a temporary performance drop in 3Q20. On a stylised retail investor portfolio, annual performance reached an annual average

of + 0.2 % at the end of November 2020, up from – 0.2 % at the end of October 2020 (T.67).

In 4Q20, more than 90 % of the EUR 4tn of **retail investment in funds** continued to be concentrated in equity, bond and mixed funds. Investment value is up from EUR 3.5tn at the end of 1Q20, linked to strong market recovery.

Gross annual performance for EU UCITS increased to 3.5 % in 4Q20 on average, from 1.1 % in the previous quarter. This followed the significant drop (– 5.9 %) in 1Q20. Performance reversal since 1Q20 follows the market recovery of underlying asset markets after the COVID-19 related market stress in 1Q20. However, performance remained at low levels, especially compared with 4Q19, when it was around 14 % (T.68). Dispersion across Member States strongly picked up, linked to strong divergence in market recovery across EU countries (A.172).

EU equity UCITS annual gross performance rebounded to 9.2 % in 4Q20, in contrast with the sharp fall observed in 1Q20 (more than – 10 %). However, it remained contained in comparison with the exceptional level of 4Q19 (27 %). The performance of UCITS primarily investing in bonds was 1.4 % in 4Q20, from – 3.8 % in 1Q20. Similarly, the annual gross performance of mixed UCITS picked up to 3.6 % in 4Q20, from – 6 % in 1Q20. Cost levels were broadly stable over the reporting period, and the net performance of funds, and thus the net value of investor portfolios, largely follows developments in gross performance ⁽²⁹⁾.

Dynamics in **fund flows** for retail fund investment mirror the performance of funds in relation to the asset they primarily focus on. UCITS mostly investing in equity registered very strong net inflows of EUR 24 bn in 3Q20 and EUR 59 bn in 4Q20 compared with net outflows of – EUR 27 bn in 1Q20. Retail flows in UCITS concentrating on bonds, while remaining positive, reduced during 2020 with net inflows in 4Q20 of EUR 29 bn, down from EUR 59 bn in 1Q20. Mixed UCITS had net outflows of – EUR 8 bn in 4Q20 from net inflows of more than EUR 2 bn in 1Q20 (T.69).

Analysed performance **by management type**, annual gross performance of equity UCITS improved overall from the extremely low values (beyond – 10 %) in 1Q20. Gross annual

performance significantly improved for actively managed funds, reaching 9.7 % in 4Q20, from 2.8 % and 5.3 % in 2Q20 and 3Q20 respectively. For passive funds the increase in performance was much lower, 5.8 % in 4Q20 from 2.1 % in 3Q20 and from 1.6 % in 2Q20. UCITS equity ETFs in 4Q20 reached a gross annual performance of 4 % from 0.8 % in 2Q20 and – 0.3 % in 3Q20. Despite significantly higher costs, actively managed equity funds reported a higher net performance (8.1 %) in 4Q20 than passive UCITS (5.3 %) and ETFs (3.3 %).

In terms of fund flows, in 4Q20 net inflows for active UCITS were more than EUR 100 bn from EUR 42 bn and EUR 5 bn in 3Q20 and 2Q20 respectively. Passive equity UCITS reported a slight increase in inflows from EUR 11 bn in 3Q20 to around EUR 12 bn in 4Q20.

Though only accounting for around 4 % of the size of the UCITS market, **structured retail products** in the EU prompt continued monitoring because of the complexity and variety of the products on offer and the existence of substantial costs (T.70) ⁽³⁰⁾.

In January 2021, the prices of several equities that had been the targets of short selling by some hedge funds (e.g. GameStop, AMC) began to increase sharply, attributable to a surge in trading by retail investors communicating with each other via online message boards ⁽³¹⁾. Some of the retail trades may have represented a form of investor activism, which does not have a direct impact on ESMA's investor protection objective. Of greater concern is the extent to which investors may have taken on excess risk relative to their financial position and may have unrealistic expectations of price performance based on sentiments expressed by fellow retail investors online, which may in turn create bubble risk. The influence of online message boards on investor behaviour is likely to be greater than ever given the popularity of online trading by retail investors since the onset of the pandemic (T.65). The pandemic appears to have acted as a catalyst for this increased trading against a backdrop of longer-term drivers in the form of digitalisation and platformisation in finance.

⁽²⁹⁾ ESMA (2020), ASR on Performance and Costs of Retail Investment Products.

⁽³⁰⁾ An extended analysis of the SRP market is in the 2021 ESMA Annual statistical report on performance and costs of EU retail investment products (forthcoming).

Much of the analysis in the report is the result of innovative techniques for data gathering and analysis, detailed in the article on SupTech in this publication.

⁽³¹⁾ See the discussion under 'Equity: decoupling continues', above.

T.65

MiFIR transaction data analysis

Large increase in retail trading during pandemic

Since January 2018, purchases and sales of financial instruments have been reportable under MiFIR. NCAs share the data with each other through the Transaction Reporting Exchange Mechanism (TREM) operated by ESMA. By analysing data on those transactions in which the buyer is a natural person, several NCAs have carried out analyses of retail investment trends during the COVID-19 pandemic.

The sharp drop in valuations and the surge in volatility following the onset of the pandemic in March 2020 corresponded to large increases in stock buying and volume traded by retail investors, a trend confirmed by studies in different countries. For example, findings published by FR-AMF in April 2020 showed that numbers of purchases of blue-chip equities in the SBF120 index by retail clients increased fourfold in March 2020, and overall volumes tripled. New clients accounted for up to 20 % of the amounts invested in equities by retail investors ⁽³²⁾.

BE-FSMA data on transactions in the Belgian market showed a similar overall trend ⁽³³⁾. A breakdown by age group revealed that those aged 18–35 saw the biggest increase in trading activity, making around 10 times as many purchases of shares in the BEL 20 index as in a comparable period before the crisis.

IT-CONSOB published findings from an analysis of the weekly activity carried out by Italian retail investors on domestic equities included in the FTSE All Share Index over January 2019 to August 2020. The results showed the prevalence of net purchases of equities in 2020. In particular, over 6 weeks it recorded an upsurge in volatility due to the outbreak of the pandemic, about EUR 4.5 bn, a figure considerably higher than the 2019 average ⁽³⁴⁾. Different explanations for the increased trading activity can be identified. Possible factors include (i) households seeking a destination for their increased levels of savings because of constrained consumption and precautionary savings (A.159); (ii) increased time spent online during lockdowns, with ready access to online trading and investment tools; (iii) high periods of volatility encouraging speculative activity; (iv) long-term investors seeking to take advantage of more attractive valuations following the initial sharp downward adjustment to asset prices.

The extent to which the phenomenon of increased trading is positive or negative from the perspective of investor protection depends on the situation of the individual investor and their motivation for purchasing or selling shares. Indications that transactions increased especially among younger individuals may prompt some concern given that they are likely to be less experienced and tend to be less wealthy. On the other hand, if they are investing long-term as opposed to engaging in short-term speculation, then greater participation at a time of lower

asset valuations may be financially advantageous. Younger investors able to lock up their money for many years are typically able to take greater risks than older investors, who will need to liquidate their investments in the near or medium term. The BE-FSMA data analysis indicates that the biggest increase in trading was among those of intermediate trading frequency, suggesting that increased trading may have been attributable to a mixture of speculative and long-term motivations.

Investor protection: decline in potential closet indexers

Closet indexing (CI) is a practice that can be detrimental to investors both from the point of view of transparency and information that is conveyed to investors, and in terms of efficient capital allocation. The ESMA indicator aims to identify UCITS exhibiting patterns that are potentially associated with CI. Confirmation that funds actually engage in CI strategies can only be fully established when combined with supervisory scrutiny.

Within the sample identified by ESMA, the share of closet indexing equity UCITS significantly declined compared with the previous 6 months across identification criteria. Focusing on the criterion based on the ESMA indicator aims to identify UCITS exhibiting patterns that are potentially associated with CI. Confirmation that funds actually engage in CI strategies can only be fully established when combined with supervisory scrutiny. Within the sample identified by ESMA, the indicator 'active share < 60 % and tracking error < 4 %' declined from 9 % computed in 4Q19 to 5 % in 2Q20. Considering the other two criteria, the maximum was 2 % in 2Q20 against just below 5 % in 4Q19 (T.71) ⁽³⁵⁾. It will be important going forward to monitor whether this decrease in the share of closet indexing equity UCITS will be sustained or temporary.

Among NCAs reporting data quarterly, **complaints** in connection with financial instruments – reported via firms as well as directly by consumers to NCAs – increased substantially (A.178) to more than a third above the 2-year average. Interpreting trends here

⁽³²⁾ AMF (2020), 'Retail investor behaviour during the COVID-19 crisis', April.

⁽³³⁾ FSMA (2020), 'Belgians trade up to five times as many shares during the coronavirus crisis', May. For an extended set of findings, see Priem, R. (2020), 'The impact of the COVID-19 confinement on the financial behavior of individual investors'. The working paper is not an FSMA publication.

⁽³⁴⁾ Consob (2020), 'Report of financial investment of Italian households'.

⁽³⁵⁾ The ESMA closet index indicator 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 about 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. For more details please see ESMA (2020), *Report on Trends, Risks and Vulnerabilities*, No 2.

requires an understanding not only of recent events but also of data limitations – such as significant time lags – and heterogeneity between countries.

The increase was broad-based, with all types of financial instrument receiving more complaints in 2Q20 and 3Q20 than in the preceding quarters. This may relate to the increase in retail trading (T.65) but may also be due to other factors such as losses during the market turmoil in March and April. Relatively high levels of complaints around contracts for differences (CFDs) persisted, though the data do not include some major retail CFD markets (e.g. NL, PL) and only a limited

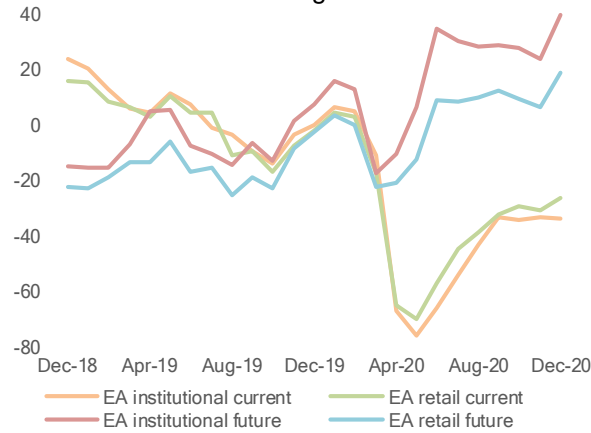
number of complaints can be categorised by financial instrument. Among complaints with a breakdown by financial instrument, 17 % of the total in 3Q20 were about funds, around twice the proportion in 3Q19. The overall pattern appears to be to some extent attributable to different seasonal effects in connection with NCAs' reporting of data. The most common MiFID service associated with complaints in 3Q20 continued to be execution of orders (71 %). The leading causes were general administration (47 %), fees and terms (23 %), and poor information (11 %) and (A.179-A.182).

Key indicators

T.66

Market sentiment

Current sentiment less negative

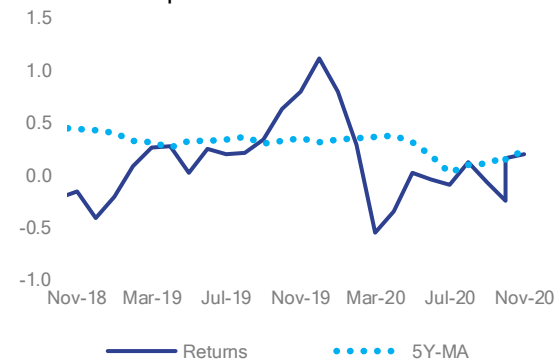


Note: Sentix Sentiment Indicators for the EA retail and institutional investors on a ten-year horizon. The zero benchmark is a risk-neutral position. Sources: Refinitiv Datastream, ESMA.

T.67

Portfolio returns

Returns turn positive in 4Q20

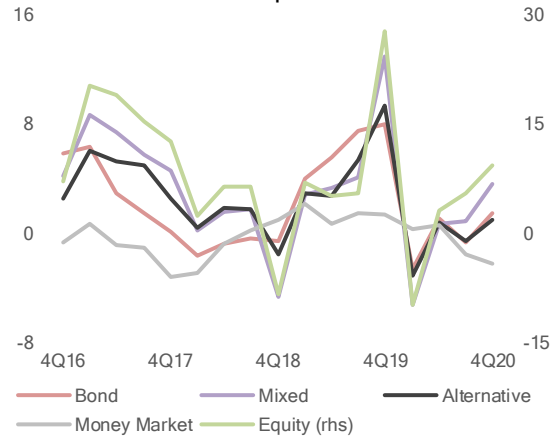


Note: 12-months trailing average monthly gross returns for a stylised household portfolio, in %. Asset weights, computed using National Financial Accounts by Institutional Sectors, are 36% for collective investment schemes, 39% for deposits, 22% for shares, 3% debt securities. Costs, fees and other charges incurred for buying, holding or selling these instruments are not taken into account. Sources: Refinitiv Datastream, RefinitivLipper, ECB, ESMA.

T.68

UCITS annual performance by asset class

Increase in 4Q20 except for MMFs

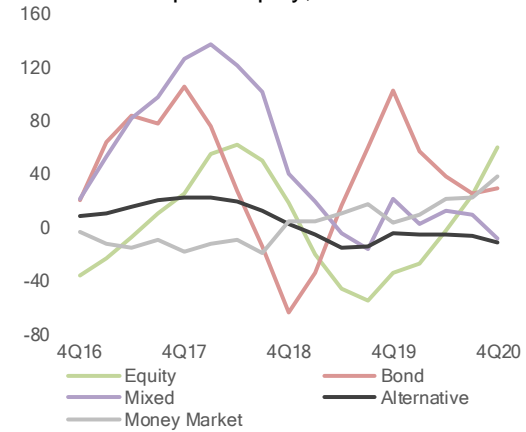


Note: EU-27 UCITS evolution of gross annual performance, retail investors, by assets class, %. Equity on the right hand side. Sources: Refinitiv Lipper, ESMA.

T.69

Annual net flows by asset class

Net inflows: up for equity, down for bonds

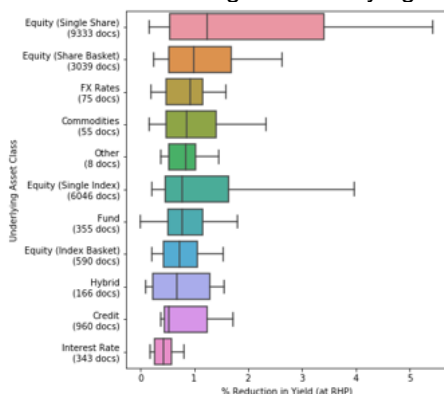


Note: EU-27 UCITS annual net flows, retail investors, by asset class, EUR bn. Sources: Refinitiv Lipper, ESMA.

T.70

SRP costs by underlying asset class

Sizeable costs for range of underlyings

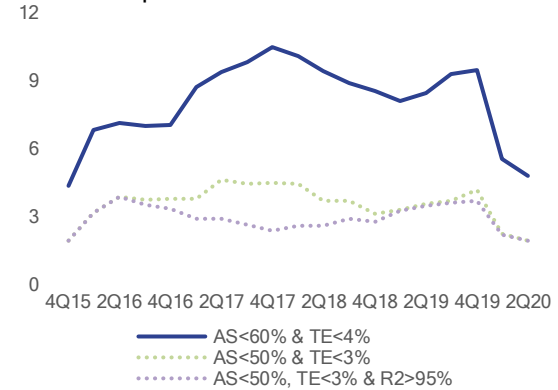


Note: Range in median percent total cost across 16,339 PRIIPs by underlying asset class (UAC) and maturities. Box edges are 25th and 75th percentiles. Additional lines ('whiskers') are 10th and 90th percentiles for a UAC. "Other" includes Real Estate, Inflation, and other uncommon UACs. Numbers in parentheses are of scanned KIDs by UAC. Sources: ESMA, Structuredretailproducts.com, financial entities' websites.

T.71

ESMA closet index indicator

Decline in potential closet indexes



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.

Structural developments

Market-based finance

Trends

During 2H20, primary markets mostly recovered from the COVID-19 related market stress earlier in 2020. The share of capital markets financing for non-financial corporates improved from its lowest point in the first phase of the crisis. Primary equity markets reopened but showed signs of differentiation between incumbent firms and new entrants. Corporate fixed income market issuance remained at high levels, but slowed down after touching record highs in 2Q20, with issuance quality slightly deteriorating towards BBB-rated bonds. Increasing corporate indebtedness raises concerns of debt overhang in the medium to long term. Access to capital markets for SMEs continues to be limited. Nevertheless, SME share trading has improved in the second half of the year, especially on SME growth markets. Market based credit intermediation decreased owing to valuation losses. On the other hand, wholesale funding increased thanks to bank deposits motivated by precautionary savings.

Corporate financing: resilient capital markets

European **capital markets** proved, overall, resilient in providing funding to corporates, especially in fixed income primary markets. Policy support from national governments and central banks was crucial to sustain both the financial and non-financial corporate sectors.

The annual growth rate of **market financing** of EA non-financial corporations (NFCs) in 3Q20 recovered by 3 pps from the steep decline of the previous quarter related to COVID-19 market stress. Lower market-financing levels than in 2019 (-2 % year on year) were driven by the increase in the stock of bank loans vis-à-vis NFCs, which increased by 5 % from December 2019 to the same period in 2020 (T.80). This coincided with a 2 % year-on-year decline in equity and non-investment fund shares, with EUR 20.7tn outstanding, equivalent to 38 % of total NFC financing in 3Q20. Despite a 1 % year-on-year decline to a total of EUR 14.8tn outstanding, unlisted shares continue to account for a significant share of EA NFC financing (27 % of total NFC financing).

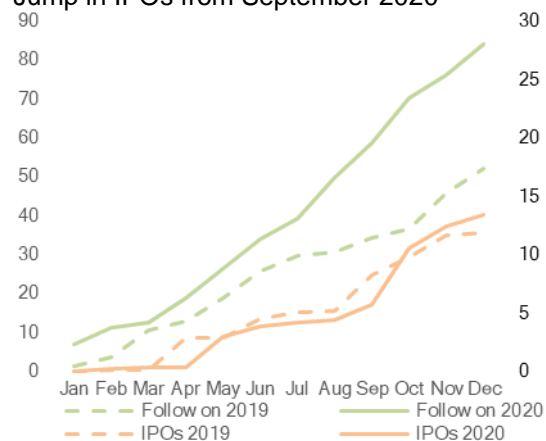
Equity markets: IPO reopening in 2H20

In the second half of 2020, equity primary markets proved to be robust, with **initial public offerings (IPOs)** and follow-on issuance above 2019 levels, amid improved liquidity and lower volatility in secondary markets.

The number and value of IPOs continued to be subdued for most of 3Q20 but jumped above 2019 levels after September. More than half of 2020's IPOs (82 out of 116 deals) were launched from September 2020 onwards, as a large number of firms went public after delaying IPOs amid the COVID-19 related market stress at the beginning of the year. Overall, EEA IPO markets raised EUR 9.5 bn from 91 IPOs in 2H20, compared with EUR 7 bn from 49 deals during the same period in 2019.

T.72

Equity issuance – IPOs and follow-on issuance
Jump in IPOs from September 2020



Note: Cumulative amount of Follow-on issuance in the EEA30 (lhs) and IPOs (rhs) in 2019 and 2020, EUR bn.
Sources: Refinitive Eikon, ESMA

There is a marked heterogeneity across sectors and across entity domiciles in IPOs. The consumer (23 deals) and technological (22 deals) sectors accounted for almost 50 % of the total IPOs in 2H20, followed by the industrial (15) and healthcare (11) sectors. The number of tech IPOs grew by 60 % in the year in the EU, but is still low

compared with the US and China ⁽³⁶⁾. Little IPO activity was observed for firms in the utility (3) and energy (1) sectors ⁽³⁷⁾. Most IPOs were launched by firms domiciled in Sweden (19), Italy (17) and Norway (16), accounting for more than half of the total IPO activity.

In contrast, **follow-on issuance** continued to grow rapidly, as incumbent companies continued to use this tool to recapitalise. In 2H20, a total of 581 secondary offerings worth more than EUR 50 bn were issued in the EEA, almost twice as much as in 2H19. The market size of follow-on issuance in the industrial sector was the largest, with a total of EUR 10 bn, followed by financial and healthcare (at around EUR 9 bn and EUR 8 bn respectively).

Overall, these trends show a significant gap between already **public** firms and companies willing to raise new capital. While the former encountered no particular challenges in raising equity through secondary offerings, IPO activity remained low compared with the size of EU capital markets.

Corporate bonds: lower issuance and credit quality

Corporate fixed income primary markets slowed down throughout the second half of 2020. Following the peak in 2Q20, total long-term **corporate bond issuance** declined to an average of EUR 100bn per month towards the end of the year. Total long-term corporate bond issuance for the reporting period was EUR 615 bn, a decline of 25 % with respect to 1H20 and 18 % compared with 2H19. Total long-term issuance in 2020 amounted to more than EUR 1.4tn ⁽³⁸⁾. This figure is comparable to the levels observed in 2019. Similar developments were observed for short-term issuance, which accounted for EUR 574 bn in 2H20, 15 % less than 1H20 and 16 % less than 2H19.

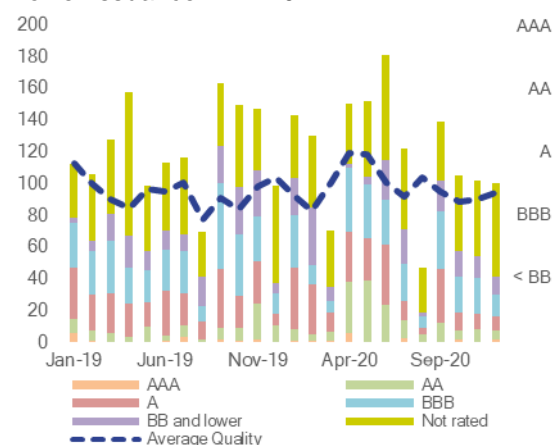
Overall, on average, 75 % of the issued rated corporate bonds in 2H20 were IG, amounting to a total market size of EUR 260 bn (40 % less than 1H20). Within the IG universe, there has been a shift from higher rated bonds to BBB-rated bonds. In the HY corporate segment, compared with 2Q20, quarterly activity increased from June onwards for a total of EUR 44 bn of issued bonds

in 3Q20 and EUR 40 bn in 4Q20 (T.73). The continued ultra-low-yield environment combined with low corporate bond spreads (A.39) may have contributed to this development by contributing to search-for-yield strategies.

Overall, the average quality of issued bonds deteriorated to BBB towards the end of the year, compared with an average rating of A during 2Q20 (T.73). As a result of these credit quality shifts in corporate bonds issuance, the share of lower quality outstanding securities with a rating of BBB or lower increased in 2H20 ⁽³⁹⁾. Unrated corporate bonds account for 40 % of total issuance in 2H20 (EUR 270 bn).

T.73

Gross issuance of corporate bonds by rating
Lower issuance in 2H20



Note: Monthly corporate bond issuance in the EEA30 by rating, EUR bn, and average issuance rating (rhs).
Sources: Refinitiv Eikon, ESMA

The 2H20 issuance of corporate bonds has been dominated by financial sector securities, accounting for more than 60 % of the total, at almost EUR 400 bn (this compares with EUR 180 bn for industrials and EUR 40 bn for utilities).

Average years to maturity at issuance increased during 3Q20. The share of corporate debt whose maturity at issuance is beyond 10 years has increased to slightly more than 28 % of the total, from 20 % in 2Q20 and 17 % in 1Q20. Compared with 8 years in early 2020, average maturity increased to 11 years from September to November. This pattern is clearer for IG bonds than for HY bonds. In December, average years to maturity declined to pre-crisis levels (8Y).

⁽³⁶⁾ See CNBC (2020), 'Why tech IPOs are flourishing in the U.S. and China – but not Europe', 19 October.

⁽³⁷⁾ Other sectors include financials (8 IPOs), basic materials (5) and telecommunications (3).

⁽³⁸⁾ Long term-corporate debt refers to corporate bonds with

> 1-year maturity at issuance. The reported figures include both rated and unrated long term-debt securities.

⁽³⁹⁾ See 'Securities markets' article above.

Corporate bond issuance levels have been driven by a number of COVID-19 related factors. First, the ECB eased the eligibility standards under which corporate bonds were accepted as collateral⁽⁴⁰⁾. This market intervention contributed to continued low corporate borrowing costs, especially for firms rated IG⁽⁴¹⁾.

Another driver for corporate bond issuance was firms using bond markets to manage their cash positions rather than for investing in assets, as they needed to compensate for lost earnings, but also to pay back bank borrowing during 1H20. These factors appear to have become less relevant during 2H20⁽⁴²⁾. In the medium to longer term, increased corporate debt levels may generate a risk of creating a debt overhang (T.74)⁽⁴³⁾.

T.74

Indebted firms issued more bonds on average in 2020 Rising risk of debt overhang

A high level of corporate indebtedness may give rise to the problem of debt overhang, especially following periods of acute market stress such as the impacts of the COVID-19 pandemic on the corporate sector. The effects of the crisis have the potential to be worse for companies that already had high levels of indebtedness at the start of the pandemic. The main risk is that firms may not be able to cover interest expenses after increasing their debt levels. In this respect, large debt impairs the ability of firms to invest in real assets and secure profits for the future.

We investigate whether firms that already had critical levels of indebtedness at the end of 2019 were more likely to issue corporate bonds in 2020. In this respect, we focus our attention on the sample of 252 companies that issued corporate bonds in 2020⁽⁴⁴⁾. To measure the level of indebtedness of a firm, we use interest coverage (IC) ratio and debt-to-equity (DE) ratio.

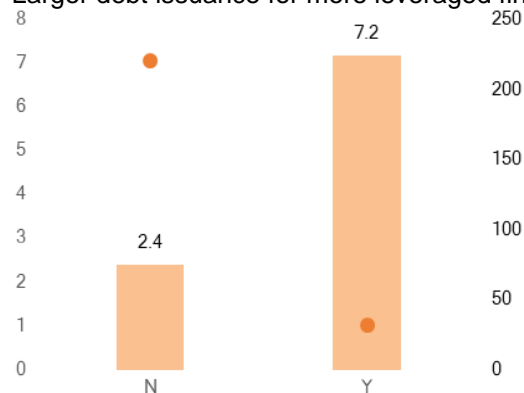
The IC ratio measures the extent to which a firm is able to cover interest expenses with its available earnings, thus having a risk of debt overhang. In our analysis, we categorise companies whose IC ratio falls below 1.5 for three consecutive years before 2020 as having a risk of debt overhang⁽⁴⁵⁾. Overall, 13 % of firms (32) issuing debt in 2020 fall in this

category. Results show that companies with higher level of debt in the 3 years before 2020 issued on average EUR 7.2 bn in 2020, compared with issuance of EUR 2.4 bn by other firms (T.75).

T.75

Interest coverage ratio

Larger debt issuance for more leveraged firms



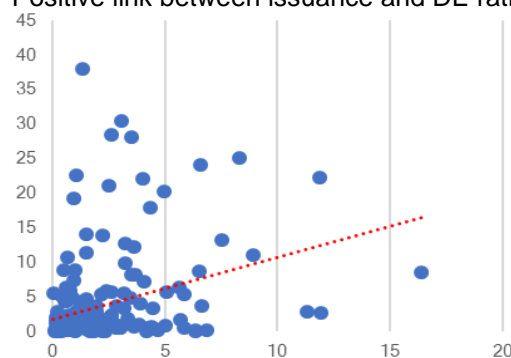
Note: Average corporate bond issuance (lhs in EUR bn) and number (rhs) of companies whose interest coverage ratio is below 1.5 "Y" and above 1.5 "N". Sources: Refinitiv Eikon, ESMA.

This result is backed by the positive relationship between the 2019 DE ratio and corporate bond issuance in 2020 (T.76). The DE ratio is a measure of leverage capturing to what extent a company finances its operations with debt with respect to equity. High levels of DE ratio correspond to low levels of IC ratio. Firms with higher leverage as of end-2019 were more likely to issue debt in 2020.

T.76

Debt-to-equity ratio

Positive link between issuance and DE ratio



Note: Debt to equity ratio (x-axis in %) and corporate bond issued amount (y-axis in EUR bn) of companies which issued bonds in 2020. Sources: Refinitiv Eikon, ESMA.

⁽⁴⁰⁾ It also allowed 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.

⁽⁴¹⁾ See ECB, 'Pandemic emergency purchase programme (PEPP)', and ECB, 'Corporate sector purchase programme'.

⁽⁴²⁾ See Darmouni, O. and Siani, K. (2020), 'Crowding-out bank loans: The effects of the Fed bond market stimulus on firms'.

⁽⁴³⁾ A key issue for financial stability in the near to medium term will be the deterioration in corporate solvency as a result of the pandemic-induced decline in profitability

and increased corporate indebtedness. See IMF (2020), *Global Financial Stability Report: Bridge to recovery*, October, Chapter 3.

⁽⁴⁴⁾ Sample selection in this box is driven by data availability on commercial databases.

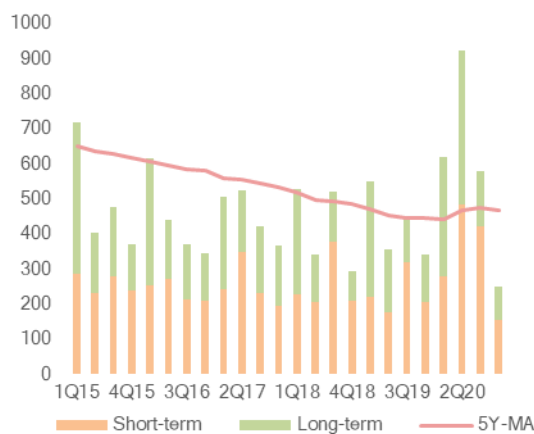
⁽⁴⁵⁾ This partly follows the methodology introduced by Adalet McGowan, M., Andrews, D. and Millot, V. (2017), 'The walking dead? Zombie firms and productivity performance in OECD countries', *OECD Economics Department Working Papers*, No 1372, and Banerjee, R. and Hofmann, B. (2018), 'The rise of zombie firms: Causes and consequences', *BIS Quarterly Review*, September.

Sovereign bonds: elevated issuance in 2020

With the extension of fiscal support in most countries, sovereign bond issuance continued to be elevated in 3Q20, with EEA issuance being 20 % higher than its 5-year moving average (T.77). The last quarter of the year saw a decline in total issuance at only EUR 250 bn. In total, EUR 2.4tn of sovereign bonds were issued in the EA from 2020, including 54 % short-term (EUR 1.4tn), which increases near-term rollover risks.

T.77

European sovereign bond issuance
Record sovereign issuances in 2020



Note: Gross sovereign bond issuance in the EEA30, EUR bn. Short-term=Maturities < 12 months.
Sources: Refinitiv Eikon, ESMA

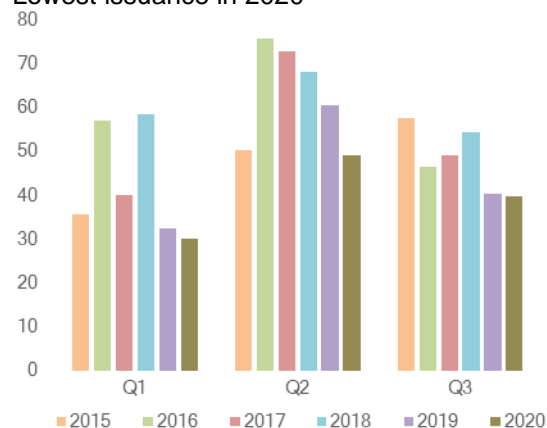
Other issuances: CLO at minimum

Collateralised debt obligation (CLO) issuance in Europe slightly increased in the second half of 2020, but the outlook remains negative. According to JP Morgan data, European CLO issuance picked up in October with 12 deals worth EUR 4 bn in a month. To date, total 2020 CLO issuance is 25 % lower than the previous year, adding up to EUR 22 bn.

Activity in **securitised products** in Europe continued to be low. EUR 39 bn of securitised products were issued in 3Q20, a decline of close to 20 % from the previous quarter and 2 % less than a year before (T.78).

T.78

Total issuance of securitised products
Lowest issuance in 2020



Note: Issuance, EUR bn, of securitised products in Europe (including ABS, CDO, MBS, SME, WBS), retained and placed.
Sources: AFME, ESMA

Around 47 % (EUR 19 bn) of securitised issuance in 3Q20 was placed, compared with EUR 14 bn of retained securitisations. The large decline in 3Q20 securitisation was predominantly driven by the decline in placed issuance, which overall in 2020 is around 30 %. Retained issuance, on the other hand, is broadly stable compared with 2019.

SMEs: increase in trading on growth markets

European SMEs have been significantly affected by the COVID-19 driven economic downturn. The loss in revenues caused severe liquidity shortages for a large proportion of SMEs, giving rise to concerns over potential defaults on loans and the need to lay off employees ⁽⁴⁶⁾.

In this environment, SME **external financing** relied heavily on national government guarantee schemes and on bank loans. As a response to the pandemic, the EC has mobilised financial support to SMEs. On top of this, Member States and commercial banks have been designing measures to facilitate access to finance for SMEs and increase flexibility on loan repayments ⁽⁴⁷⁾. According to the latest survey on the access to finances of enterprises by the ECB, bank loans remain the primary source of financing for EA SMEs to bridge liquidity gaps ⁽⁴⁸⁾. The demand for bank loans increased by 20 % in the period April–September 2020. In contrast, market-based

⁽⁴⁶⁾ See McKinsey & Company (2020), 'COVID-19 and European small and medium-size enterprises: How they are weathering the storm', October.

⁽⁴⁷⁾ See European Commission, 'Access to finance for SMEs'.

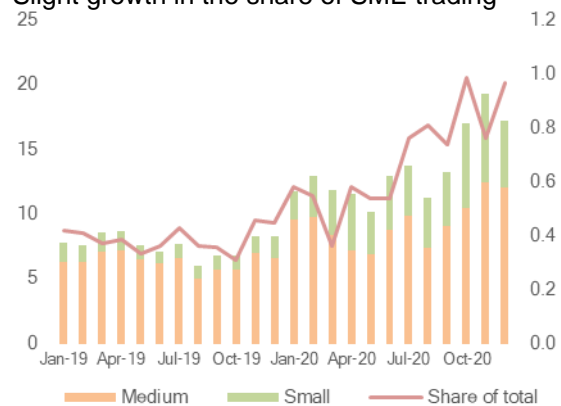
⁽⁴⁸⁾ See ECB (2020), 'Survey on the Access to Finance of Enterprises in the euro area', November.

instruments were much less considered as a potential source of finance, as only a few SMEs considered equity (10 %) and bonds (2 %) relevant to the financing of their business.

In order to improve **access to capital markets** for smaller firms, MiFID II introduced the possibility of registering an MTF operator as an **SME growth market (GM)** ⁽⁴⁹⁾. As of end-2020, 18 out of 227 registered MTFs are authorised to be GMs, with only one entity authorised as a GM during 2020. According to transparency data reported by EEA30 + UK trading venues, there were around 8 500 SME shares available for trading in 2020, with 18 % of them (1 500) being also available for trading on GMs ⁽⁵⁰⁾.

Total **trading volumes** in SME shares amounted to EUR 163 bn as in 2020, an increase of more than 75 % year-to-date. With almost EUR 50 bn of total annual trading volumes, UK-domiciled venues accounted for 30 % total trading volumes in SME shares (EUR 44 bn). The share of SME trading volumes increased from 0.4 % of the total equity trading in March to almost 1 % in December 2020, with a decline to 0.7 % in November. Still, there has been some improvement in the market for SME shares during 2H20 (T.79). Overall, monthly SME trading volumes remained stable at an average of around 15 bn per month during 2H20. By sector, healthcare (EUR 45 bn) represented the largest share of SME trading in 2020, followed by the technological (EUR 27 bn) and consumer (EUR 15 bn) sectors.

T.79
SME trading volumes
Slight growth in the share of SME trading



Note: Monthly trading volumes on EEA30 + UK venues of SME shares in 2019 and 2020, EUR billion (lhs), and % share in total shares trading (rhs). "Small"=(0,20mn), "Medium"=(20mn,200mn). Sources: FIRDS, FITRS, ESMA

Focusing on GMs, total trading volumes on these venues amounted to EUR 61 bn in 2020 (EUR 37 bn in 2H20), accounting for 74 % of total SME trading on MTFs and 38 % of total trading in SMEs. Trading activity on GMs has seen exceptional growth since the beginning of 2019 (from a monthly average of EUR 2 bn in 2019 to EUR 5 bn in 2020), driven by both the increased number of platforms and the larger number of SME instruments available for trading on these segments. By GM segment domicile, the largest SME volumes in 2020 were traded in the UK (EUR 27 bn), followed by Sweden (EUR 17 bn) and France (EUR 15 bn).

Market-based finance: decrease in 1H20

Entities engaged in market-based credit intermediation represented EUR 35.4tn in 1H20 (T.84). The size of this heterogenous sector declined by 2.5 % in 1H20 because of significant asset devaluations that were not compensated for by inflows. AuM in investment funds decreased in 1H20 (-2.4 %), affected by valuation losses in 1Q20. Other financial institutions saw a similar decrease in AuM over the 6-month period (-3.4 %).

Despite the liquidity stress, wholesale funding for the banking sector continued to grow, although at

⁽⁴⁹⁾ Provided that 50 % of the issuers with shares available for trading on the relevant segment have a market capitalisation of less than EUR 200 million. GMs provide for lighter reporting burdens and reduced compliance costs.

⁽⁵⁰⁾ In our methodology, the classification of SME issuers

here is based on market capitalisation reported in 2019. Only share issuers with a valid legal entity identifier 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.

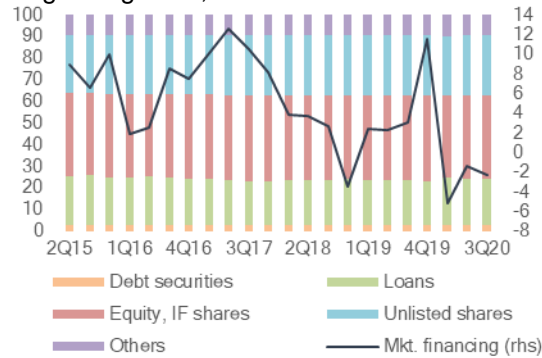
a slower pace in 2Q20 (1.3 % annualised) than in 2Q19 (6.7 %) (T.85). Developments here were diverse, with much of the increase in wholesale funding attributable to other financial institutions' deposits (EUR 1.2tn; + 9.8 %) and MMF deposits (EUR 156 bn; + 56.9 %). On the other hand, bank funding through securitised assets decreased by 7.9 % (EUR 336 bn). The growth of bank deposits is not limited to financial institutions but is a general trend, including for households and NFCs. This reflects precautionary savings and lack of investment opportunities.

Key indicators

T.80

Market financing

Negative growth, loans increase

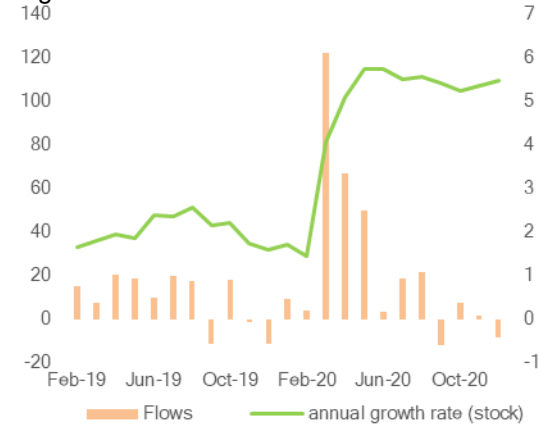


Note: Liabilities of EA non-financial corporations (NFC), by debt type as a share of total liabilities. Others include: financial derivatives and employee stock options; insurance, pensions and standardised guarantee schemes; trade credits and advances of NFC; other accounts receivable/payable. Mkt.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

T.81

Loans vis-à-vis EA NFCs

Higher stock of loans in 2H20

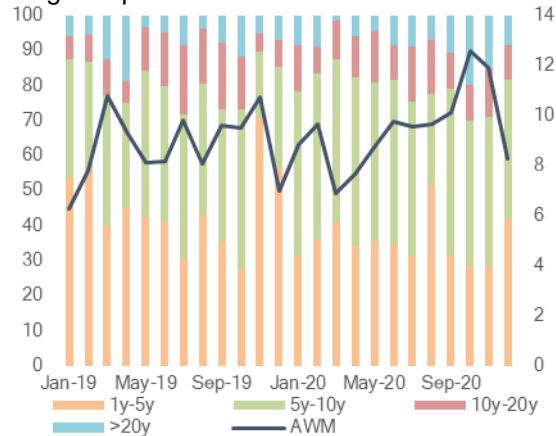


Note: Loans vis-à-vis euro area NFC reported by MFI in the euro area. Financial transactions, EUR bn (lhs) and annual growth rate of stock% (rhs).
Sources: ECB, ESMA

T.82

Corporate bond maturity

Large drop in maturities in December

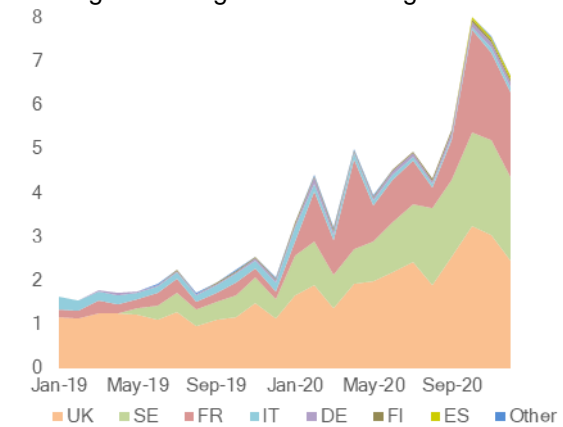


Note: Weighted average maturity at issuance date of corporate bonds issued in the EEA, in % (lhs). AWM= Average weighted maturity, in years (rhs).
Sources: Refinitiv Eikon, ESMA.

T.83

SME trading volumes

Trading on SME growth markets grows

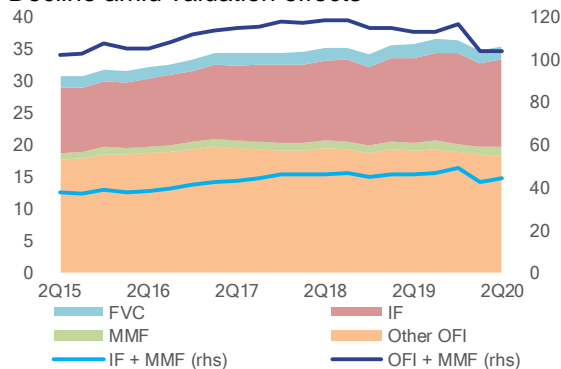


Note: SME trading volumes on GMs, by segment MIC domicile, EUR bn.
Sources: FIRDS, FITRS, ESMA

T.84

MMFs and other financial institutions

Decline amid valuation effects

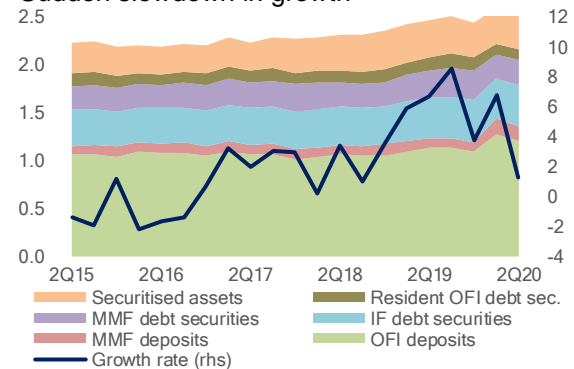


Note: Total assets for EA MMFs and other financial institutions (OFI): investment funds (IF), financial vehicle corporations (FVC), Other OFI estimated with ECB Quarterly Sector Accounts, in EUR tn. Expressed in % of bank assets on rhs.
Sources: ECB, ESMA.

T.85

Non-bank wholesale funding

Sudden slowdown in 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

Against the backdrop of new pledges from the largest greenhouse gas-emitting countries to aim for future carbon neutrality, EU sustainable debt markets continued to expand at a brisk pace in 2H20 (+ 32 % from 1H20, EUR 508 bn), linked to robust supply from the corporate sector and massive public-sector financing needs to support the EU's economic recovery. The performance of environmental, social and governance (ESG) equity benchmarks was mixed. This mainly reflected the negative (positive) impact of COVID-19 related vaccine announcements on sectors that had performed well (poorly) during the crisis, such as healthcare (transportation), and are overweight (underweight) in ESG portfolios. ESG equity funds attracted high net flows again, as ESG-related communication by asset managers paid off.

International background

Several developments during 2H20 were largely commented on because of their significance in potentially achieving the targets set out under the **Paris agreement**, with potentially substantial implications for sustainable finance.

First, the world's largest emitter of carbon dioxide (CO₂), China, announced that it would aim for carbon neutrality by 2060. This was the country's first long-term climate goal, although the plan envisages that emissions will continue to rise until 2025 and start decreasing only from 2030⁽⁵¹⁾. Second, in the US (the world's second largest emitter of CO₂) the incoming president has pledged not only to re-enter the Paris agreement, but also to reach 'net-zero emissions' by 2050 – with similar announcements from Japan and South Korea, respectively the fifth and eighth largest CO₂ emitters. Third, the European Commission announced its intention to cut carbon emissions by at least 55 % from 1990 levels, from 40 % previously (carbon neutrality had already been agreed in December 2019, with the exception of Poland).

The implementation of these various pledges could have potentially significant ramifications for the world of climate finance. Public-sector support, in the form of direct subsidies, public programmes (e.g. infrastructure projects) or

regulatory measures, will boost particular industries and may affect equity market valuations. Reflecting these expectations, the S&P Global Clean Energy index gained 138 % in 2020, compared with 18 % for the S&P 500. In addition, achieving carbon neutrality objectives may lead to the development of 'climate transition' finance, which aims to facilitate complex transformations in highly polluting sectors (e.g. heavy metals or mining). An example of climate transition finance instruments is transition bonds, which include mechanisms such as offering compensation to investors when the issuer fails to achieve a specific target⁽⁵²⁾. Lastly, heightened global investor attention to companies' environmental credentials will further encourage transparency, and help improve the availability and quality of climate-related disclosures, currently judged inadequate or insufficient⁽⁵³⁾.

Sustainable debt

As part of the plan to meet its new emission reduction targets, the European Commission announced that it would heavily rely on sustainable debt issuance (i.e. green bonds and social bonds) to finance its programmes. This includes raising EUR 240 bn through green bonds to finance part of the Recovery and Resilience Facility⁽⁵⁴⁾ (as part of the Next

⁽⁵¹⁾ See *Nature* (2020), 'How China could be carbon neutral by mid-century', 19 October.

⁽⁵²⁾ See HSBC (2020), 'The importance of transition finance', 29 June.

⁽⁵³⁾ See FSB (2020), 'Task Force on Climate-related Financial Disclosures: 2020 status report', October.

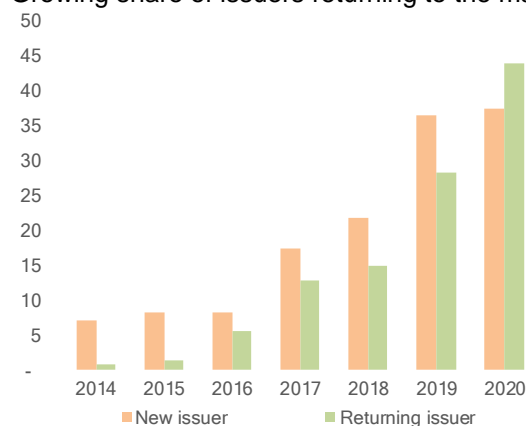
⁽⁵⁴⁾ See European Commission (2020), 'President von der

Generation EU programme), which aims to support the region's economic recovery from the impact of the COVID-19 crisis. This will provide a further significant boost to the EUR 414 bn EU green bond market (T.97). In 2H20, EU green bond gross **issuance** doubled compared with the first half of the year (EUR 86 bn), owing to robust supply from corporate issuers (245 deals) and a few large issuances from agency and sovereign issuers. A sign of the positive dynamic under way for corporate green bonds is the growing share of issuers returning to the market: more than half of the corporate green debt sold in 2020 was from companies that had previously issued a green bond (T.86).

T.86

Corporate green bond issuance

Growing share of issuers returning to the market



Note: Gross annual green bond issuance by new versus returning corporate issuers, EUR bn.
Sources: Refinitiv EIKON, ESMA.

However, **liquidity** remains tight in both corporate and sovereign green bond markets (T.99), despite growing trading volumes. Corporate bid-ask spreads were on average EUR 0.05 above those of conventional bonds from similar issuers, around 50 % lower than a year earlier. To prevent this issue from turning away potential investors, some sovereign issuers have considered or introduced innovative features. Germany's green bonds for example are 'twinned' with conventional federal bonds of equivalent maturity and coupon rates, and can be swapped by investors. This initiative illustrates

how financial innovation can help to channel investments into sustainability areas (T.87).

T.87

Green financial technology

Supporting green bond issuers and investors

Innovation in finance is an integral part of meeting the new climate and social targets. When referring to innovation in sustainable finance, we can mean two different but interconnected concepts. The first is innovation in the design of financial products in which the new innovative features help channel investments into sustainable objectives. The second refers to the use of innovative technologies and solutions, such as distributed ledger technology (DLT), artificial intelligence (AI), machine learning, the internet of Things (IoT) and other digital technologies enabling sustainability goals in financial products and services, also called green financial technology (FinTech).

DLT, such as blockchain, has the potential to improve current processes across the financing value chain in terms of speed, transparency, inclusiveness and efficiency thanks to its immutability and traceability features, among others⁽⁵⁵⁾. DLT can enable the exchange of intangible or tangible assets without the need for intermediaries and without having to rely on a central authority. The exchange is possible through tokenisation of goods and services. There are security tokens that provide investors with returns depending on project performance, and utility tokens that provide access to future services provided by the infrastructure project. There is also a new concept of 'purpose-driven' tokens used to incentivise individuals and corporations to act in a sustainable manner⁽⁵⁶⁾. In such a set-up, individuals and organisations that can prove that they have delivered on sustainability objectives (reduced emissions, use of energy-efficient devices, tree planting, etc.) can be rewarded with a token that can be exchanged for some other services provided by the organisation issuing these tokens. Use cases of such purpose-driven tokens are limited, but there is potential for further development. Other use cases for DLT can include providing a 'book of accounts' on emission certificates, enabling transparency and management of contracts in infrastructure projects⁽⁵⁷⁾.

Since 2018, several financial institutions have issued bonds using blockchain technology, including an example of a blockchain-powered green bond. A recent report studied blockchain-based bonds issued by banks up to 3Q19 and concluded that, for the bond market, blockchain presents cost-saving opportunities more than 10 times those of non-DLT bond processes, with the largest efficiency gains in reporting, brokerage, sales, structuring, price setting and risk rating⁽⁵⁸⁾. Cost reduction can come from the reduced number of actors involved in the bond process, facilitated immediate distribution (e.g. smart contracts governing competitive bidding), improved reconciliation activities (e.g. no need for anti-fraud or error checks with cryptographic

Leyen's State of the Union Address: Charting the course out of the coronavirus crisis and into the future', 16 September.

⁽⁵⁵⁾ OECD (2019), 'Blockchain technologies as a digital enabler for sustainable infrastructure', *OECD Environment Policy Papers*, No 16, OECD Publishing, Paris.

⁽⁵⁶⁾ Blockchain & Futurstuff (2019), 'Purpose-driven tokens', 11 April.

⁽⁵⁷⁾ OECD (2019).

⁽⁵⁸⁾ HSBC Centre of Sustainable Finance and Sustainable Digital Finance Alliance, 'Blockchain: Gateway for sustainability-linked bonds', report.

signatures) and instant settlements. Potentially, if DLT is combined with other data technologies such as IoT, it can allow investors to have direct and real-time access to the environmental impact of their investments (streamlining reporting and benchmarking activities).

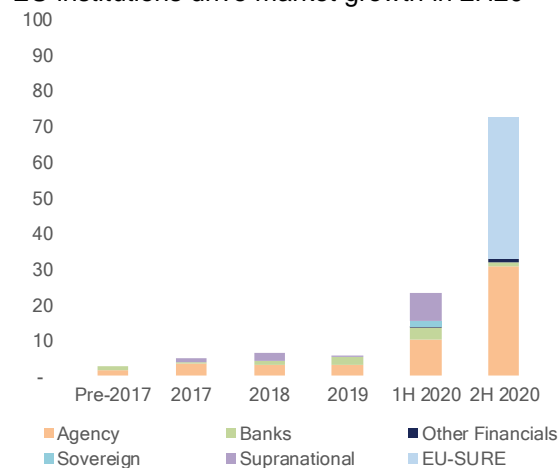
When assessing the prospects of using DLT, it should be stressed that DLT is a technology known for massive energy consumption and CO₂ emissions. The energy consumption of bitcoin (BTC)-mining networks has been reported in particular and compares to that of Ireland or Switzerland⁽⁵⁹⁾. However, less resource-intensive DLT mechanisms have been developed, allowing blockchain technology to be deployed in a way that does not dramatically affect energy consumption. It includes moving away from the proof-of-work validation method, privileging the proof-of-authority method and adopting less energy-consuming network architecture⁽⁶⁰⁾. The environmental costs of DLT are important in incentivising its use for sustainability purposes. It is noteworthy that the September 2020 digital finance strategy for Europe stresses the importance for the financial sector to reap efficiency gains through wider use of DLT, and encourages the development of and investment in 'low or zero emission DLT'⁽⁶¹⁾.

Lastly, other technologies such as AI, machine learning and robot-advising can be applied by financial institutions to design investment portfolios with ESG features and to implement, for example, recent changes to MiFID II that require integration of sustainability into investment advice. These technologies can allow collection and analyses of complex data on customers' profile, behaviour, preferences and browsing history, matching the values of investors to investments and turning it all into personalised sustainability portfolios. The design AI-based individual investment portfolios can then be more transparent, less costly, comprehensive and evidence based, and better suit investor preferences and profile with regard to sustainable investments. Experts in the field stress that AI can be used to facilitate investments that have a near-perfect match to the values of investors only if the complexity of an individual's values is recognised in building a taxonomy around the use of AI, and the ethical 'fingerprints' of organisations in which the investment portfolio designer considers investing are thoroughly assessed, rather than simply being labelled ESG.

The second dimension of the EU's financing plans concerns its support to mitigate unemployment risks in an emergency (SURE) facility, which provides financial assistance to address the increase in public expenditure from employment support measures⁽⁶²⁾. To finance this facility, three social bonds were issued in October and November for a total amount of EUR 39.5 bn, dwarfing previous European issuance levels in the market (T.88). Each of

these auctions was 13 times oversubscribed. Overall social bond issuance grew from EUR 23 bn in 1H20 to EUR 74 bn in 2H20.

T.88
Social bond issuance
EU institutions drive market growth in 2H20



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.

A key question that arises is the reliability of existing sustainable debt labels. In attributing characteristics such as 'green', 'social' or 'climate transition' to debt instruments, these labels not only provide a signal to investors but can also act as a catalyst to draw financial resources to new projects. Similarly, the labelling effect may improve financing conditions for existing projects, which could ultimately increase the financial resources available to, for instance, social activities and projects. Nevertheless, these labels have come under scrutiny due to the risk of impact washing in the context of 'use-of-proceeds' bonds, such as green or social bonds.

A first concern is that the labels' compliance requirements are restricted to the specific projects benefiting from the proceeds, thus enabling issuers to profit from these labels despite poor records of, for example, human rights breaches, polluting activities, or tax fraud allegations. An often-raised counterargument is that use-of-proceeds bond labels create a broader incentive for issuers to pay more heed to the impact of their actions on the environment or society. However, the emergence of 'transition' debt labels and impact-linked instruments that

⁽⁵⁹⁾ BBC News (2019), [Bitcoin's energy consumption 'equals that of Switzerland'](#), 3 July; *The Economist* (2018), ['Why bitcoin uses so much energy'](#), 9 July.

⁽⁶⁰⁾ OECD (2019).

⁽⁶¹⁾ See European Commission (2020), ['Digital finance package'](#).

⁽⁶²⁾ See European Commission, ['SURE'](#).

are designed for this exact purpose suggests that such incentives have failed to materialise.

Another possible source of concern may come from issuers using these labels while making misleading claims about projects, to benefit from favourable funding conditions, which would damage investors' trust in the market. Indeed, frameworks guiding the issuance of sustainable debt instruments are on a voluntary basis, and within these frameworks post-issuance allocation reports are not systematic, leaving plenty of leeway for firms to choose the final allocation of proceeds and means of achievement. This is especially true of social bonds, given the difficulty of defining 'social concepts' and the complexity of measuring impacts. While the EU Green Bond Standard (GBS) should ensure the accuracy of proceeds allocation and improve the transparency of information on the proceeds allocation and ultimate impact of green bonds (T.89), there is a clear case for monitoring social bond market developments.

T.89

The EU Green Bond Standard

Supporting green bond issuers and investors

The European Commission is working on a proposal for the introduction of an EU GBS, based on the recommendations of the EU Technical Expert Group ⁽⁶³⁾.

The group recommended that the GBS should be a 'voluntary, non-legislative' label with four main components:

- **EU taxonomy alignment:** proceeds financing activities in line with the criteria set out in the EU taxonomy regulation;
- **publication of a green bond framework:** including alignment with the environmental objectives set out in the EU taxonomy and information on proposed use of proceeds, processes and reporting;
- **reporting:** mandatory allocation report on the use of proceeds and environmental impact report;
- **verification:** mandatory external review of the framework and allocation report.

The proposal also envisaged that ESMA should be put in charge of oversight and supervision of external review providers.

The GBS has a dual objective of supporting green bond market growth in Europe and strengthening investor protection. An inception impact assessment identified three main barriers to market growth ⁽⁶⁴⁾: lack of standardised definitions, causing reluctance to invest and risk of reputational damage for issuers;

complex review procedures with a wide array of practices and actors and varying degrees of expertise, quality and impact; and lack of investable projects.

By reducing search costs, developing clear definitions and introducing minimum standards for external reviewers, the GBS is expected to boost the supply of and demand for green bonds.

ESG investing

Benchmark returns and RoE

The announcement of highly effective vaccines against COVID-19 and the prospect of a return to normality have led to a sudden repositioning in equity markets. Some sectors that had performed well in lockdown conditions underperformed in the second half of 2020, and vice versa. For example, the MSCI World Healthcare index (USD) outperformed the broader World index by 7 pps in 1H20 but underperformed it by 10 pps in 2H20. In contrast, the MSCI World Transportation index (USD) underperformed by 5 pps, and then outperformed by 11 pps. Since less carbon-intensive sectors (such as healthcare) tend to be overweight in ESG indices and portfolios compared with, for example, transport or manufacturing, this contributed to a lower performance of ESG benchmarks.

The performance of ESG equity benchmarks varies with the choice of benchmark provider and investment horizon. For example, in 2H20 the MSCI World and EMU ESG Leaders indices underperformed the broader World and EMU benchmarks by 200 basis points (bps) and 176 bps respectively (T.90). Meanwhile, the Euro STOXX ESG Leaders 50 index has consistently outperformed the Euro STOXX 50 benchmark over the last few years, especially on a risk-adjusted basis (see T.100 and T.101). Such high dispersion in ESG benchmark performances reflects to some extent differences in benchmark composition. Index providers use ESG ratings from various rating providers, but these ratings tend to display a low level of correlation (see 'ESG ratings: Status and key issues ahead', below).

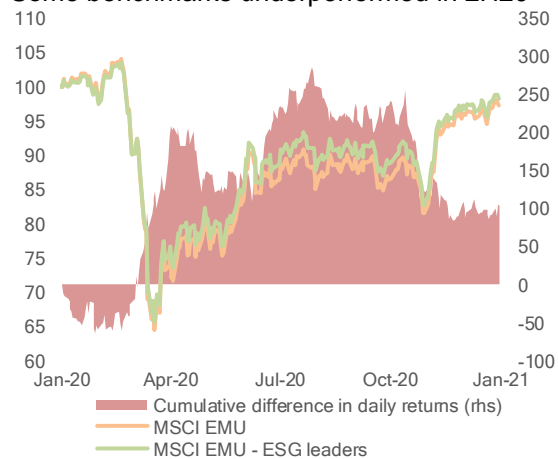
⁽⁶³⁾ EU Technical Expert Group on Sustainable Finance (2019), 'Report on EU Green Bond Standard', 18 June.

⁽⁶⁴⁾ European Commission, 'Establishment of the EU Green Bond Standard: Inception impact assessment'.

T.90

Euro Area ESG equity benchmark returns

Some benchmarks underperformed in 2H20



Note: MSCI EMU index and MSCI EMU ESG leaders index rebased with 31/12/2019=100, and difference in year-to-date returns, bps (right axis).
Sources: Refinitiv Datastream, ESMA.

As with other ESG products, questions have been raised on the actual impact that such benchmarks are having on ESG-related outcomes. For this reason, it is worth examining the market-based incentives that can make investors place their capital with less-polluting companies. There is evidence that a growing number of investors, including large institutional investors and asset managers, may well be willing to receive lower returns in exchange for investing in more sustainable companies⁽⁶⁵⁾. However, the 'sustainability focus' of portfolios is likely to be stronger if firms that pollute less are consistently more profitable for investors than polluting companies. Otherwise, investments motivated by sustainability principles may become particularly volatile during sharp economic shocks, such as the COVID-19 pandemic⁽⁶⁶⁾.

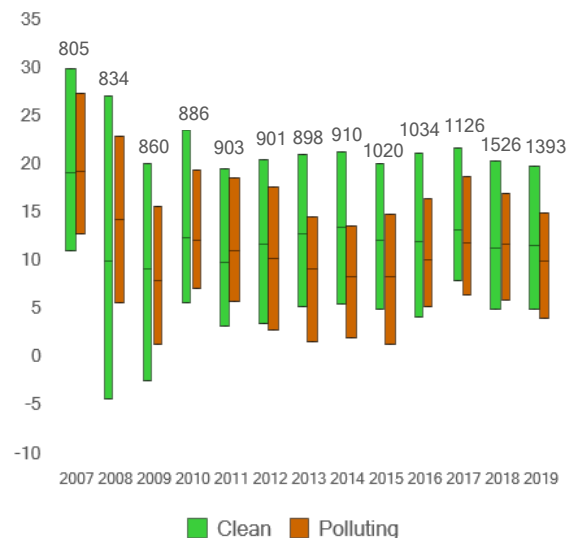
The range in return on equity (RoE) for relatively clean firms has in recent years (especially 2013–2016) been slightly higher than the range in RoE for relatively polluting firms (T.91). However, taking a longer-term perspective, it does not appear that the differential is both consistently and significantly higher, for example when looking at times of severe economic stress: the global financial crisis of 2007–2009, and also the most important years of the European sovereign debt crisis (2011 and 2012). Additional RoE differentials for clean firms relative to more polluting firms would be beneficial in stimulating

capital markets to orient their investments towards less environmentally damaging firms.

T.91

RoE of clean and polluting firms

Limited incentive to invest in cleaner firms



Note: Annual RoE for listed EU firms, grouped into firms whose total CO₂-equivalent emissions (scope 1 and scope 2) are below the 25th percentile ('clean') and above the 75th percentile ('polluting'). The number of companies in the sample for each year sits on top. RoE is measured as net income before preferred dividends divided by the average common equity values for the current year and the previous year. The horizontal line within each box denotes the median for that group. Box edges are the 25th and 75th percentiles for RoE within each group of firms.

Sources: Refinitiv EIKON, ESMA.

ESG funds

The appetite of EU investors for funds following ESG strategies remains high. According to data from Morningstar, since March 2020 ESG equity funds have experienced EUR 72 bn in net inflows (19 % of their March AuM), compared with EUR 86 bn for non-ESG equity funds (0.3 % of AuM). This brings the total assets of EU ESG equity, bond and mixed funds to EUR 835 bn, a 55 % increase from March, making up 11 % of the total assets of equity, bond and mixed funds (ESG and non-ESG).

In the absence of an official EU-wide definition or label, a key question is the extent to which funds' ESG communication influences the perception that investors have of these funds. Aside from national labels, rules exist in several EU countries on the way and extent to which funds are allowed

⁽⁶⁵⁾ Pastor, L., Stambaugh, R. F. and Taylor, L. A. (2019), 'Sustainable investing in equilibrium', *NBER Working Papers*, No 26549; [European Commission](#).

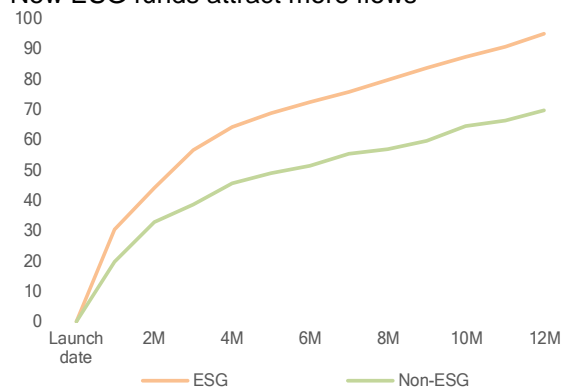
⁽⁶⁶⁾ Döttling, R. and Kim, S. (2020), 'Sustainability preferences under stress: Evidence from mutual fund flows during COVID-19', working paper.

to communicate their ESG strategies⁽⁶⁷⁾, but these rules are neither systematic nor harmonised.

Of the nearly 2 300 new equity, bond and mixed funds launched over the last 2 years in the EU, almost a third referred in their regulatory or marketing documentation, one way or another, to ESG investing⁽⁶⁸⁾. In the 12 months following their inception dates, ESG equity funds attracted on average EUR 95mn, compared with EUR 70mn for non-ESG funds (T.92)⁽⁶⁹⁾.

T.92

Net flows into new EU equity funds
New ESG funds attract more flows

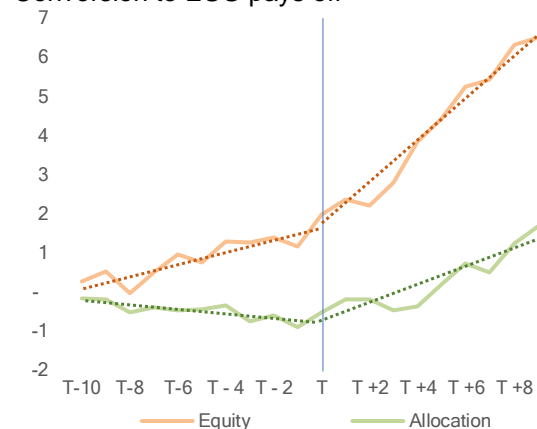


Note: Average cumulative net flows into EU ESG vs. non-ESG equity funds from their launch date, monthly data in EUR mn. Funds launched from January 2018 only. Sources: Morningstar, ESMA.

Rather than launching new funds, some asset managers opt instead to onboard ESG strategies within existing funds and revise the documentation of their funds accordingly to incorporate ESG elements – thereby making it possible to identify their conversion dates. This conversion effect seems to pay off: based on a sample of 880 equity and mixed funds, equity funds attracted on average five times more net flows in the 10 months after conversion than in the 10 months before, while mixed funds were able to stem outflows (T.93).

T.93

Net flows into EU funds converting to ESG
Conversion to ESG pays off



Note: Net cumulative flows into EU equity and allocation funds before and after conversion to ESG, monthly data, EUR bn. T=conversion date. Sources: Morningstar, ESMA.

The popularity of ESG products thus highlights the need for clear definitions and common EU rules to ensure that these investments fully correspond to investor preferences, and expectations in terms of impact or exclusions (e.g. from ESG controversy-ridden companies; T.94).

T.94

ESG data and ratings

ESG-related controversies

Evaluating firms' sustainability commitment in ESG terms has become standard practice. Controversies, defined by the ESG data provider Sustainalytics as 'incidents that may negatively impact stakeholders, the environment or the company's operations', reflect firms' behaviour and implementation of ESG policies. Thus, monitoring controversies provide yet another factor to evaluate sustainability. They may also act as a catalyst and push firms to adopt sustainable practices, as controversies can damage firms' reputations and business opportunities. and thus increase costs.

Diversity of methodologies raises consistency issues

Controversy counts can either feed into ESG scores and ratings or be offered as a separate ESG data product. Like ESG ratings, they are not subject to standardised methodologies, which raises similar comparability and consistency issues⁽⁷⁰⁾. Most providers group them into recognisable ESG categories, such as 'human rights', 'carbon emission'

ESG-related matters.

⁽⁶⁷⁾ For example, the French AMF checks if the information made available to investors is clear, accurate and non-deceptive.

⁽⁶⁸⁾ This includes, but is not limited to, any reference to investment decision-making or screening based on ESG aspects, reference to ethical investing, socially responsible investing thematic investing, impact investing and engagement with investee companies on

⁽⁶⁹⁾ The difference is even larger for mixed funds (EUR 126 m versus EUR 58 m) but the later average launch date of non-ESG mixed funds means that, for a higher share of these funds, the sample period covers the COVID-19 crisis (when many funds had outflows).

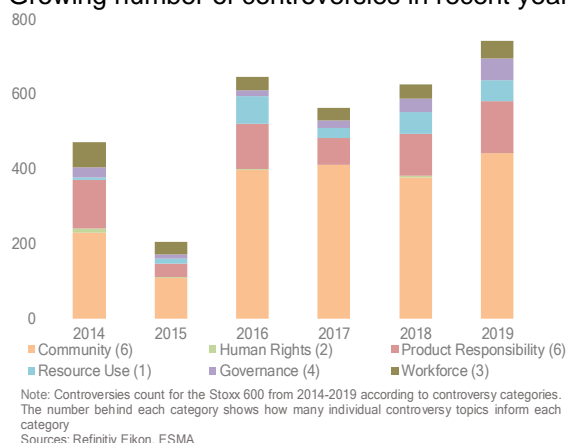
⁽⁷⁰⁾ See ESMA (2020), *Report on Trends, Risks and Vulnerabilities*, No 2, p. 49.

or ‘tax fraud’. However, while Refinitiv defines 23 controversy topics feeding into 7 categories, MSCI uses 28 indicators for 5 categories, while Sustainalytics evaluates 10 topical areas ⁽⁷¹⁾. Global and local news outlets usually act as the main sources, enabling wide coverage and cross-border accountability. Still, arbitrary choices are often necessary, such as minimum relevance thresholds and categorisation. Furthermore, media tend to focus on larger companies, which can hamper objectivity and introduce size bias (some providers partially try to address these issues, e.g. by applying weights to correct for firm size).

Governance controversies affect the financial sector

Data from Refinitiv on ESG-related controversies for constituents of the STOXX Europe 600 index from 2014 to 2020 show that the overall number of controversies has increased in recent years (T.95). However, it would be misleading to conclude only that firms’ behaviour is becoming more controversial. The rising count may also reflect increased public scrutiny of ESG-related matters.

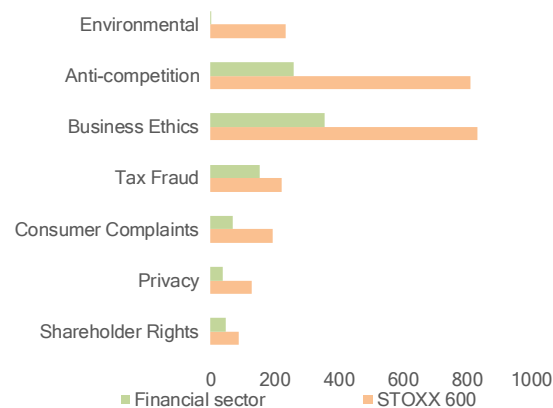
T.95
ESG controversies
Growing number of controversies in recent years



The emergence of certain types of controversies reflects changing investor priorities or focus (e.g. shareholder rights), but also recent developments in market structures or companies’ business (e.g. data privacy issues). However, controversies related to community and product responsibility continue to prevail, with 60 % and 19 % of the overall count. A closer look at these topics reveals that business ethics, anti-competition and tax fraud drive the high ‘community’ count. A subsample of 103 financial services sector firms from the broader STOXX Europe 600 index alone dominate controversies related to tax fraud and represent a high share of business ethics-related ones, while they do not face any significant environmental controversy (T.96).

T.96
STOXX Euro 600 index and financials: ESG controversies

Ethics and competition issues prevail



Note: Number of ESG controversies for STOXX 600 index companies and financial Industry constituents from 2014 to 2019, top 5 controversy topics. Sources: Refinitiv EIKON, ESMA.

Potential use cases

Despite their challenges, controversy scores can provide investors with useful information complementing other types of ESG ratings (usually disclosure driven) and help to address impact-washing concerns. They can also be used by authorities to monitor the conduct risk of entities within their remit, and to identify or anticipate growing consumer-related issues before they create harm.

Emissions trading

In September 2020, the European Commission announced plans to cut greenhouse gas emissions by at least 55 % below 1990 levels by 2030. The previous commitment had been 40 %. All relevant EU policies will be reviewed against this new target, including the **EU emissions trading system (ETS)** ⁽⁷²⁾. The impact assessment ⁽⁷³⁾ proposed, among other measures, to expand the scope of the existing EU ETS to fossil fuels used in non-ETS sectors, such as buildings, road transport and maritime transport. The review will also concern the allocation method for allowances with implications for the total cap and thus the amount of allowances available.

In the ETS, revenues depend on the assumed free allocation of emission allowances, and the caps aim to guarantee the environmental outcome. The impact assessment stressed that the undertakings covered by the ETS today (11 000 heavy energy-using installations such as

⁽⁷¹⁾ See Refinitiv, ‘Refinitiv ESG company scores’, MSCI ESG Research LLC, ‘MSCI ESG controversies’, and Sustainalytics, ‘Controversies research’.
⁽⁷²⁾ See more at European Commission, ‘EU emissions

trading system (EU ETS)’.
⁽⁷³⁾ European Commission (2020), [Impact assessment, SWD\(2020\) 176 final, 17.9.2020.](#)

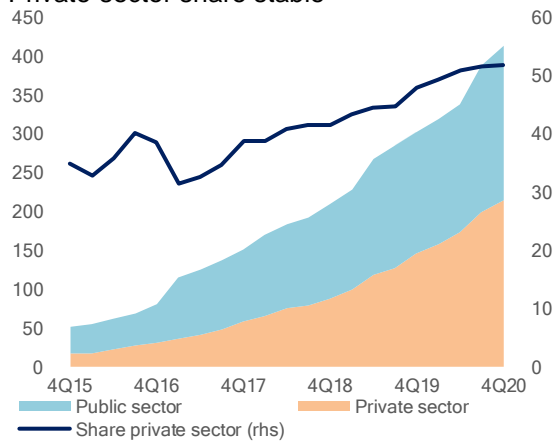
power stations and industrial plants, and airlines operating between European countries) are emitting less than the total cap. This gap between the cap and the actual emissions was estimated at around 250mn allowances in 2019, thanks to the large decline in emissions. If it remains, such a surplus could potentially prevent the ETS from delivering the necessary investment signal to reduce emissions in a cost-efficient manner.

In reaction to the announcement of the European Commission of a 55 % target by 2030, a spike in emission allowances' **turnover** has been observed on the European Energy Exchange from an average of EUR 39mn in 2020 to a record EUR 134mn in September. Allowance **prices** did not seem to be affected by the spike and slightly increased from around EUR 27 per tonne of CO₂ in November to EUR 32 in December (see T.102).

Key indicators

T.97

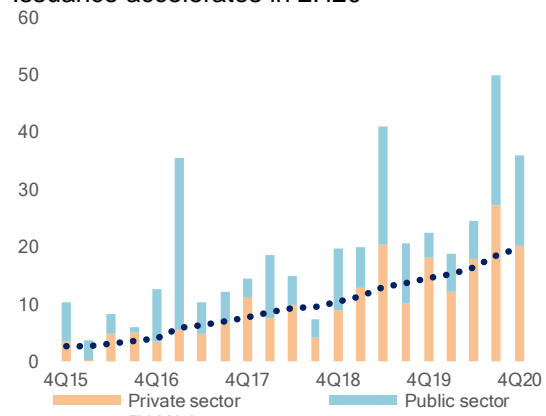
Green bonds outstanding
Private-sector share stable



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.98

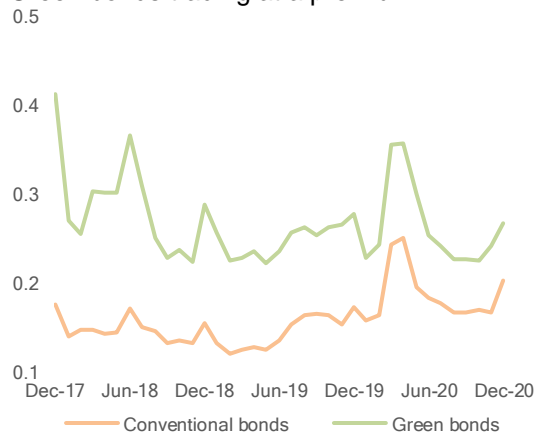
Green bond issuance
Issuance accelerates in 2H20



Note: Green bond gross issuance in the EEA30 by sector, EUR bn.
Sources: Refinitiv EIKON, ESMA.

T.99

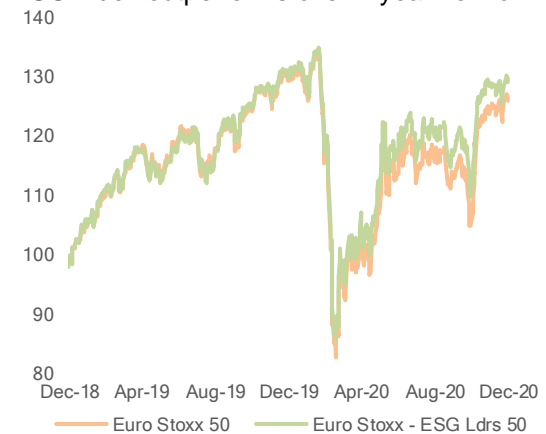
Sovereign green bond and conventional bond liquidity
Green bonds trading at a premium



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

T.100

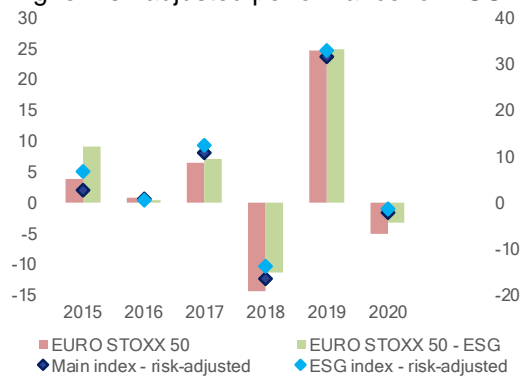
Euro area ESG stock indices
ESG index outperforms over 2-year horizon



Note: Euro Stoxx 50 ESG leaders and broader indices, indexed with 31/12/2018=100.
Sources: Refinitiv Datastream, ESMA.

T.101

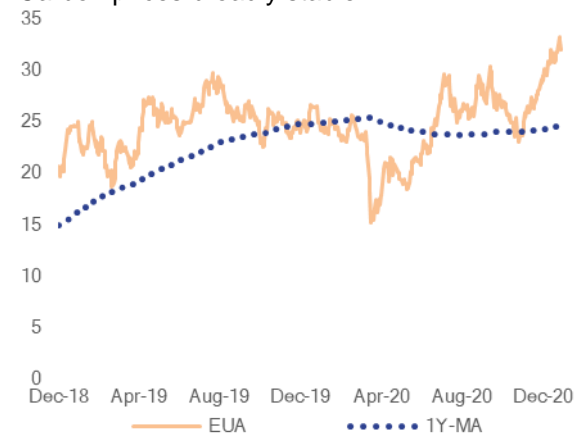
ESG index risk-adjusted returns
Higher risk-adjusted performance for ESG index



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

T.102

Emission allowance spot prices
Carbon prices broadly stable



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

The wider COVID-19 impacts continue to fuel digitalisation, with positive outcomes for consumers and firms but at the same time challenges and risks, especially related to cyber-resilience. In the crypto space, BTC price is at all-time highs, fuelled by strong investor demand, positive news reports and the expectation that cryptoassets (CAs) will ultimately achieve mainstream acceptance. Developments around global stablecoins continue to be under regulatory scrutiny, while sentiment towards Central Bank Digital Currencies (CBDCs) is shifting positively.

Digitalisation increases need for cyber-resilience

After a contraction in 1Q20, FinTech funding rebounded in 2Q20 and 3Q20 and stands at par with the substantial levels of 2019, suggesting that investors' interest in the sector remains strong. This is also consistent with the steady flows in AI and FinTech funds (see T.107). Yet deal activity has declined for the fourth quarter in a row, mirroring investor consolidation into more established FinTechs.

Wider COVID-19 impacts continue to spur digitalisation by forcing an increased rate of technological adoption by consumers and businesses, some say equivalent to a 2- to 5-year leapfrog in digital transformation. This shift benefits large technology companies, as evidenced by their strong market performance. The weight of Microsoft, Apple, Amazon, Google's parent Alphabet and Facebook in the S&P 500 gradually increased from 18 % to 23 % in 2020, representing a rise in market capitalisation of more than EUR 1.1tn.

Generally, while the pandemic provides some positive outcomes for consumers, through increased digitalisation and enhanced products and services, it contributes to further increasing the dominance of large technology companies. 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 those companies.

The growing digitalisation of financial services increases the need for cyber- and operational

resilience. Information collected by ESMA on CCP outages shows a downward trend (see T.109). However, concerning the financial sector more broadly, anecdotal evidence suggests that the number of cyberattacks and scams has increased in the wake of the pandemic and technological transformation. The digital finance package recently published by the Commission is particularly timely and relevant in that respect (see T.104). On a related topic, ESMA published guidelines on outsourcing to cloud service providers with a view to helping firms in the financial securities space better identify, manage and monitor the risks arising from their cloud outsourcing arrangements ⁽⁷⁴⁾.

T.103

Financial innovation scoreboard

Assessment of risks and opportunities

The ESMA financial innovation scoreboard is a framework that provides a ranking relating product financial innovations require deeper analysis and potential policy responses.

Cryptoassets – small in size, concerns around stablecoins

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.

Distributed ledger technology – some interesting experiments

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.

Artificial intelligence, machine learning and big data – potential longer-term impact

⁽⁷⁴⁾ ESMA (2020), 'Final Report – Guidelines on outsourcing

to cloud service providers', December.

The increasing adoption of AI and big data helps financial services companies to be more efficient and therefore may lead to cost reductions for investors. Operational risks are present, as are risks around the explicability of AI-based recommendations, strategies and analysis.

The cloud and digitalisation – growing with positive outcomes but risks as well

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

Regulatory and supervisory technology – potential benefits

The widespread adoption of regulatory technology (RegTech) and supervisory technology (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.

T.104

European Commission's digital finance package A complete set of measures to support digital innovation

On 24 September, the European Commission published a digital finance package, with a view to embracing digital innovation for the good of consumers and businesses ⁽⁷⁵⁾. The objectives of the package are threefold, namely (i) making finance more 'digital friendly' and stimulating innovation and competition among finance; (ii) removing fragmentation in the digital single market for online services; and (iii) promoting a well-regulated, data-driven financial sector.

The package includes a series of measures and two legislative proposals on digital operational resilience and CAs. The legislative proposal on digital operational resilience is intended to strengthen digital operational resilience and includes an oversight framework for critical third-party ICT providers to the financial sector. Other parts of the proposals cover ICT risk management, a resilience-testing framework and incident reporting. The legislative proposal on CAs aims to clarify the application of existing EU rules to CAs, to introduce a pilot regime for CAs covered by these rules and to establish a new EU legal framework for CAs that are not covered by these rules, based on a taxonomy of definitions of different types of CAs.

Cryptoasset prices at all-time highs

After a rebound from the March trough over the summer, CA prices soared through the end of 2020. The total market capitalisation of CAs now exceeds the historical highs of 2018 at well over EUR 500 bn (see T.110). During the last week of December, BTC reached its all-time high value at above EUR 23 700, i.e. almost 50 % above its historical peak at the end of 2017. It has also proven to be an extremely successful year for Ether; by the end of Q42020 it had more than quadrupled its value since January, and prices seem to continue to rise together with BTC (see T.111).

Trading volumes for CAs have been on the rise as well. In December, they reached a daily average of EUR 135 bn ⁽⁷⁶⁾, roughly EUR 100 bn over the high reached in January 2018. Notably, while BTC continues to account for about two thirds of the total market capitalisation of CAs, Tether, the largest stablecoin, surpasses BTC in turnover figures ⁽⁷⁷⁾. The total value of stablecoins nearly doubled in Q3 and continued to grow in Q4 to exceed EUR 26 bn. Tether, with a market cap of EUR 18.7 bn, leads the way, with USD Coin in second place at EUR 3.6 bn, followed by Dai at EUR 1.1 bn. BTC futures set new all-time highs in late November, in both trading volume and open interest, although they still remain very low (see T.112). In October, the FCA banned the sale to retail consumers of derivatives and exchange-traded notes that reference certain types of CAs ⁽⁷⁸⁾.

The surge in value and trading volumes for CAs is driven by positive newsflows in the crypto sector, such as the move by PayPal to accept cryptocurrency, buying and selling on its platform, and the growing interest in decentralised finance (DeFi) (see below). It is also fuelled by strong investor demand and search for yield amid unprecedented global fiscal and monetary stimulus. Yet CAs are highly volatile and bear high risks for investors, as already highlighted by the three ESAs in their 2018 warning ⁽⁷⁹⁾. The legislative proposal on CAs published by the

⁽⁷⁵⁾ European Commission (2020), 'Digital finance package', September.

⁽⁷⁶⁾ Source: CoinMarketCap.

⁽⁷⁷⁾ Source: Refinitiv.

⁽⁷⁸⁾ FCA (2020), 'FCA bans the sale of crypto-derivatives to

retail consumers', October.

⁽⁷⁹⁾ ESMA, European Banking Authority and European Insurance and Occupational Pensions Authority (2018), 'ESMA, EBA and EIOPA warn consumers on the risks of virtual currencies', February.

European Commission in September 2020 is intended to address these risks (T.104)

DeFi is a catch-all term for financial products built on peer-to-peer networks, such as the public Ethereum blockchain. DeFi effectively expands the use of blockchain from simple value transfer to more complex financial use cases, building on decentralised applications and smart contracts. DeFi as a concept is not new – the well-publicised The DAO⁽⁸⁰⁾ was an early example of DeFi – but the phenomenon has attracted growing interest recently. The total value locked in DeFi is estimated at about EUR 13.3 bn as of end-December, compared with EUR 3.5 bn as of end-July 2020⁽⁸¹⁾. The most popular DeFi applications fall into three broad activities, namely lending, trading (through decentralised exchange platforms) and asset management.

DeFi holds the same promises as the technology on which it is built, namely disintermediation, 24/7 availability and censorship resistance. It also faces similar challenges and risks, including in relation to operational resilience, scalability and governance. It therefore remains to be seen how these initiatives may grow and reach the scale that they need. The DAO, for example, exposed important flaws in the governance of fully decentralised organisations. ESMA will continue to monitor developments in the DeFi space, as it may raise specific regulatory and supervisory challenges.

CBDCs under discussion, stablecoins under scrutiny

The pandemic has exposed consumers' demand for more accessible and lower-cost digital payments. COVID-19's impact on retail payments, including a sharp fall in the use of physical cash by consumers, and private initiatives around stablecoins, have contributed to a shift in sentiment towards CBDCs among central bankers, which could in turn facilitate the uptake of DLT in financial securities markets.

Illustrations of this shift are, for example, the statement by Christine Lagarde that the ECB

'should be prepared to issue a digital euro, should the need arise', and the report published by the ECB in October examining the case for the creation of a digital euro⁽⁸²⁾. Other central banks, including Sweden's Riksbank, the Swiss National Bank and the People's Bank of China, are further ahead with equivalent projects of their own. In the US, the Boston Fed has partnered with MIT to develop a 'hypothetical' open-source CBDC platform oriented to central bank uses⁽⁸³⁾.

Yet the need to examine thoroughly the associated risks and operational challenges remains very prominent. In October, the BIS, together with a group of seven central banks, published a report⁽⁸⁴⁾ highlighting the foundational principles and key features that a CBDC would need to satisfy, with a view to fostering exploration and collaboration on the matter.

On a related topic, market developments around private stablecoins continue to be under scrutiny by global regulators. In its November working paper⁽⁸⁵⁾, the BIS highlighted the need to account for differences between existing stablecoins and planned global stablecoins when designing regulatory responses to the phenomenon. It also suggested that many of the benefits of stablecoins may be achieved with CBDCs and other initiatives such as fast payment systems. Meanwhile, the Libra association announced that it was preparing to launch its long-awaited Libra currency in January but in a more limited format than originally planned, namely with just one dollar-backed coin, renamed Diem⁽⁸⁶⁾.

RegTech/SupTech – potential for authorities

RegTech and SupTech continue to be of high relevance to the financial system, including to the regulatory and supervisory community, spurred by both market participants' need to comply with growing regulatory requirements and the

⁽⁸⁰⁾ The DAO (short for decentralised organisation) was launched through a crowdfunding sale in 2016. It was meant to operate like a venture capital fund for the crypto space, using a fully decentralised business model.

⁽⁸¹⁾ Source: DeFi Pulse.

⁽⁸²⁾ ECB (2020), 'Report on a digital euro', October.

⁽⁸³⁾ Brainard, L. (2020), 'An update on digital currencies', August.

⁽⁸⁴⁾ Bank of Canada, European Central Bank, Bank of Japan,

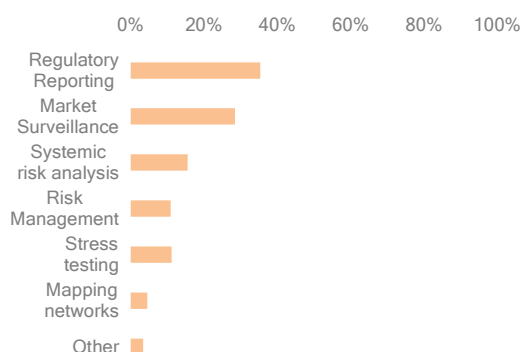
Sveriges Riksbank, Swiss National Bank, Bank of England, Board of Governors of the Federal Reserve and BIS (2020), 'Central bank digital currencies: Foundational principles and core features', October.

⁽⁸⁵⁾ Arner, D., Auer, R. and Frost, J. (2020), 'Stablecoins: risks, potential and regulation', *BIS Working Papers*, No 905, November.

⁽⁸⁶⁾ *Financial Times* (2020), 'Facebook's Libra currency to launch next year in limited format', 27 November.

increased availability of advanced tools that facilitate risk-based, efficient supervision ⁽⁸⁷⁾.

T.105
Relative time/resources spent on specific applications
Most tools applied to reporting and surveillance



Note: Horizontal axis is the average (across NCAs responding) share of time/resources dedicated to each specific application area. Only NCAs including at least some positive percentage in each category (including Other) have been included.

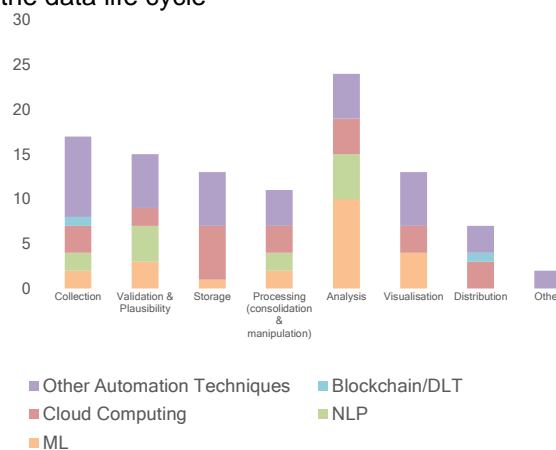
Sources: NCA RegTech/SupTech survey responses, ESMA.

A recent ESMA survey of NCA activity ⁽⁸⁸⁾ shows that the main use cases for SupTech tools are regulatory reporting and market surveillance, with 35 % and 28 % of respondents respectively indicating these as the areas that, on average, take up the most time and resources (T.105). The types of tools used are oriented towards application programming interfaces and business intelligence tools that help link different databases together. This enables NCAs to improve the efficiency of regulatory reporting or to enhance market surveillance, by quickly detecting unusual patterns that would escape the human eye. At the same time, the application of information extracted using these tools to other areas, e.g. stress testing or systemic risk analysis, remains limited.

In the area of SupTech, cloud computing, machine learning and natural language processing are the most common tools used. These tools appear to be beneficial in many areas of the data life cycle, such as data analysis, validation or collection (T.106). With respect to data collection, NCAs appear to prefer collecting structured data through legacy in-house systems rather than outsourcing this activity to an external provider. Similarly, 94 % of respondents report that data are almost exclusively stored on the premises. Not surprisingly, security and privacy issues rank high among challenges and risks

relating to cloud-based storage and systems provided by external vendors.

T.106
SupTech applications across the data life cycle
SupTech tools can contribute to many areas of the data life cycle



Note: Vertical axis is the count of NCAs having responded. Other automation techniques' includes automated XBRL filing rule validations, in-house software, data lakes and Business Intelligence tools.

Source: NCA RegTech/SupTech survey responses, ESMA.

Despite the existing appetite among NCAs to deploy and test the existing tools, there remain challenges to more widespread use of SupTech (as well as RegTech). While data quality issues and the limited availability of financial and human resources are repeatedly mentioned as the most critical concerns, other factors, such as the consideration of legal risks – e.g. in the context of the general data protection regulation – have considerable impact as well. Moreover, while benefiting from efficiency gains, supervisors must ensure transparency in the application of SupTech to decision-making, in order to mitigate reputational risks. Lastly, as indicated above, the application of external software or cloud systems may increase security risks. This is especially important in the light of ongoing discussions in Europe for a strategy on data privacy and its implications for entities' reputation and operational security. National supervisors have also indicated a need to invest more in adequate human resources in order to continue to adequately monitor and supervise technological innovation in the EU financial services sector.

These challenges highlight the potential for further coordination and cooperation efforts at EU level, an issue that is, among others, being

⁽⁸⁷⁾ For a detailed overview of RegTech/SupTech, including definitions, drivers and examples, please refer to ESMA (2019), 'RegTech and SupTech – change for markets and authorities', in *Report on Trends, Risks and*

Vulnerabilities, No 1.
⁽⁸⁸⁾ These trends are based on an ESMA survey that was conducted in 2Q2020 and addressed to EU NCAs within ESMA's remit.

addressed by the EC's digital finance package ⁽⁸⁹⁾. Indeed, key pillars of the package include the promotion of data-driven finance while at the same time enhancing the digital operational resilience of the financial system. In addition, the package, alongside the recently launched EU data governance act ⁽⁹⁰⁾, emphasises enhanced data sharing with external stakeholders, for example through the use of

data-sharing providers. Greater data sharing in this way is expected to drive cooperation and facilitate knowledge transfer between supervisors and market participants, which may also spur the wider application of RegTech and SupTech techniques.

⁽⁸⁹⁾ [European Commission \(2020\)](#).

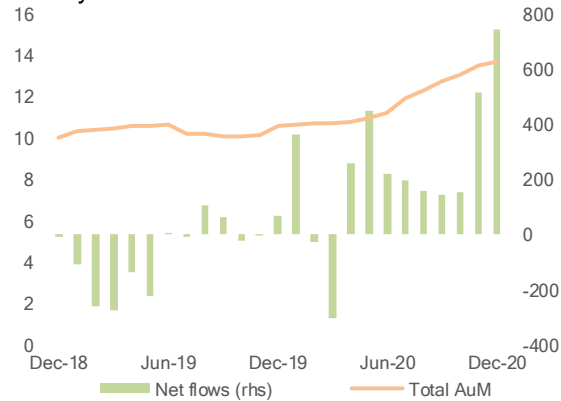
⁽⁹⁰⁾ The data governance act forms part of the European strategy for data. For more information please see

European Commission, '[Policies on building a European data economy](#)'.

Key indicators

T.107

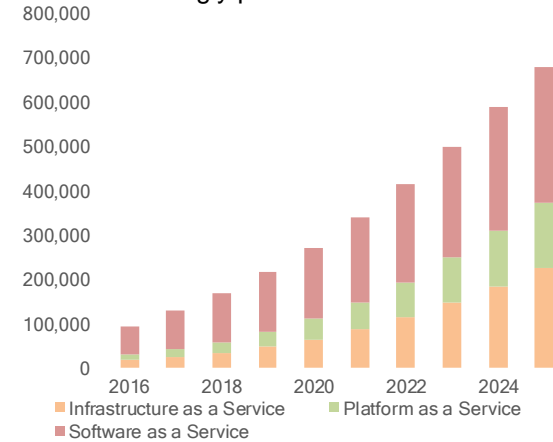
Fund strategies focused on AI and FinTech
Steady flows in AI and FinTech funds



Note: Total AuM, 12-month rolling average, EUR bn, and monthly net flows, EUR mn, for selected EU-domiciled funds (n=41) whose name includes reference to AI, automation, FinTech or robotics.
 Sources: Morningstar Direct, ESMA

T.108

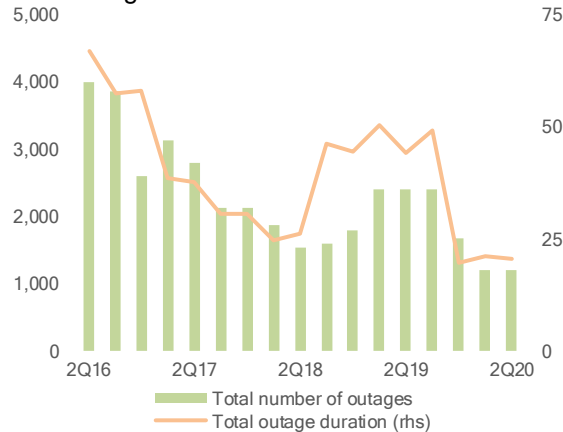
Cloud services
Firms increasingly purchase cloud services



Note: Revenue in the Public Cloud in million USD.
 Sources: Statista (Forecast adjusted for expected impact of COVID-19), December 2020

T.109

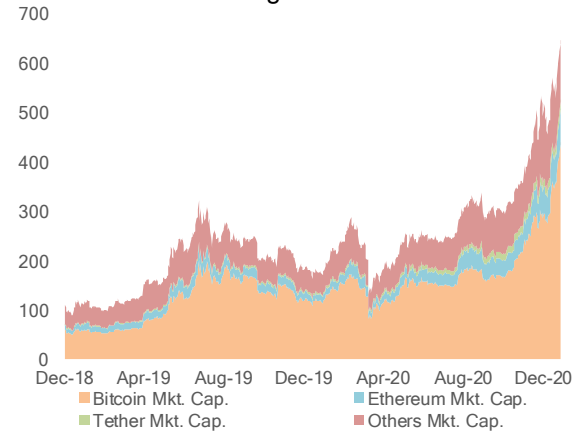
Digital operational incidents
CCP outages show downward trend



Note: Number of outages and total outage duration in minutes, by quarter, for global sample of CCPs (n=11).
 Sources: Clarus, CCPs, ESMA

T.110

Cryptoasset market capitalisation
Bitcoin drives booming values



Note: Market capitalisation of Bitcoin, Ethereum, Tether and other cryptocurrencies, in EUR bn.
 Sources: CoinMarketCap, ESMA

T.111

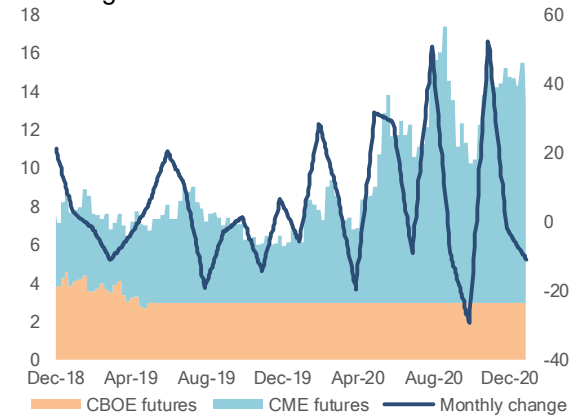
Cryptoasset prices
Valuation at historical highs



Note: Prices of selected crypto-assets, EUR thousand.
 Sources: Refinitiv Datastream, ESMA

T.112

Bitcoin futures market
Growing interest in BTC futures



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

Risk analysis

Financial stability Vulnerabilities in money market funds

Contact: antoine.bouveret@esma.europa.eu ⁽⁹¹⁾

Summary

The acute market stress period of March 2020 showed that EU money market funds remain vulnerable to liquidity risk on their asset and liability sides. This article identifies a series of structural risks. The evidence related to these risks can serve as input to the currently ongoing discussions on MMF regulatory reforms. On the asset side, non-public debt MMFs have very high and concentrated exposures to private money markets that have low liquidity, making MMFs highly vulnerable to a symmetric liquidity shock as in March 2020. Regulatory constraints might also make some MMFs more vulnerable to runs from investors, as a result of concerns related to redemption fees and gates, or of tight constraints on NAV deviations. Finally, MMF ratings also add to the constraints on managers, by restricting their eligible assets and by penalising the use of liquidity management tools provided in the Money Market Fund Regulation (MMFR).

Introduction

MMFs are key intermediaries in the financial system: they provide short-term funding to issuers, mainly banks, and are used as cash management vehicles by investors. MMFs play an important role in short-term funding markets such as commercial paper (CP) or certificates of deposit (CDs).

During the global financial crisis of 2007–2008, US and European MMFs faced acute stress due to their exposures to commercial paper backed by assets related to subprime borrowers (asset-backed commercial paper). In some cases, fund sponsors stepped in to provide support to their MMFs by purchasing instruments directly from the funds (Bengtsson, 2013). As the crisis intensified following Lehman's collapse, MMFs saw a surge in outflows and, in the US, the central bank launched a range of facilities to support MMFs and money markets.

In the aftermath of the crisis, important regulatory reforms took place to reduce vulnerabilities and increase the resilience of MMFs. In the EU, the MMFR provides for a range of regulatory requirements, which entered into force in 2019.

The intense stress experienced by MMFs in March 2020 has shown that, despite regulatory reforms, MMFs remain subject to vulnerabilities. This article focuses on structural risks and vulnerabilities in the MMF industry.

Background

MMFs are collective investment schemes that provide short-term funding to financial institutions, governments and corporates. MMFs invest in short-term instruments such as CP, CDs, short-term government debt, bank deposits or repurchase agreements (repo).

MMFs are used as short-term cash management vehicle by investors. MMFs provide liquidity (daily redemption), diversification and stability of value (low fluctuation of MMF shares); they remunerate investors with market yields. MMF returns are related to the yields on the instruments in the MMF portfolio. Compared with other assets, MMFs offer higher yields than bank deposits, and higher liquidity than short-term bond funds (RA.1). Direct investment in money market instruments such as CP or CDs offers less liquidity and requires an expensive infrastructure

⁽⁹¹⁾ This article was written by Antoine Bouveret and Lorenzo Danieli.

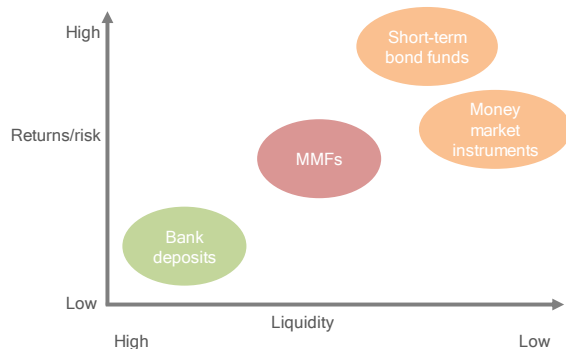
such as internal credit assessment or internal trading desks.

The investor base of MMFs consists almost entirely of corporates (28 %) and institutional investors (insurance companies, investment funds or other financial institutions), while retail participation is very low (RA.2).

RA.1

Cash management vehicle

Trade-offs between liquidity and returns

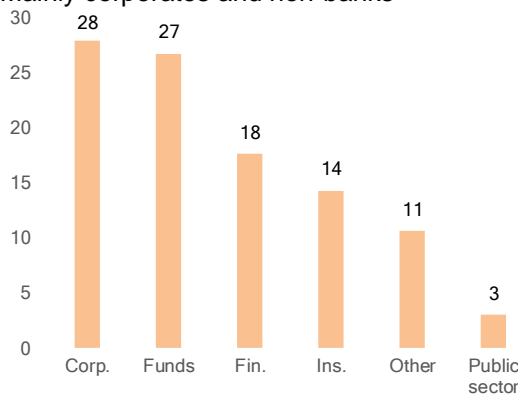


Source: ESMA.

RA.2

MMF investors

Mainly corporates and non-banks



Note: Ownership of EU MMF shares by investor type, in percent.
Corp.: Corporates, Fin: Other financial institutions (including banks), Ins.: Insurance companies. The 'Other' category includes MMFs sold through intermediaries (third party).
Sources: Fitch, ECB, ESMA.

Different types of MMFs

The MMFR defines two broad types of MMFs: short-term MMFs (investing mainly in assets maturing within 120 days) and standard MMFs (investing mainly in assets maturing within 6 months) ⁽⁹²⁾.

Within the short-term category, MMFs can be of three types. **Variable Net Asset Value (VNAV)** MMFs can invest in a range of eligible assets (including government debt, CP or CDs) and they mark-to-market their NAV. Hence, VNAV shares can be redeemed at their market value by investors.

Public debt Constant Net Asset Value (CNAV) MMFs must invest at least 99.5 % of their assets in government debt, repo collateralised by government debt or cash. CNAVs offer redemption of their shares at par value, as they are allowed to use the amortised cost method, but they also have to calculate their mark-to-market NAV.

Low Volatility Net Asset Value (LVNAV) MMFs can invest in a broader range of assets (including CP and CDs) than CNAVs. LVNAVs offer a constant NAV; however, if the mark-to-market NAV of LVNAVs deviates more than 20 bps from the constant NAV, LVNAVs have to convert to VNAVs.

MMFs are subject to a range of **regulatory requirements**, including portfolio rules and diversification requirements. Some requirements are specific to the MMF type (RA.3). While all MMFs are subject to daily and weekly liquidity requirements, the levels differ by types ⁽⁹³⁾. MMFs providing redeemability at par (CNAVs and LVNAVs) have higher liquidity requirements than VNAVs: 10 % daily liquid assets compared with 7.5 % for VNAVs, and 30 % WLA compared with 15 % for VNAVs. In addition, CNAVs and LVNAVs could be subject to redemption fees and gates, if their WLA go below 30 % and they face

⁽⁹²⁾ Short-term MMFs have a 60-day limit on the weighted average maturity (WAM) of their portfolio. The WAM is the average length of time to legal maturity (or to the next interest rate reset, if shorter) of all the underlying assets in the MMF portfolio. The WAM measures the portfolio's sensitivity to changes in interest rates. Short-term MMFs also have a 120-day limit on the weighted average liquidity (WAL) of their portfolio. The WAL is the average length of time to legal maturity of all the underlying assets in the MMF portfolio. The WAL measures the credit risk of the portfolio. Standard MMFs have a WAM limit of 6 months and a WAL limit

of 12 months.

⁽⁹³⁾ Daily liquid assets comprise cash and daily maturing assets, including overnight repo and deposits. Weekly liquid assets comprise weekly maturing assets, including repo and deposits maturing within 5 business days for all MMFs. For LVNAVVs and CNAVs, government assets with a residual maturity of up to 190 days are also considered WLA up to 17.5 pps of the regulatory requirement. For VNAVs, money market instruments or shares of other MMFs (provided they are able to be redeemed and settled within 5 business days) are also considered WLA up to 7.5 pps.

daily outflows above 10 %, while those provisions do not apply to VNAV's ⁽⁹⁴⁾.

RA.3

MMF Regulation

Regulatory requirements for short-term MMFs

MMF type	CNAV	LVNAV	VNAV
	Pricing		
Dealing NAV	Constant NAV	Constant NAV, provided that the market NAV does not deviate more than 20 bps	Variable
Valuation method	Amortised cost	Amortised cost for instruments (i) ≤ 75 days and (ii) where the difference from mark-to-market value is below 10 bps; mark-to-market otherwise	Mark-to-market
	Liquidity requirements (% of NAV)		
Daily liquid assets (min)	10 %	10 %	7.5 %
Weekly liquid assets (min)	30 %, with up to 17.5 % in government assets with a maturity up to 190 days	30 %, with up to 17.5 % in government assets with a maturity up to 190 days	15 %, with up to 7.5 % in money market instruments or shares of other MMFs
	Liquidity fees and gates		
Optionality	If WLA < 30 % and daily outflows > 10 %, MMF may impose fees, gates or suspension of redemptions. No formal limit		N/A
Mandatory activation	If WLA < 10 %, fees or suspension must be enacted		N/A

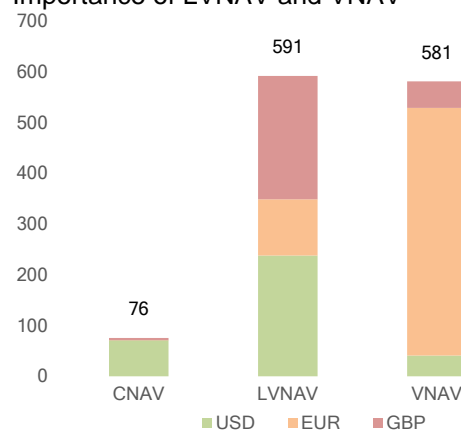
Market overview

The EU MMF industry is diverse across types and currencies. As of November 2020, the size of the EU MMF industry amounted to around EUR 1 400 bn according to the ECB, spread across MMF types (RA.4). LVNAV's and VNAV's each account for 47 % and CNAV's for 6 % of MMFs. Overall, slightly more than half of EU MMFs offer redeemability at par (CNAV's and LVNAV's). EUR MMFs account for 48 % of MMFs, followed by USD (28 %) and GBP (24 %).

RA.4

MMF size

Importance of LVNAV and VNAV



Note: Net asset value of EU MMF by type and currency in EUR bn, as of November 2020. The sample covers around 90% of EU MMFs universe. Sources: Refinitiv Lipper, ESMA.

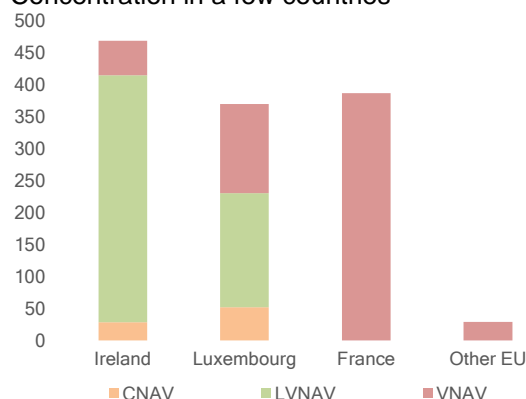
The EU MMF industry is concentrated mainly in three Member States (RA.5). Ireland accounts for around 37 % of MMFs by size, followed by France (31 %) and Luxembourg (30 %), with other EU countries accounting for around 2 %. By MMF types, there are large differences between countries: LVNAV's are almost all domiciled in Ireland (67 %) and Luxembourg (31 %), while VNAV's are mainly domiciled in France (59 %) and in Luxembourg (26 %). Those differences may partly reflect historical factors such as the prohibition of CNAV MMFs in France, accounting issues (VNAV's are presumed to be cash equivalent in France ⁽⁹⁵⁾) or different demands from investors.

⁽⁹⁴⁾ EU and US rules for MMFs are slightly different on a few points. In the United States, redemption fees and gates are to be considered by MMFs only when WLA breach the 30 % level, while, in the EU, daily outflows also need to be above 10 %. In the United States, redemption fees and gates apply to all type of MMFs, except government MMFs, while in the EU they do not apply to VNAV's.

⁽⁹⁵⁾ According to the AMF, shares in VNAV's are presumed to

be considered cash equivalent under International Accounting Standard 7, provided that MMFs are used as a short-term cash management vehicle rather than as an investment. The presumption of negligible risk of change in the value of these funds can be refuted based on the events and circumstances relating to market trends, notably in periods of tension (AMF, 2018).

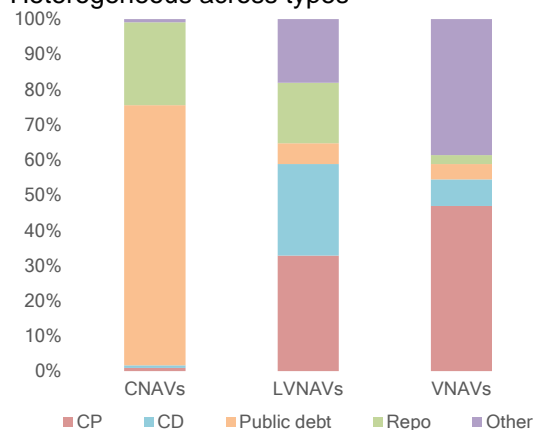
RA.5
MMF by country of domicile
Concentration in a few countries



Note: Net asset value of EU MMFs by domicile and type, in EUR bn, as of September 2020. Data based on a sample of EU MMFs covering around 80% of the EU MMF universe. Sources: Lipper, AMF, ESMA.

MMFs' portfolio compositions reflect their regulatory type: CNAVs invest almost exclusively in public debt and repo, while LVNAVs and VNAVs are predominantly exposed to CP and CD markets (RA.6).

RA.6
MMF portfolio composition
Heterogeneous across types



Note: Portfolio composition of MMFs by types, in % of NAV as of Sep. 2020. Sources: Crane, ESMA.

Role of credit rating agencies

MMF ratings

Most funds typically have MMF ratings from Credit Rating Agencies (CRAs). MMF ratings are different from credit ratings: they assess not credit risk but rather the ability of the MMF to preserve capital and maintain liquidity (see RA.7 on CRA methodologies). Since MMF ratings do not typically meet the definition of a credit rating as set out under the CRA Regulation, they are not considered credit ratings and therefore do not fall within the scope of the regulatory requirements of the CRA Regulation.

RA.7
MMF rating methodologies

Overview of CRA approaches to MMFs

	S&P	Moody's	Fitch
Rating definition	Fund ability to maintain principal value	Fund ability to meet the dual objectives of providing liquidity and preserving capital	Fund ability to provide principal preservation and liquidity through limiting credit, market and liquidity risks
Credit risk exposures	100 % A-1 or A-1+, 50 % repo limit with A-2 counterparties. Exposures unrated by S&P are not eligible	No formal limit, credit profile based on securities ratings and maturities	100 % F1 or higher (except for repo), 25 % repo limit with F2 counterparties. Unrated exposures not eligible, unless rated by Moody's or S&P
NAV deviation limit	25 bps	No formal limit	No formal limit

Using a sample of MMFs domiciled in Ireland and Luxembourg, covering around 60 % of the EU universe, more than 99 % of those MMFs have an MMF rating from at least one of the three CRAs, and more than 80 % of MMFs are rated by at least two CRAs (RA.8). However, in France, very few MMFs are rated, implying that at the EU level the share of rated MMFs is more likely to be around 60 %. All rated MMFs have an AAmmf rating. The use of MMF ratings is related to the predominance of institutional investors, whose investment policy usually restricts them to investing only in MMFs rated AAmmf by at least two CRAs (IMMFA, 2014). According to the European Commission (2013), the use of MMF ratings was also related to the lack of clear rules around MMFs, except in France, leading investors to rely on external assessments provided by CRAs⁽⁹⁶⁾. The importance of

⁽⁹⁶⁾ 'Credit ratings have been useful for investors since until recently there was no common definition of MMF in Europe. It was very difficult to perceive the different risk characteristics of MMFs subject to different national legislations which often imposed weak constraints on credit, liquidity and interest rate risk. IMMFA requires its

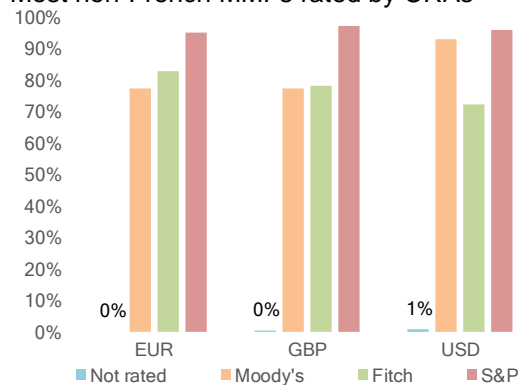
members to be rated due to this situation. To the contrary MMFs domiciled in France are usually not rated because the MMF sector has long been carefully delineated by rules that prescribe the characteristics of

AAAmf ratings is also reflected in industry codes of practice⁽⁹⁷⁾. An analysis by the European Commission also shows that, when three UK MMFs were put on negative watch by a CRA, they experienced up to 50 % outflows in 2 weeks (EC, 2013, pp.12–13).

RA.8

MMF ratings

Most non-French MMFs rated by CRAs



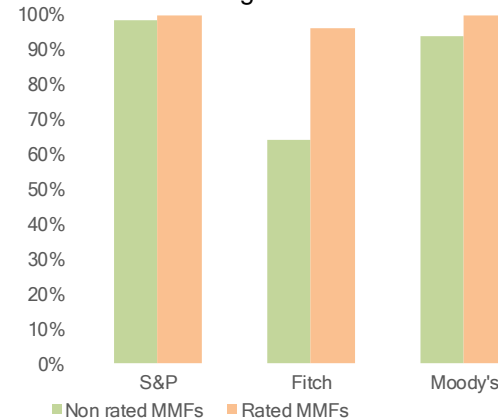
Note: Share of EU MMFs with money market fund ratings, in % of NAV. Based on a sample of MMFs with NAV of EUR 870bn as of October 2020 (60% of EU universe). The sample does not include any French MMF. Sources: Crane, ESMA.

without MMF ratings tend also to invest in high-rated issuers, although their exposures to Fitch-rated issuers are significantly lower than for MMFs with an MMF rating from Fitch (65 % of NAV against 98 %).

RA.9

MMF portfolio exposures

All instruments held by rated MMFs have external credit ratings



Note: Share of rated instruments in MMF portfolio by CRA (in % of NAV). Sources: Crane, ESMA.

Credit ratings

To reduce over-reliance on external ratings, the MMFR requires MMFs to perform internal credit quality assessments. External credit ratings of the assets in their portfolio may be considered, but they cannot be mechanically relied upon. Looking at detailed portfolio holding data, credit ratings continue to play an important role. MMFs that obtain an MMF rating invest only in high-rated instruments and issuers: MMFs rated by S&P invest 100 % in instruments and issuers that have credit ratings from the same CRA (RA.9).

This close relationship can be explained by constraints related to CRAs' MMF-rating methodologies. For some CRAs, their methodologies specify that MMFs can only invest in high-rated issuers, and in most cases any exposure below some credit rating level would not be compatible with an AAmmf rating for the MMF. For one CRA, MMFs are restricted to investing only in instruments rated by the same CRA, while other CRAs might allow ratings from other CRAs to be taken into account. MMFs

Vulnerabilities in the MMF sector

In March 2020, some segments of the US and EU MMF industry experienced very high levels of stress. MMFs exposed to private markets (LVNAVs and VNAVs in the EU, prime MMFs in the US) recorded very high outflows, while facing challenges in disposing of their assets due to the lack of liquidity in CP and CD markets⁽⁹⁸⁾.

Following actions by central banks to support money markets, redemptions slowed while liquidity improved in money markets. No EU or US MMFs had to implement fees or gates or suspend redemptions. However, this episode shows that MMFs remain subject to a range of vulnerabilities.

Those vulnerabilities can be split across a few dimensions: (i) liquidity of underlying markets, (ii) regulatory requirements, (iii) role of CRAs and (iv) investor behaviour.

a MMF asset. Fund ratings were therefore not required to establish investor confidence in France' (European Commission, 2013, p. 49).

⁽⁹⁷⁾ For example, the 2012 code of practice of the International Money Market Funds Association (IMMFA) requires that IMMFA funds be rated AAA

(IMMFA, 2012). Since then, the IMMFA has revised its code of conduct, which no longer refers directly to MMF ratings.

⁽⁹⁸⁾ For further details about how stress affected MMFs in March 2020, see ESMA (2020a), FSB (2020) and IOSCO (2020).

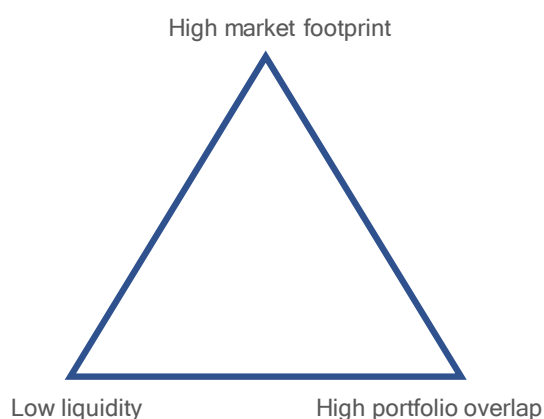
Liquidity in money markets

MMFs are exposed to three intertwined challenges regarding liquidity on their asset side: MMFs have a large market footprint in the asset classes they invest in; those markets are not very liquid even in normal times; and MMFs have a high degree of portfolio overlap (RA.10).

RA.10

MMF asset liquidity

Common vulnerabilities

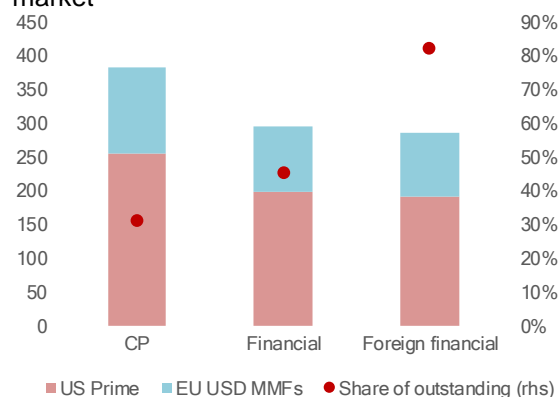


MMFs have a very large **market footprint** in private money markets. As of February 2020, US prime MMF and USD LVNAVs and VNAVs exposures amounted to around one third of the US CP market (RA.11). More importantly, those MMFs held more than half of the CP issued by financial institutions, including 82 % of all CP issued by foreign financial institutions. The footprint is lower in other currencies but still substantial: MMFs hold more than 50 % of the EUR and GBP financial CP markets, although precise estimates are challenging because of limited transparency in some segments of the European CP market.

RA.11

Market footprint

MMFs hold the majority of the USD financial CP market



Note: US Prime and EU USD LVNAV and VNAVs exposures to US Commercial Paper market, in USD bn and % of outstanding, as of end-February 2020.

Sources: Federal Reserve, Banque de France, ECB, Crane, ESMA.

The **market liquidity** of the CP market is low, even in normal times, for a range of reasons. First, investors tend to buy and hold the instruments until maturity, owing to the short maturity of CP, implying low trading volumes on secondary markets. The distribution of CP at issuance also plays a role. Most CP is sold through a group of dealers or banks that agree to sponsor and make markets in the CP issuer's programme in exchange for a fee. Programme members might provide liquidity in the secondary market, but they have no obligation to do so. Non-programme institutions would generally not buy CP they did not help issue, because of reduced information on the issuer or for commercial reasons. Finally, banks need balance sheet capacity to be able to intermediate large amounts of CP. In the US, dealer inventories of CP amounted to around USD 10 bn at end-February, less than 1 % of the market, implying limited capacity to intermediate CP trading (RA.12). Only after the launch of the Fed's Money Market Mutual Fund Liquidity Facility did dealers increase their CP inventories⁽⁹⁹⁾. Limited capacity of banks to act as dealers and intermediate the CP and CD markets seems to result from prudential regulation (IOSCO, 2020).

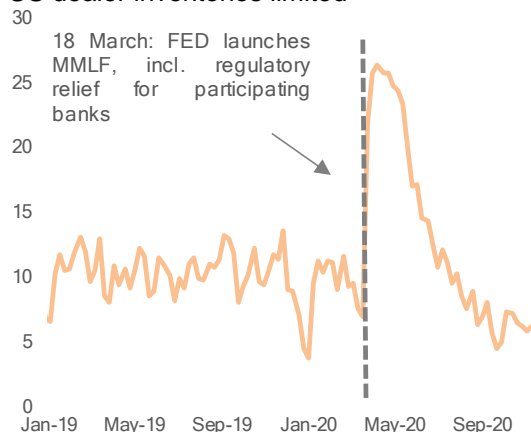
⁽⁹⁹⁾ The facility consists in loans made by the Federal Reserve to banks to fund the purchase of assets from

MMFs. Such loans are collateralised by the assets purchased from MMFs.

RA.12

Absorption capacity

US dealer inventories limited



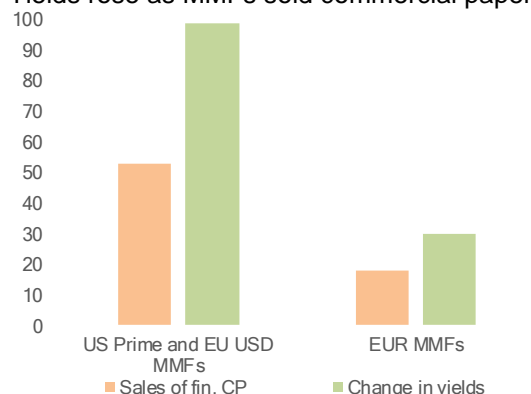
Note: US Primary dealers inventories of CP, in USD bn.
Sources: Federal Reserve, ESMA.

The limited absorption capacity of the CP market was tested in March, as MMFs sold instruments to meet investor redemptions. We estimate that USD MMFs (US prime and EU USD MMFs) sold more than USD 50 bn of financial CP, more than five times average dealer inventories. Over the same period the yield on CP surged by almost 100 bps. Similar patterns were also observed in EUR CP markets, with MMFs selling around EUR 18 bn of CP, while yields rose by 30 bps (RA.13) ⁽¹⁰⁰⁾.

RA.13

Volume of sales and yields

Yields rose as MMFs sold commercial paper



Note: Estimated sales of financial CP by US Prime and EU USD LVNAVs and VNAVs, (in USD bn), and by EUR MMFs (in EUR bn). Change in 3M financial CP yield in basis points. All changes are between end-February and end-March.
Sources: ECB, Federal Reserve, Crane, ESMA.

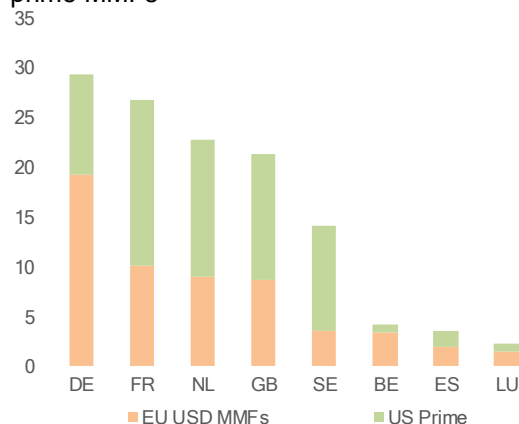
Finally, MMFs tend to be exposed to the same type of assets and issuers. RA.14 shows a high

degree of overlap between US prime and EU USD MMFs in the financial CP market: both types of MMFs have more than USD 10 bn in exposures to CP issued by French and German banks. Such overlap implies that, if one type of fund sells CP, other types of funds will face challenges selling the same instrument due to the low level of liquidity.

RA.14

USD MMFs

High overlap between EU USD MMFs and US prime MMFs



Note: Holdings of financial CP by country of issuer for EU USD LVNAVs and VNAVs, and US Prime MMFs, in USD bn as of end-February 2020.
Sources: Crane, ESMA.

Formally, the degree of portfolio overlap can be assessed by estimating the portfolio similarity of MMFs (RA.15). Using a sample of 65 US prime MMFs and 20 EU USD LVNAVs (with NAVs of USD 1 080 bn and USD 343 bn respectively), we estimate the portfolio similarity as of end-February 2020. The index is based on the holdings of financial CP by issuer. Two MMFs will be very similar if they share exposures to the same issuer for the same relative amount (in % of their NAV).

⁽¹⁰⁰⁾The volumes of sales of CP are proxied by the change in holdings of CP by MMFs between end-February and end-March for a sample of MMFs accounting for around

70 % of the EU MMF sector. When CPs held at end-February that matured in March are excluded, the volume of sales is around EUR 11 billion.

RA.15

MMF portfolios

Portfolio similarity

MMFs tend to invest in similar assets, in terms of issuer type, instrument or maturity. A measure of portfolio similarity can be estimated for each MMF, based on the composition of its portfolio. We use a measure based on cosine similarity (Girardi et al., 2016). For each MMF, the share of each issuer in its portfolio is estimated and then the portfolio similarity index is computed as:

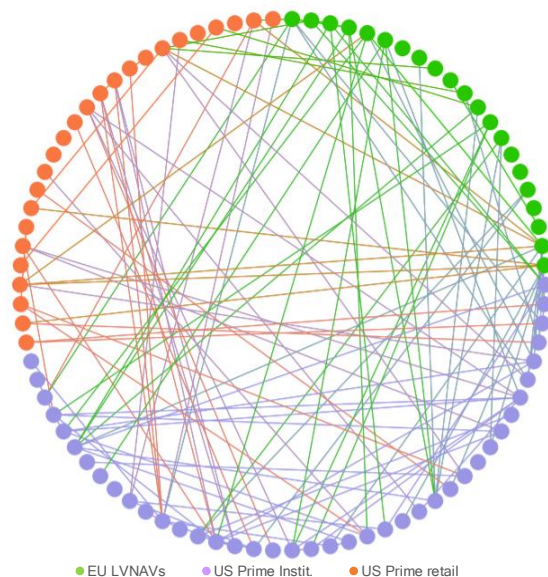
$$Similarity_{i,j} = \frac{w_i \cdot w_j}{\|w_i\| \cdot \|w_j\|}$$

where w_i is the vector asset weights in the portfolio of MMF i and w_j is the vector asset weights in the portfolio of MMF j . This index ranges from 0 (no similarity) to 1 (where each portfolio exactly replicates the other).

RA.16 displays the very high level of portfolio similarity across EU and US MMFs investing in USD CP. The figure only shows edges between MMFs when the portfolio similarity is very high (above 0.76). The network chart is quite dense, implying a high degree of portfolio overlap, when measured by CP exposures, across US prime funds and EU USD LVNAVs. This degree of overlap is common across MMF types and currencies, and remains stable over time (Georg et al., 2018). Overall, US prime funds and USD LVNAVs tend to be very similar on the asset side, even though they cater to different types of investors.

RA.16

USD MMFs

High portfolio similarity across USD MMFs

Note: Portfolio similarity index by MMF type. Only values above 0.76 are displayed for readability. Sources: Crane, ESMA.

In addition, some asset management companies selling MMFs belong to banking groups. Based on a sample of funds with EUR 938bn in NAV as of end-February 2020, such MMFs may on average have higher exposures to the banking group (close to 13% of NAV, RA.17) than independent funds (less than 5%). The higher exposure relates to deposits and repo with the banking group, while exposures to financial instruments issued by the banking group (CPs and CDs) are similar to other MMFs. High intragroup exposures imply that, if those MMFs were to reduce their exposures, their provision of liquidity to the banking group would decline.

RA.17
MMFs belonging to banking groups
High exposures to banking groups
14%



Note: Average exposures of EU LVNAVs and VNAVs of MMFs to banking groups), in % of NAV.
Sources: Crane, ESMA.

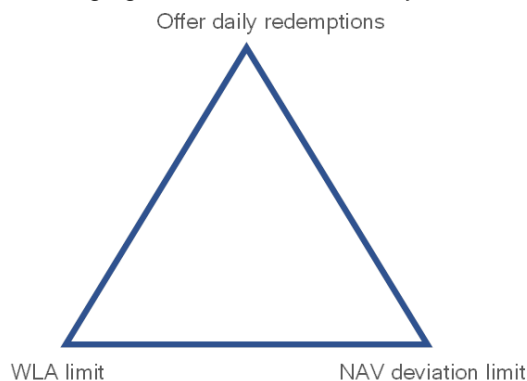
The combination of those three characteristics (large market footprint, high degree of overlap and low liquidity in underlying markets) makes MMFs particularly vulnerable to symmetric shocks. If several MMFs face large redemptions at the same time, they are likely to try to sell the same type of assets simultaneously. Given the limited absorption capacity of the underlying asset market, such sales will be challenging to execute, thereby creating liquidity issues for MMFs.

Role of regulatory constraints for LVNAVs

For MMFs providing redeemability at par, the EU regulatory framework provides tighter liquidity requirements. For CNAVs, these constraints might be less binding, since these MMFs invest almost exclusively in government debt, which is more liquid than private debt.

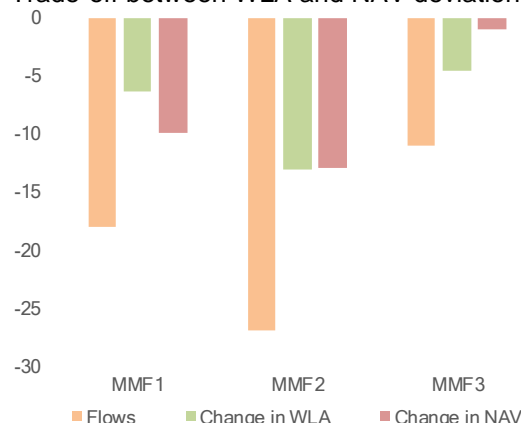
However, for LVNAVs, the largest MMF type in the EU, regulatory constraints can be binding, especially since some of them might be conflicting. To meet daily redemptions, LVNAVs have to liquidate instruments. At the same time, LVNAVs have to keep their WLA above 30 % of NAV, and their NAV deviation below 20 bps (RA.18).

RA.18
LVNAV regulatory constraints
Challenging to meet simultaneously under stress



During periods of stress, LVNAVs are likely to face challenges to meet all those constraints at the same time. RA.19 shows three MMFs that faced very high outflows in March (more than 10 % in 2 weeks, as indicated by the orange bar). To meet those redemptions, funds can sell their most liquid assets, but that will result in a decline in WLA (green bar) and a risk of breaching the 30 % requirement. Funds can also choose to dispose of less-liquid assets, but in that case the sales could result in mark-to-market losses. Such losses will lead to a deviation between the mark-to-market NAV and the constant NAV. Although no LVNAV breached the 20 bps collar in March, a few funds were close to the threshold, with one fund having an 18 bps deviation.

RA.19
MMF liquidation strategy
Trade-off between WLA and NAV deviation



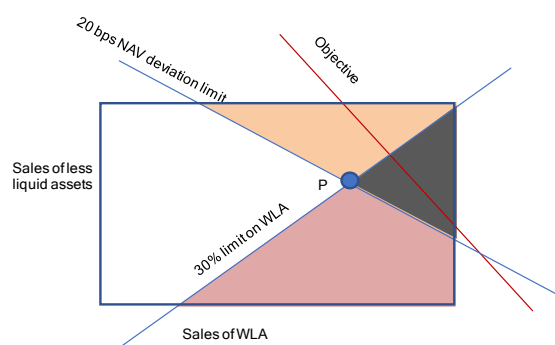
Note: 7D net flows in % of assets and weekly change in WLA (in pp) and NAV deviation (in bps) as of 25 March 2020 for three USD LVNAVs.
Sources: Crane, ESMA.

In that context, we have shown in a recent article (Baes et al., 2021) how the interaction of regulatory constraints and limited liquidity in underlying markets can result in LVNAVs being

unable to maintain a stable NAV and have WLA above the regulatory limit at the same time.

RA.20 illustrates the trade-off faced by LVNAVs, by showing the highest level of redemptions an MMF can face. These levels depend on the sale of WLA (x-axis) and of less-liquid assets (y-axis). Given the 30 % WLA constraint, MMFs are limited in the quantity of liquid assets they can sell, shown in the figure by the red triangle (indicating non-feasible sales of WLA). MMFs can sell less-liquid assets, but this will result in deviations between the constant NAV and the mark-to-market NAV, since funds will sell at a discounted price given the low liquidity of the market. Therefore, MMFs cannot sell more than a given amount of less-liquid assets, represented by the orange triangle (the dark grey triangle represents the area where both NAV and WLA constraints apply). The highest level of redemption that could be met is reached at the point P.

RA.20
Money market fund liquidation strategy
Trade-off between WLA and NAV deviation



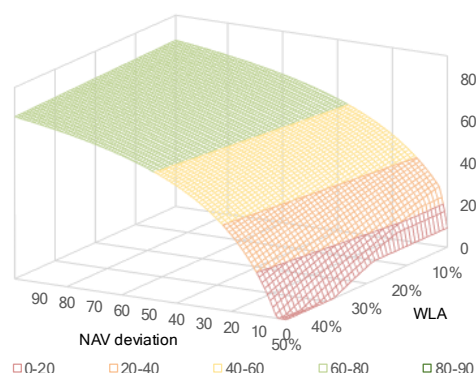
In addition, we can analyse how changes in regulatory requirements (WLA or NAV deviation) or improvement in underlying market liquidity can strengthen the resilience of LVNAVs.

For the purpose of a simulation, we assume that a stylised LVNAV has 35 % of its NAV in WLA and 65 % in other assets, corresponding to aggregate reporting by EU LVNAVs as of February 2020. When the fund sells WLA, we assume that the MMF faces a cost of 10 bps; when it sells other assets, the cost is 40 bps,

reflecting the difference in liquidity ⁽¹⁰¹⁾. It is then possible to calculate the maximum level of redemption this MMF can face, depending on the NAV deviation requirement (ranging from 0 to 100 bps) and on the required levels of WLA (ranging from 10 % to 50 %). RA.21 shows the corresponding results: using existing regulatory requirements, the maximum level of redemptions is at 42 % of NAV. In addition, the level of redemptions is the highest when the NAV deviation is the largest and when the WLA are the lowest (since the MMF can sell most of its WLA).

Overall, changing the level of WLA has limited effects – the resulting increase in the maximum level of redemptions would be low. If WLA declined to 10 %, maximum redemptions would only increase by 6 pps to 48 %. On the other hand, increasing the NAV deviation has a large impact on MMFs' ability to meet redemptions: increasing the deviation from 20 bps to 50 bps results in a rise in maximum redemptions of more than 20 pps, to 63 % of NAV ⁽¹⁰²⁾. In the extreme case where LVNAVs switch to a floating NAV, the constraint vanishes and MMFs can meet any level of redemptions ⁽¹⁰³⁾.

RA.21
MMF reforms
Impact of changes in regulatory constraints



Note: Maximum level of redemptions as a function of NAV deviation and weekly liquid asset requirements, in % of NAV.
Sources: Baes et al. (2020).

Finally, increasing the liquidity of the underlying markets has, in that simulation, a very large effect on the resilience of MMFs. If the price impact of WLA declined from 10 bps to 5 bps, and the price impact of other assets from 40 bps to 20 bps, the

⁽¹⁰¹⁾ These values are taken from the liquidity discounts from the ESMA MMF stress test guidelines (10 bps is the average for 3M AA and A sovereign bonds, and 43 bps for 3M A corporate bonds); see ESMA (2020b).

⁽¹⁰²⁾ However, based on current CRA methodologies for MMF ratings, a deviation larger than 25 bps would not be compatible with an AAmmf rating for some CRAs,

thereby limiting the additional flexibility for MMF managers.

⁽¹⁰³⁾ This result holds only if MMFs are able to dispose of their assets at a given price. If markets froze, as in March 2020, MMFs might not be able to sell their assets, irrespective of the price they offer.

maximum level of redemptions a fund could face would rise to 58 % (against 42 % previously). By reducing the price impact of trades, such reforms allow MMFs to sell more assets at a lower cost, keeping NAV deviations limited.

Overall, the analysis indicates that, to improve the resilience of LVNAVs (measured by the level of redemption a fund can face), increasing the NAV deviation is more effective than changing WLA requirements. However, potential cliff-edge effects would remain when the NAV deviation approached the collar; a move to floating NAV would remove those effects. Changes to the structure of money markets resulting in higher liquidity of money market instruments would be largely effective in improving MMF resilience as well, although such changes are more of a long-term nature and outside the regulatory perimeter.

The role of redemption fees and gates

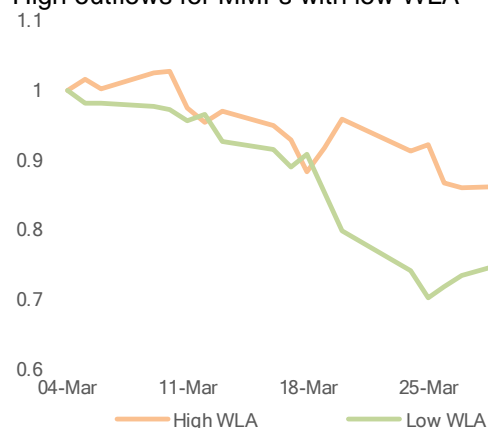
Some market participants have argued that MMF regulatory reforms may have created a first-mover advantage by tying breaches of WLA to the use of redemption fees and gates (Blackrock, 2020).

As the levels of WLA decline towards the regulatory threshold of 30 %, investors might have an incentive to pre-emptively run to avoid being subject to fees and gates. In the US, Li et al. (2020) provide evidence that the US prime funds with the lowest WLA had higher outflows than MMFs with higher levels of liquid assets.

In the EU, rules are slightly different. For fees and gates to be considered, the MMF has to breach the 30 % WLA thresholds **and** record daily outflows higher than 10 %. In that context, EFAMA (2020) considers that existing rules are adequate.

We follow the approach used by Li et al. (2020) by splitting our sample of MMFs into funds with low WLA and funds with high WLA. For each daily observation, MMFs are categorised based on the level of WLA in the previous day. MMFs with low WLAs end up having WLAs below 40% of NAV, while high WLAs MMFs had liquidity above 40%. RA.22 shows the results for 13 US dollar LVNAVs with a NAV of USD 313bn as of March 2020: MMFs that had previously disclosed low WLA recorded higher outflows than other MMFs¹⁰⁴.

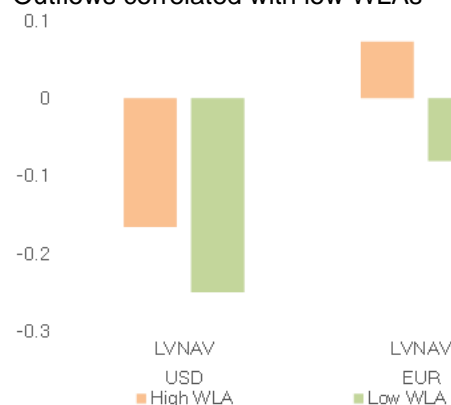
RA.22
USD LVNAV flows
High outflows for MMFs with low WLA



Note: Cumulated outflows since 4 March for USD LVNAVs, rebased at 1=4 March, in % of NAV. MMFs categorized based on lagged levels of WLAs. Sources: Crane, ESMA.

A similar pattern is observed across currencies for LVNAVs (RA.23 MMFs with low WLAs experienced higher outflows than MMFs with high WLAs).

RA.23
MMF flows
Outflows correlated with low WLAs



Note: Change in assets between 4 March and 30 March, in % of NAV. MMFs are split based on WLA lagged by one day. Sources: Crane, ESMA.

The role of Credit Ratings Agencies

The methodology used by CRAs can have an impact on MMF managers. As explained previously, rated MMFs might be restricted to investing only in instruments rated by CRAs. In addition, CRA methodologies for MMF could potentially limit fund managers' flexibility. For LVNAVs, the MMFR provides that if the NAV

¹⁰⁴ As a robustness check, we also grouped MMFs based on their WLA levels before the COVID-19 crisis (January 2020). The analysis yields similar results.

deviation is higher than 20 bps then the fund must convert to VNAV. Such a conversion might trigger a downgrade from AAmmf. For example, if the NAV deviation were higher than 25 bps, S&P would downgrade the fund from AAmmf. For other CRAs, the switch to VNAV might not trigger a downgrade on its own, but only if it were coupled with outflows and liquidity issues⁽¹⁰⁵⁾. Finally, for the three CRAs, the use of redemption fees or gates would automatically trigger a downgrade.

Investor behaviour

Investors typically use MMFs as cash management vehicles. Excess cash can be invested in MMFs rather than bank deposits, as MMFs offer higher yields thanks to their exposures to short-term instruments. In addition, either because MMFs offer a stable NAV or because VNAV MMFs have had historically very low levels of volatility (Benhami and Le Moign, 2018), investors might still consider MMFs cash-like instruments, despite regulatory reforms.

In that context, when faced with liquidity needs, investors will redeem their MMF shares. When such liquidity shocks are idiosyncratic or temporary because of seasonality factors (end-of-quarter or end-of-year redemptions), MMFs should not face particular challenges. However, when investors are affected by a large symmetric liquidity shock, as witnessed in March 2020, MMFs will face simultaneous large redemptions by multiple investors. In addition, in the EU, MMF shares are almost exclusively held by institutional investors (unlike in the US where retail MMFs are sizeable), and such types of investors tend to redeem more quickly than retail investors (Cipriani and La Spada, 2020), implying higher risks for EU MMFs.

Conclusion

MMFs are an integral part of the EU financial system, as they provide maturity and liquidity transformation. However, despite important regulatory reforms, the COVID-19 crisis has shown that vulnerabilities remain. The evidence related to these vulnerabilities presented in this article can serve as input to the currently ongoing discussions on MMF regulatory reforms.

On the asset side, EU MMFs have a very large market footprint in short-term private markets with limited liquidity. MMFs tend to have similar exposures, implying that, in the event of a wave of redemptions, MMFs would struggle to dispose of their assets.

On the liability side, investors consider MMFs cash-like instruments and expect daily liquidity with very limited risks. Such expectations might make MMFs vulnerable to runs.

In addition, some regulatory provisions regarding liquidity management tools (such as the use of fees and gates) might create incentives for investors to redeem ahead of others, for example to avoid being subject to fees and gates. Methodologies used by CRAs could also reduce managers' flexibility, especially during times of stress, as managers may want to limit the probability of an MMF rating downgrade.

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⁽¹⁰⁵⁾ A breach of the NAV corridor would not, in itself, trigger a negative rating action but a downgrade would be likely if variable pricing led to outflows that resulted in

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Financial stability

Fund portfolio networks: a climate risk perspective

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Summary

Within the European financial sector, investment funds are more exposed to climate-sensitive economic sectors than banks, insurers and pension funds. However, few investment fund climate-related financial risk assessments have been conducted. This article provides a first attempt to fill this gap, using a data set of EUR 10.7 trillion of European investment fund portfolio holdings. Funds whose portfolios are tilted towards more polluting assets (brown funds) distribute their portfolio over a larger number of companies than funds with cleaner portfolios (green funds). This apparent diversification hides a concentration risk: brown funds are more closely connected with each other (have more similar portfolios) than green fund portfolios, which tend to 'herd' less (have less similar portfolios to those of other green funds). This suggests that widespread climate-related financial shocks are likely to disproportionately affect brown funds. A preliminary climate risk scenario exercise confirms this: besides total system-wide losses of EUR 0.5 trillion to EUR 1.3 trillion, most brown funds' losses range from about 8 % to 19 % of affected assets, in contrast to green funds' losses, which usually range from 3 % to 7 %. In addition, brown funds have more systemic impact: they contribute more to total system-wide losses (by virtue of their greater interconnections within the fund universe) than green funds. These findings provide support for ongoing EU regulatory and supervisory initiatives on sustainable finance.

Introduction

Within the European financial sector, investment funds are considered to have the largest exposure to climate-sensitive economic sectors such as utilities, transport and fossil fuel extraction (ESRB, 2020; Battiston et al., 2017). However, whereas a number of efforts have been made to conduct climate-related financial risk assessments of the European banking and insurance sectors, there has been little similar analysis of the European investment fund universe (Allen et al., 2020; Bank of England, 2015, 2018, 2019; EIOPA, 2020; ESRB, 2020). This article aims to help fill this gap, based on a hitherto unexplored data set of EUR 10.7 trillion of European investment funds' portfolio holdings of approximately 14 million direct and indirect

exposures to equity and corporate bond instruments.

This article applies a network perspective to investment funds' exposures to climate (transition) risk⁽¹⁰⁶⁾. Such a perspective could be critical when considering financial stability, because:

- In addition to buying equities, corporate bonds, sovereign debt and other such assets, investment funds can also invest in other funds, which themselves have exposures to climate-sensitive sectors. It is necessary to look through these exposures in order to 'unpack' the indirect exposure of investment funds to climate risks, via their holdings of other funds' shares.

⁽¹⁰⁶⁾There are two generally accepted types of climate risk: physical risk and transition risk. Physical risk relates to either event-driven (e.g. floods) or longer-term (e.g. sustained higher temperatures) developments that either cause direct damage to organisations' assets or indirectly affect their operating environment (e.g. supply chains). Transition risk relates to the financial and

reputational risks faced by legal entities as part of the extensive policy, legal, technological and market changes that arise to address the efforts required to mitigate and adapt to climate change. See TCFD (2017) for further discussion. This article focuses on transition risk.

- The extent to which climate risk shocks affect multiple funds at the same time depends on how similar their portfolios are (i.e. how dense are the interconnections between investment funds).

Using this approach and data set, the article aims to answer the following questions:

- How can we measure and compare investment fund portfolios, from a climate risk perspective?
- What methods exist to assess the density of the network of fund portfolio holdings, and how can these methods shed light on investment funds' relative (and joint) vulnerability to future climate-related financial shocks?
- Given a set of climate risk scenarios, which funds suffer the greatest asset losses, and what are key areas of focus for supervisors and policymakers as a result of this exercise?

This work forms part of ESMA's strategy on sustainable finance (ESMA, 2020) and reflects ESMA's growing focus on sustainable finance-related topics, in line with the recently revised ESMA Regulation⁽¹⁰⁷⁾. ESMA aims to continue expanding its efforts in the area of sustainable finance and investment funds in the coming years, including on climate risk stress testing.

The remaining sections describe the data set employed, approaches to measure investment portfolios from a climate risk perspective, the network-based analysis of investment fund holdings, a description and results of the asset valuation exercise, and implications and next steps.

Data set and methodology

The data set includes the following:

- detailed (ISIN-level) portfolio holdings data for EU-domiciled investment funds, obtained from a commercial provider;
- additional descriptive fund information, such as inception date and investment strategy; and

- information on the firms issuing the assets held by these funds, such as CO₂-equivalent emissions, revenue and country of domicile.

Portfolios from 23 965 EU-domiciled investment funds have been recovered, covering the most recent data available for each fund at the time of analysis (4Q20) – one share class per fund. Table RA.1 below provides further details on the size and magnitude of the data set: a total of EUR 10.7 trillion of investments are included, spread out over 3.3 million positions. This compares with roughly EUR 15.7 trillion net assets among EU UCITS and AIFs at the end of 1Q20 (EFAMA, 2020)⁽¹⁰⁸⁾. This suggests that the present data set is sufficiently representative of the EU investment fund sector overall.

RA.1

Portfolio holdings data set description

EU fund portfolio holdings by asset type

Asset type	Number of investments (thousands)	Value of investments (bn EUR)
Equities	1 377	4 819
Corporate bonds	867	1 721
Funds	128	1 328
Government/supranational debt	302	1 263
Cash and cash equivalents	214	1 020
Structured finance	79	216
Real estate	53	142
Derivatives	266	106
Other	43	71
Commodities	1	1
Total	3 330	10 685

Note: 'Cash equivalents' comprises commercial paper, time deposits, certificates of deposit, and cash set aside to offset forwards, options, repurchase agreements, swaps or futures. 'Derivatives' comprises futures, forwards, swaps, options and CfDs. 'Other' comprises bank loans, infrastructure assets, 'Other assets and liabilities', and 'Undefined'.

Sources: Morningstar, Refinitiv, ESMA.

As further shown in Table RA.1 above, the largest investment positions held by funds are equities (c. EUR 4.8tn), and corporate bonds (c. EUR 1.7tn), which are spread over 21 122 unique companies (located anywhere in the world). Holdings of shares issued by other investment funds (either UCITS or AIFs) make up

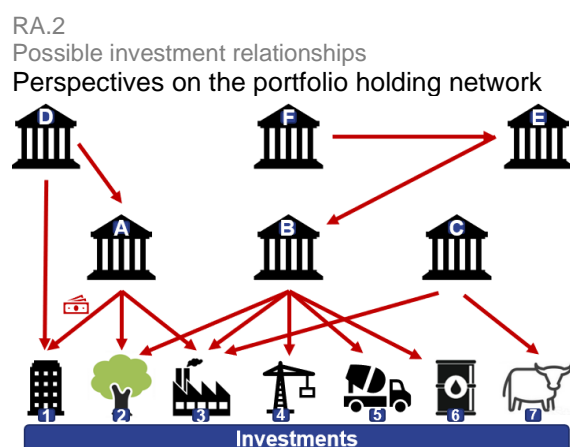
⁽¹⁰⁷⁾ Regulation (EU) No 1095/2010.

⁽¹⁰⁸⁾ Out of these 23 965 funds, 18 754 are classified as UCITS according to the commercial data provider, with total assets worth roughly EUR 7.7 trillion. Using ESMA supervisory AIFMD data, a further 1 585 AIFs can be identified, with assets worth EUR 0.45 trillion. This leaves 3 626 funds in the data sample, with EUR 2.6 trillion of assets, that could either be UCITS or AIFs but could not be explicitly classified. These figures compare with EUR 9.4 trillion and EUR 6.2 trillion net

assets for EU UCITS and EU AIFs overall, according to EFAMA statistics. From another perspective, there are 21 780 actively managed funds with total portfolio assets worth EUR 9.2tn, 2 149 passively managed funds with assets worth EUR 1.5tn, and a small number of funds (36, total assets worth c. EUR 0.01tn) that cannot be classified. In this article we do not distinguish between ETFs and non-ETFs, or between actively and passively managed funds, although this is a potential avenue for future research.

the third largest asset class by value (c. EUR 1.3tn, spread out over 12 609 funds)⁽¹⁰⁹⁾. Sovereign and supranational debt instruments, and cash holdings make up the largest remaining categories of investment positions. For the purposes of this article, the focus is on holdings of equities, corporate bonds and lastly shares issued by other investment funds.

Chart RA.2 below demonstrates some of the relationships that can exist between investment funds: Funds A, B and C invest directly in downstream entities 1 to 7. Fund D invests in Fund A and also directly in entity 1, and thus Fund D has both direct and indirect exposures to entity 1, as well as purely indirect exposures to entities 2 and 3. Elsewhere, Fund E, via its investment in Fund B, has indirect exposure to assets 2 to 6. Lastly, Fund F is one step further removed but still can be said to have indirect exposure to assets 2 to 6, via its sole exposure to Fund E.



Source: ESMA.

Unpacking this investment network, for example by substituting Fund D's shares in Fund A with the downstream assets held by Fund A (assets 1 to 3), enables a full overview of exposures to climate-sensitive assets. Doing so creates a further 12 million indirect exposures to equity and corporate bond instruments, worth an extra EUR 0.8 trillion⁽¹¹⁰⁾. After various data-cleaning

and consistency checks, the unpacked data set, which is used throughout this article unless otherwise noted, amounts to approximately 14 million equity and corporate bond holdings, worth a total of EUR 6.8 trillion. Useful descriptive variables are merged with this information, such as the fund's inception date, parent entity and domicile.

Next, we merge in the latest available (from Refinitiv) issuer information for the equity and/or corporate bonds held by the investment funds. Variables retrieved include total assets, revenue (earnings before interest, taxes, depreciation and amortisation (EBITDA)), and economic sector (Statistical Classification of Economic Activities in the European Community (NACE) four-digit). One key variable is firm emissions: total CO₂ and CO₂-equivalent emissions are included (i.e. CO₂ plus methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorinated compounds (PFCs), sulphur hexafluoride (SF₆) and nitrogen trifluoride (NF₃)). We include both direct emissions and emissions arising from the generation of energy purchased by the firm (i.e. scope 1 and 2 emissions). The data source is the firm's regulatory filings or, where not available, an estimate based on either past filings or the firm's relative position in its industry (Refinitiv, 2019)⁽¹¹¹⁾. A total of 81 % of equity and corporate bond holdings are associated with emissions data.

Table RA.3 below summarises this information for the most polluting sectors (measured by total emissions vs total revenue)⁽¹¹²⁾. The sectors displayed match well with expectations (Ge and Friedrich, 2020). For example, the 90 firms that 'Manufacture other non-metallic mineral products' constitute the most environmentally damaging economic sector within the sample.

⁽¹⁰⁹⁾The constituents of certain ETFs and some indices are not always available. This is relevant to the 'unpacked' network discussed in the subsequent paragraphs (and affects 4 % of the fund-to-fund exposures).

⁽¹¹⁰⁾Some funds in the sample do not invest in any equity or corporate bond instruments. This is why the additional euro investment values from the unpacked data set do not match the total value of fund investments in Table RA.1.

⁽¹¹¹⁾Although emissions data are subject to data provider-specific issues, and are not entirely standardised (see

Kalesnik et al., 2020), this represents a preliminary exercise that can subsequently be updated in future years once more robust and supervised data are available.

⁽¹¹²⁾The corresponding five least polluting sectors are (beginning with the most polluting) advertising and market research; activities auxiliary to financial services and insurance activities; insurance, re-insurance and pension funding; public administration and defence; and forestry and logging.

RA.3

Breakdown of downstream assets by economic sector
Top five most polluting economic sectors

Sector	Carbon footprint	Number of firms in sector	Total investments per sector (bn EUR)
Manufacture of other non-metallic mineral products	17 639	90	27
Manufacture of basic metals	16 541	115	22
Utilities	10 273	223	946
Air transport	6 186	58	18
Waste management	5 195	25	21
All equity and corporate bond holdings	2 126	7 071	6 601

Note: Carbon footprint is measured as total emissions (CO₂-equivalent, tonnes) divided by total revenue (EBITDA, million EUR) across unique firms in the sector (using only firms for which at least one equity or corporate bond position is held in the portfolio holdings data set, and for which both emissions and revenue figure are available). We use total CO₂ and CO₂-equivalent emissions. Both direct emissions and emissions arising from the generation of energy purchased by the company (i.e. scope 2 emissions) are included. 'Total investments per sector' refers to total equity and corporate bond positions held in that sector by EU investment funds in the portfolio holdings data set (bn EUR).
Sources: Morningstar, Refinitiv, ESMA.

Comparing fund portfolios from a climate perspective

This section discusses measures by which fund portfolios can be assessed from a climate risk perspective. One simple method is to examine the share of portfolio exposures to firms that are deemed to be 'green' or 'brown'. To do this, we classify firms into four categories:

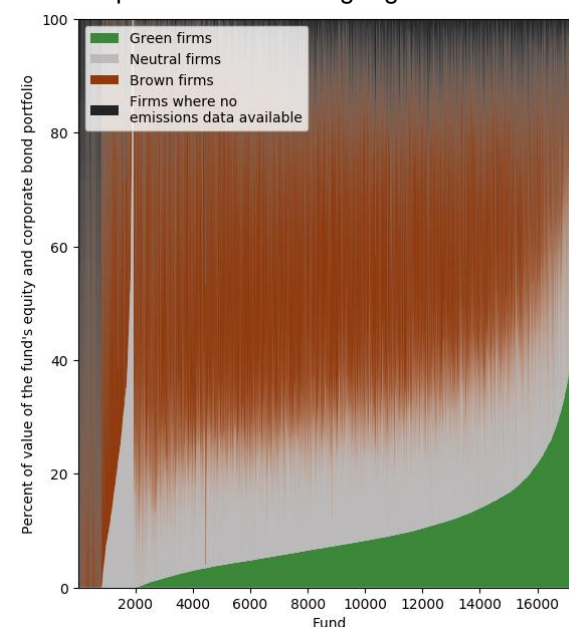
- firms whose emissions are below the bottom third (33rd percentile) of all firms in the data sample (i.e. 'green' firms);
- firms whose emissions are greater than or equal to the top third (67th percentile) of all firms (i.e. 'brown' firms);
- firms whose emissions lie between these groups (i.e. 'neutral' firms);
- firms missing emissions information.

Chart RA.4 below displays these respective shares, and shows that many fund portfolios underweight green firms. In other words, the share of EU funds' equity and corporate bond investments in green firms is lower than 33 % of the value of their portfolio ⁽¹¹³⁾ (the mean share of

portfolio holdings in green firms, across all funds in the sample, is 11 % and the median is 8 %). In addition, many fund portfolios overweight brown firms. That is, the share of exposures to brown firms tends to be greater than 33 % (the mean and median shares are 55 % and 57 %).

RA.4

Share of portfolios in green vs brown firms
EU fund portfolios underweight green firms



Note: The chart displays the percentage (in terms of value) of each individual fund's equity and corporate bond portfolio (y-axis) that is allocated to firms classified according to their portfolio emissions. Portfolio percentage exposures are split into the following four categories: firms whose emissions are below the 33rd percentile for the data sample ('green' firms); firms whose emissions are greater than or equal to the 67th percentile ('brown' firms); firms whose emissions are in between these groups (i.e. the 33rd percentile and the 67th percentile; 'neutral' firms); and also firms for which no emissions information is available. The x-axis denotes individual funds, sorted according to the percentage of exposures to green firms in the portfolio (from lowest to highest share).

Sources: Morningstar, Refinitiv, ESMA.

No distinction (tolerance) is made in terms of whether a firm belongs to a particularly polluting sector ⁽¹¹⁴⁾; the focus here is on the pure environmental impact of firms and the extent to which fund portfolios are exposed to these firms. Further sector-specific analyses could of course be attempted in order to provide a complementary visualisation of fund strategies; this is discussed further below.

One can also measure each fund portfolio's 'importance' from a climate risk perspective. There are several possible ways to do so, each of which has its relative advantages ⁽¹¹⁵⁾.

⁽¹¹³⁾An equal weighting would imply that the average fund's exposure to green firms is 33 % (corresponding to the 33rd percentile used to classify firms as green).

⁽¹¹⁴⁾An exception is when the emissions data are estimated

by the data provider, as discussed in the previous section.

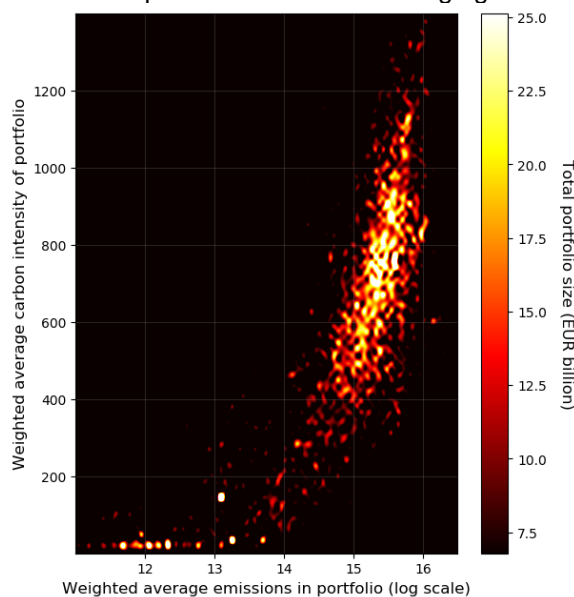
⁽¹¹⁵⁾See Raynaud et al. (2015), Swiss Sustainable Finance (2019) and World Resources Institute et al. (2015).

One approach is to take the average emissions of the portfolio, using the relative share of each investment as weights ⁽¹¹⁶⁾. The advantage of this approach is that it most accurately characterises the relative damage of the fund’s asset mix on the environment and is thus more ‘credible’ from an environmental perspective (Institut Louis Bachelier et al., 2020). Put differently, from the perspective of the planet and the climate, it is the absolute emissions that matter, not emissions normalised by other metrics (such as revenue). The impact of a higher-emitting company will be greater on the planet than that of another, possibly smaller, company.

One can also normalise each firm’s emissions by its revenue (i.e. calculate its carbon footprint) and average this across all firms in the portfolio, again weighted by each investment’s relative share ⁽¹¹⁷⁾. This measure is perhaps more closely reflective of each fund’s strategy and regulatory constraints: funds investing in firms with a high carbon footprint can be more clearly identified as less sensitive to the climate impact of their investments. In contrast, funds investing in firms with high overall emissions may simply have little choice, for example if their regulatory requirements or their investment mandate is limited to investing in investment-grade firms (which tend to be larger) or if cleaner firms issue fewer purchasable instruments.

These perspectives can be combined and also coupled with the size of each fund’s portfolio to produce an overall assessment on the most environmentally damaging fund portfolios. Chart RA.5 below demonstrates that there are many funds with high average portfolio emissions, high average portfolio carbon footprints and extremely large portfolios (exceeding EUR 20 bn). It is these funds that would appear to be of greatest supervisory interest: among EU funds, the portfolios in this subgroup hold assets with the greatest impact on the planet (i.e. high average portfolio emissions), are relatively less concerned about the impact of investing in climate-inefficient firms (i.e. high average portfolio carbon footprint) and manage the largest portfolios in the EU.

RA.5
Comparing fund portfolios across climate risk metrics
Which fund portfolios are most damaging?



Note: The x-axis is the average emissions within each fund portfolio (weighted by value of each investment position) and in log scale. The y-axis is the average carbon footprint (tonnes of CO₂-equivalent per m EUR revenue, measured as Ebitda) of investments within each fund portfolio (weighted by the value of each investment position). The colour scale (right) illustrates the total size of each fund’s portfolio, measured in bn EUR. Higher asset sizes are paler. Includes direct (scope 1) and indirect (scope 2) CO₂ and CO₂-equivalent emissions. Sources: Morningstar, Refinitiv, ESMA.

Portfolio networks: brown funds overlap strongly

The previous section considered investment funds’ portfolios from the perspective of outward environmental impact. This section and the next take the opposite perspective: the inward vulnerability of funds’ portfolios to climate-related financial risks. Assessing these risks requires the interconnections between funds to be explored. This is because the impact and spread of climate-related financial shocks will depend on:

- how many (and how much ⁽¹¹⁸⁾) investment funds are directly investing in the affected firms; and
- subsequently, how many upstream funds are indirectly exposed to firms via their holdings of shares in intermediate funds (see Chart RA.2 above).

⁽¹¹⁶⁾ This is calculated as $\sum_{i=1}^N \left(\frac{\text{current value of investment}_i}{\text{current portfolio value}} \times \text{company CO}_2 \text{ emissions}_i \right)$.

⁽¹¹⁷⁾ This is calculated as

$\sum_{i=1}^N \left(\frac{\text{current value of investment}_i}{\text{current portfolio value}} \times \frac{\text{company CO}_2 \text{ emissions}_i}{\text{company EUR revenue}_i} \right)$.

⁽¹¹⁸⁾ See previous section.

Measuring funds exposed to firms

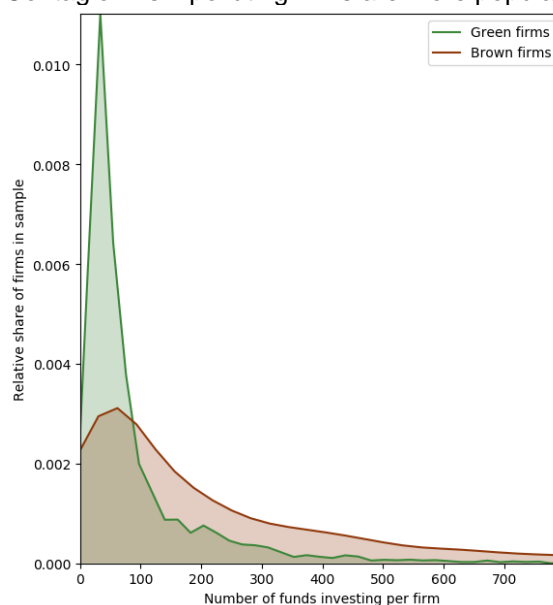
To better understand the first of these two risk drivers, Chart RA.6 compares the distribution of the number of fund investments per firm, for green firms and brown firms (see previous section for a description of this grouping). The green (brown) line displays the distribution of the number of fund investments in green (brown) firms. The number of fund investments shown is normalised, and represents the share in the total investments in the fund data set that is captured by each firm ⁽¹¹⁹⁾.

It is clear from Chart RA.6 that fewer funds invest in the same green firm (i.e. the green line is peaked). Put differently, more funds invest in each brown firm than in each green firm, as reflected in the heavier tail of the brown line – about four times more on average ⁽¹²⁰⁾. From the perspective of the issuers (i.e. brown and green firms), this suggests that brown firms are less vulnerable to liquidity risks than green firms ⁽¹²¹⁾.

Taking the fund perspective, however, if climate-related financial risks affect brown firms more than green firms (discussed further below), then this indicates that climate-related shocks will affect more funds than in the opposite situation (i.e. more funds invest in each green firm than in each brown firm). This provides a first indication of how a climate-related shock would be distributed across the fund universe.

RA.6

Comparing the number of fund investments per firm
Contagion risk: polluting firms are more popular



Note: The lines represent the distribution of the number of funds directly investing in each firm (relative to total number of investments, i.e. the normalised degree of each firm), for firms that are in the bottom third in terms of emissions ('green' firms) or in the top third ('brown' firms). Emissions are of total CO₂ and CO₂-equivalent emissions including direct (scope 1) and indirect (scope 2) emissions. The two distributions are different with at least 97 % confidence according to a two-sample Kolmogorov–Smirnov test. Distributions are truncated at the 90th percentile for ease of visualisation.

Sources: Morningstar, Refinitiv, ESMA.

Measuring fund portfolio similarity

Another perspective on interconnections is the similarity of investment fund portfolios. This is complementary to the firm-centric perspective of the preceding subsection: the fact that more polluting companies attract investments from a greater number of funds does not indicate whether funds are investing in the **same** companies ⁽¹²²⁾. The greater the extent of co-investment (i.e. portfolio similarity), the greater the potential for large climate-related (and other) financial shocks to propagate across the network (Acemoglu et al., 2015 ⁽¹²³⁾) and for second-round effects across funds (Georg et al., 2020).

⁽¹¹⁹⁾Formally, this is the degree of each downstream firm normalised by the total network degree. Only direct fund investments in firms are included (i.e. the network degree only reflects fund-to-firm connections).

⁽¹²⁰⁾A green firm can expect to sell its equity and/or bond instruments to 85 EU funds on average (median: 38 funds), whereas a brown firm will attract investments from 314 EU funds on average (median: 138 funds).

⁽¹²¹⁾There may also be structural reasons for this situation, however: insofar as emissions are linked with the size of a firm, and if there are minimum denominations for issuances of financial instruments (especially corporate bonds), then green firms may be able to sell their liabilities to fewer funds and other financial market

participants than brown firms.

⁽¹²²⁾To take an extreme case, each investment fund could be choosing to invest its entire portfolio in a single company, which would imply very little portfolio overlap across funds. Alternatively, each fund could invest a small amount in each firm in the universe, which would imply that there is a perfect overlap across all fund portfolios.

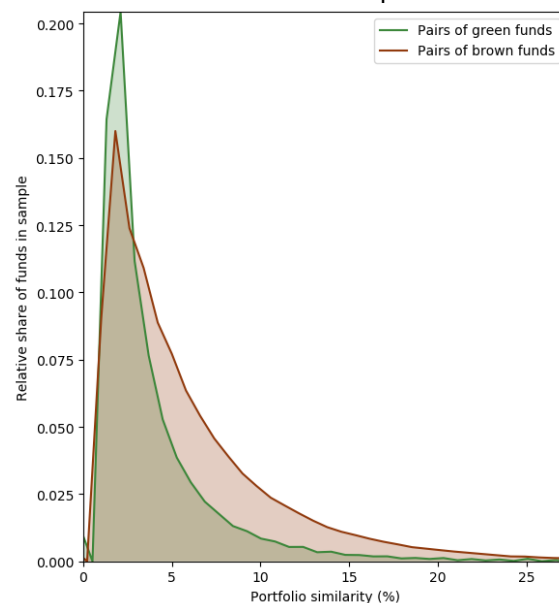
⁽¹²³⁾As explained by Acemoglu et al. (2015), for large negative shocks (as is likely to be the case for climate risk), a more interconnected network is a source of fragility: 'beyond a certain point, dense interconnections serve as a mechanism for the propagation of shocks, leading to a more fragile financial system'.

There are numerous ways in which portfolio similarity can be calculated. In this article, we consider the value of investments held in common across two funds' portfolios, divided by the joint total portfolio value of the pair of funds⁽¹²⁴⁾. This measure indicates the extent to which funds are co-investing relative to the amount that they could have, given their combined portfolios⁽¹²⁵⁾.

We then examine if there are meaningful differences in portfolio similarity between pairs of funds whose portfolios are both in the lowest third ('pairs of green funds') in terms of weighted average emissions across the universe of fund portfolios, and pairs of funds whose portfolios are both in the highest third ('pairs of brown funds'). Thus, we explore whether brown fund portfolios have more in common with each other than green fund portfolios have in common with each other. If this is the case, then brown funds will be jointly affected (i.e. suffer in a coordinated way) following climate-related financial shocks, relative to the positions among green funds.

Chart RA.7 below compares the distribution in portfolio similarity across pairs of green fund portfolios (green line) with the corresponding distribution for pairs of brown fund portfolios (brown line). It is clear that brown fund portfolios are often more similar to each other than green fund portfolios are similar to each other. This suggests greater concentration risks existing across funds whose portfolios contain more-polluting assets⁽¹²⁶⁾.

RA.7
Extent of overlapping portfolios across pairs of funds
Brown funds have more similar portfolios



Note: The lines represent the distribution of portfolio similarity across pairs of investment funds (in %). Two sets of pairs are shown: pairs of funds each of whose portfolios are in the bottom third in terms of weighted average emissions ('pairs of green funds') and pairs of funds whose portfolios rank in the top third in terms of weighted average emissions ('pairs of brown funds'), based on the fund portfolio holdings data set. Portfolio similarity is expressed as the value of common investments between each pair of funds, normalised by the joint total portfolio value of the pair of funds. Emissions are CO₂ and CO₂-equivalent emissions (scopes 1 and 2 included). The two distributions are different with at least 99 % confidence according to a two-sample Kolmogorov–Smirnov test.

Sources: Morningstar, Refinitiv, ESMA.

Visualising the fund portfolio network

As discussed above, portfolio similarities can be represented as interconnections between funds, due to common assets held. Chart RA.8 below visualises the largest portfolio similarities in the fund universe, using the emissions-based fund

⁽¹²⁴⁾For two funds, A and B: Fund A invests EUR 100 each in firms P and Q; Fund B invests EUR 60 each in firms Q, R and S. The portfolio similarity between Funds A and B is then $42\% = (100 + 60) / (100 + 100 + 60 + 60 + 60)$.

⁽¹²⁵⁾Many other similarity measures exist, which often begin from the number of investments held in common across two funds' portfolios. These are then divided by the total investment universe, by the minimum number of investments across the two portfolios or by the total investment universe considered by either the two funds. Formally, these are all the projection of the bipartite network of fund portfolio holdings onto the specified nodes (i.e. funds), with various weights corresponding to the neighbourhoods of the two funds in the original bipartite network. See Borgatti and Halgin (2016). The number of common investments by the two funds can also be normalised by all of the investments that each firm receives from all funds (i.e. not just the pair of funds under consideration), added up across all the companies in the funds' overlapping portfolios. See Newman (2001). The results in this section are robust to all of these other similarity measures (results

available upon request). Other similarity approaches could be considered, e.g. cosine similarity or Euclidean distance (Girardi et al., 2020; Georg et al., 2020).

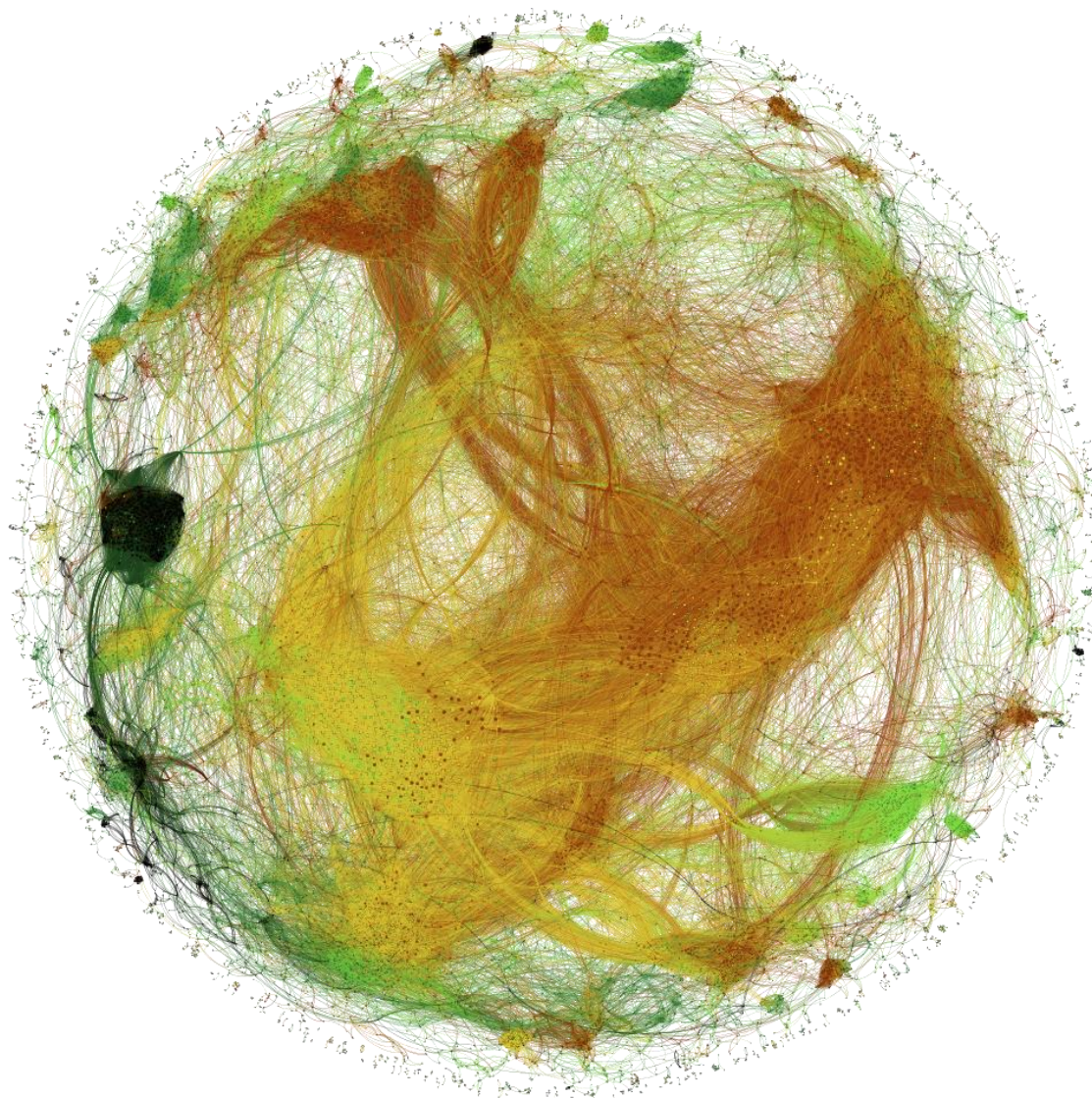
⁽¹²⁶⁾The number of available pairs is also indicative of relative concentration among fund portfolios: there are approximately 2.6 million interconnections (i.e. overlapping fund portfolios) among green funds, and about 5.1 million pairs of overlapping portfolios among brown funds (out of approximately 32 million portfolio overlaps between all funds in the universe). This is meaningful because, at the start of the exercise, the fund population was segmented into equal thirds. Despite starting from an even split of funds in the universe, there appear to be roughly twice as many interconnections between brown funds as between green funds. This also suggests a greater relative concentration of investments among brown funds and, therefore, a greater risk of funds' portfolios co-moving, following a climate-related financial shock, than funds whose portfolios are oriented towards less-polluting assets.

grouping discussed above (funds are grouped into quartiles here, rather than terciles, for ease of visualisation). The location of funds in the graph reflects the strength of their relationships, i.e. how much their portfolios overlap. Thus, colour clouds indicate clusters of funds that collectively invest in similar assets. In addition, it is important to recall that funds have no obligation to invest in one or more of the same firms, and if

two funds do not have any investments in common they will not appear in this graph. Therefore, the presence of colour is itself a sign that interconnections exist (i.e. more of a particular colour in the overall graph implies more interconnections).

RA.8

Visualising the investment funds portfolio universe, categorised by extent of average portfolio emissions
Funds with more polluting portfolios have greater interconnections (i.e. greater portfolio similarity)



Note: The chart displays the 0.5 % largest portfolio overlaps among EU investment fund portfolios. Portfolio overlap/similarity is measured as the number of common investments between two investment funds, normalised by the total number of firms considered by either the two funds. This portfolio similarity measure indicates how often two funds co-invest relative to the number of times that they could have, given their portfolios. Funds are segmented into five groups, based on the weighted (by value of the investment position) average emissions of their portfolios: black (no emissions data available for any firms held in the fund portfolio), dark green (fund portfolio is in the cleanest quarter of funds in the sample, i.e. the 0–25 % range in terms of weighted average emissions), light green (fund portfolio is in the next-cleanest quarter, i.e. the 25–50 % range), yellow-brown (fund portfolio is in the third quarter, i.e. the 50–75 % range) and brown (fund portfolio is in the fourth quarter, i.e. its portfolio weighted average emissions is among the top 75 % of funds in the sample). Emissions are CO₂ and CO₂-equivalent emissions (scopes 1 and 2 included).
Sources: Morningstar, Refinitiv, ESMA.

Owing to the very large sample size, only the 0.5 % largest portfolio similarities can be displayed (the full sample is shown in a simplified form in RA.7). Nevertheless, the following is clear.

- Brown funds (most-polluting portfolios) and yellow-brown funds (next most-polluting) have many more interconnections (i.e. portfolio overlaps) than dark green funds (cleanest portfolios) and light green funds (next cleanest). Put differently, green funds invest in different green firms, whereas brown fund portfolios tend to invest in many of the same brown firms. This can be seen by the fact that there is more yellow-brown and brown colour in the graph than there is light and dark green.
- Green funds are, by virtue of not being clustered so tightly together, located on the periphery of the investment fund universe. Thus, green funds are less likely than brown funds to play a central connecting role (i.e. hubs) within the fund universe. In addition to the above visual interpretation, this is also confirmed statistically: green funds are consistently less likely than brown and yellow-brown funds to act as ‘connectors’ among funds in the network ⁽¹²⁷⁾.
- Many funds for which no emissions information is available for any firm in their portfolio (i.e. funds coloured in black in Chart RA.8 above, which are highly clustered to the left) tend to have highly similar portfolios. This suggests both that some firms consistently do not disclose emissions information and that a key set of funds are only interested in these firms. This observation illustrates how network visualisation can assist supervisors to identify priorities for potential supervisory action. It also suggests that climate-related disclosures by a relatively limited set of firms appear to be a priority in the light of the degree of concentration of investments in these firms.
- Two shifts may be desirable to obtain a ‘balanced’ network. First, brown funds should diversify away from the same assets. Second, green funds should co-invest more, and thus,

perhaps, provide lower-emission firms with more broad-based and stable funding.

This section has shown that green funds tend to be overweight in idiosyncratic risks relative to brown funds, which in contrast are more exposed to climate-related systemic risks (by virtue of their greater portfolio overlap) than green funds. The next section quantifies the implications of these observations using some climate-related financial scenarios.

Risk outlook: clean funds better protected

This section now outlines the impact of several possible forward-looking climate scenarios on investment fund assets, in order to provide some early-stage evidence to support the previous sections. There are many caveats associated with this work, including the fact that translating climate risk into financial shocks has only recently begun to be explored in earnest, and that gaps remain in terms of scope, transmission channels and data coverage (Vermeulen et al., 2018; ESRB, 2020; NGFS, 2020).

Recent and ongoing work by the ESRB (see ESRB, 2020, which draws on scenarios developed by Vermeulen et al., 2018 ⁽¹²⁸⁾) has focused on transition risks for the EU banking and insurance financial sectors. Two shocks underpin the scenario. The first is a policy shock: following a delay in implementation, there is an abrupt shift in policymaking activity and a set of stringent policy measures enter into force, whose goal is to mitigate the adverse impact of climate change. In this situation, the carbon price is assumed to rise globally by USD 100 per ton ⁽¹²⁹⁾.

The second driver, a technology shock, is linked with technological breakthroughs that manage to lower CO₂ emissions but, in doing so, lead to dramatic revaluations across economic sectors (also implying defaults and write-offs of carbon-intensive assets). This second driver has relatively more benign effects on the macroeconomy insofar as the assumed doubling in the share of renewable energy leads only to a temporary economic slowdown (driven by old-

⁽¹²⁷⁾In other words, green funds have consistently lower betweenness than brown funds. Betweenness is the fraction of the shortest paths between any two funds (s,t) in the portfolio holdings network that pass through that particular fund, relative to all of the shortest paths between two funds (s,t). In other words, what is the proportion of times that our fund of interest acts (through the overlap of its portfolio with those of other

funds) as a bridge between any two funds (s,t) in the network? Results are available upon request.

⁽¹²⁸⁾The author would like to thank Vermeulen and colleagues for sharing detailed scenario information.

⁽¹²⁹⁾The resulting cost increase leads to a general economic slowdown, while interest rates rise as the central bank attempts to curb inflation. See Vermeulen et al. (2018) for further details.

technology industries that suffer asset losses), before the newly available technologies help support a return to economic growth.

Four scenarios are developed that relate to these two shocks, including one scenario (confidence shock) in which the absence of both shocks triggers a drop in the confidence of consumers, businesses and investors. The other three scenarios are the policy shock, the technology shock and a combination of both. Each scenario is represented relative to a baseline where non-disruptive policies are adopted.

The scenarios employed cover a time horizon of 5 years, which is admittedly short from the perspective of long-term climate change risks. As a result, the scenarios ignore second-round effects in terms of the interplay between energy transition risks and climate change. Nevertheless, the shorter time horizon works well from the perspective of investment fund assets, which are relatively short-term, in contrast to longer-term exposures such as bank loans or life insurance policies. The horizon is also long enough to allow an abstraction from the more typical concerns faced when simulating stressful situations for investment funds, including liability-side measures such as lock-out periods and other liquidity management tools (ESMA, 2019).

These scenarios are sector-specific, and cover 88 individual NACE sectors (56 unique sectors). Asset write-downs for equity and corporate bond instruments can be assessed, by linking macroeconomic conditions to their exposure to carbon prices (via CO₂ emissions). Therefore, the magnitude of the asset valuation impact varies depending on the economic sector in which a company is operating (i.e. depending on that sector's exposure to the type of climate risk being modelled). The sectors most affected by the abrupt policy adjustment (electricity, gas and steam production) are different from those that are worst hit by asymmetric technological change (mining and quarrying, and certain manufacturing activities). Moreover, as mentioned previously, certain manufacturing sectors would actually observe improving equity valuations (up to 22 %).

Table RA.9 below illustrates the (weighted) average asset write-downs across investment fund holdings of equities and corporate bonds for the different scenarios, and also presents total asset reductions in absolute and relative terms. This scenario valuation exercise includes 20 937 EU fund portfolios. Depending upon the scenario, overall losses range from EUR 0.5 trillion to

EUR 1.3 trillion, or between 6.8 % and 19.4 % of fund portfolio assets included in the exercise.

RA.9

Forward-looking climate risk scenario analysis

First-round EU fund losses in each climate risk scenario

Scenario	Average asset write-downs (%)	Total losses (tn EUR)	Total losses (% of fund assets included)
Policy shock	13.7	0.9	13.4
Tech shock	6.9	0.5	6.8
Policy + tech shock	19.8	1.3	19.4
Confidence shock	8.6	0.6	8.4

Note: Application of energy transition risk asset valuation scenarios to EU fund equity holdings, based on scenarios developed by Vermeulen et al. (2018) and employed by ESRB (2020). Average write-downs are weighed by total value of investments used in the asset valuation exercise. Percentages are expressed in terms of total portfolio holdings of equity, corporate bonds and shares issued by other investment funds. Indirect holdings are also included, i.e. we record losses on fund investments in other funds that are exposed to markdowns in asset values. The UK and the Channel Islands are included in this sample.

Sources: ESRB (2020) Vermeulen et al. (2018), Morningstar, Refinitiv, ESMA.

The impacts below are a lower bound for the potential losses faced by EU investment funds under these scenarios. First, because only EU funds are included in this exercise, indirect losses from EU fund holdings of non-EU funds that themselves invest in EU equities and corporate bonds are not included. Second, the constituents of certain ETFs and other benchmarks that are popular with investment funds are not included in the data set.

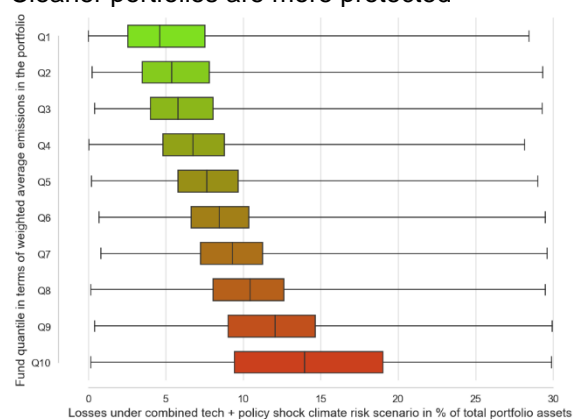
Percentage losses relative to total assets can vary significantly across investment funds. Furthermore, since the economic sector-specific stress impacts are calibrated according to the embodied CO₂ emissions in that industry, a fund with relatively greater exposure to CO₂-intensive industries suffers greater losses than a relatively less-exposed fund, all else being equal.

Chart RA.10 below presents the distribution of losses across funds under the most severe scenario: the combined policy and tech shock. Investment funds have been grouped into deciles, based on their respective weighted average (CO₂-equivalent) emissions per portfolio. Funds in the lowest decile in terms of emissions are denoted Q1 and are coloured green; funds in the highest decile are denoted Q10 and coloured red/brown.

RA.10

Forward-looking climate risk scenario analysis

Cleaner portfolios are more protected



Note: Application of energy transition risk asset valuation scenarios to EU fund equity and corporate bond holdings, based on the combined tech and policy shock scenarios developed by the DNB (2018) and employed by the ESRB (2020). Each set of distributions displays the range of losses, as a percentage of total portfolio holdings of equity, corporate bonds and shares issued by other investment funds, for funds within the respective quantile (quantiles determined based on each fund's average emissions per investment, weighted by value of each investment position) across funds recorded as domiciled in Europe. Emissions are recorded as CO₂ and CO₂-equivalent emissions (scopes 1 and 2). The vertical black line in each box shows the median percentage loss for funds in that emissions quantile. Box edges are the 25th and 75th percentiles of the fund losses for funds in that emission quantile, and additional lines ('whiskers') illustrate the percentage losses that are either below the 25th or above the 75th percentiles for funds in that emissions quantile, reaching to the 10th and 90th percentiles. Indirect holdings are also included, i.e. we record losses on fund investments in other funds that are exposed to markdowns in asset values. The UK and the Channel Islands are included in this sample.

Sources: DNB (2018), Morningstar, Refinitiv, ESMA.

As can be seen from Chart RA.10 above, most fund losses range from 3 % to 20 % of their affected portfolio holdings. However, there is a clear difference in vulnerability to these scenarios: many funds in the lower quantiles (i.e. funds investing in less-polluting companies) often bear losses that are below 5 %. In contrast, funds in the uppermost quantiles (i.e. funds with relatively more money invested in more-polluting companies) often bear losses that exceed 10 % and sometimes rise to nearly 20 % or beyond⁽¹³⁰⁾.

It is important to disentangle losses suffered by a fund because of these shocks (the subject of Chart RA.10 above) and the systemic losses that the fund creates. The latter is possible because, as illustrated in Chart RA.2 above, a fund

transmits shocks to other funds that own its shares.

Chart RA.11 below displays the range in contribution to system-wide losses from funds grouped by different portfolio cleanliness quantiles. It is clear from this chart that the systemic impact of funds is highest where fund portfolios are oriented towards the most-polluting equities and corporate bonds (plus, indirectly, to funds owning those same equities and corporate bonds). In contrast, funds in the cleanest, and even the middle, quantiles have relatively less system-wide impact. This provides further illustration of the intuition discussed in the previous sections: funds with the most-polluting portfolios are the most vulnerable to climate-related financial risks, and also make the greatest additional contribution to system-wide losses when those risks materialise⁽¹³¹⁾.

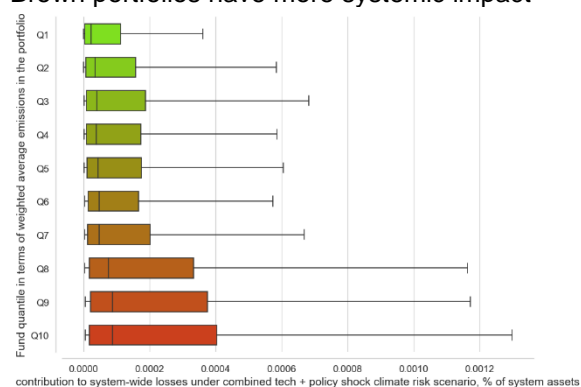
⁽¹³⁰⁾ It is clear that funds with larger exposures to the highest-emitting sectors will necessarily face the highest losses, since these losses are based on their CO₂ exposure. Chart RA.10 aims to demonstrate how large the variation is among funds, however. Chart RA.10 has been truncated to allow easier visualisation. The maximum loss under this scenario, as a share of portfolio holdings, amounts to 100 %. However, only several funds are in this extreme situation and these

can be considered outliers.

⁽¹³¹⁾ There is also evidence that older funds also make a greater systemic contribution, although this is perhaps not surprising insofar as funds that operate for a longer time are likely to become popular investment vehicles for other, more recent funds. They may also have more difficulties in adjusting their portfolios (for example, due to long-established investment mandates and client bases). This is a subject left for future research.

RA.11

Contribution of each fund to system-wide losses

Brown portfolios have more systemic impact

Note: Application of energy transition risk asset valuation scenarios to EU fund equity and corporate bond holdings, based on the combined tech and policy shock scenarios developed by the DNB (2018) and employed by the ESRB (2020). Each set of distributions displays the contribution to system-wide losses, as a percentage of total system assets included in the scenario exercise (equity, corporate bonds and shares issued by other investment funds), for funds within the respective quantile (quantiles determined based on each fund's average emissions per investment, weighted by value of each investment position) across funds recorded as domiciled in Europe. Emissions are recorded as CO₂ and CO₂-equivalent emissions (scopes 1 and 2). The vertical black line in each box shows the median percentage loss for funds in that emissions quantile. Box edges are the 25th and 75th percentiles of the fund losses for funds in that emission quantile, and additional lines ('whiskers') illustrate the percentage losses that are either below the 25th or above the 75th percentiles for funds in that emissions quantile, reaching to the 10th and 90th percentiles. Indirect holdings are also included, i.e. we record losses on fund investments in other funds that are exposed to markdowns in asset values. The UK and the Channel Islands are included in this sample.

Sources: DNB (2018), Morningstar, Refinitiv, ESMA.

This exercise represents a first methodological attempt to explore the asset valuation impacts faced by EU investment funds across potential climate risk scenarios. There are, as previously mentioned, a number of caveats and gaps that need to be addressed, so these results should be seen as preliminary, and a stepping stone towards a comprehensive stress test for climate-related risks.

Importantly, this exercise does not include second-round effects due to feedback or adaptation mechanisms such as portfolio rebalancing (although fire sales, which typically happen over a few days, appear less relevant given the 5-year time horizon). However, it is likely that, over such a long time horizon, investment funds would orient their portfolios towards assets less affected by climate-related financial risks of the type explored above. Consequently, this asset valuation exercise can be seen either as a warning sign or as an indicator of opportunities for investment funds to anticipate future trends.

Implications and next steps

The above assessment has provided initial evidence on climate-related financial vulnerabilities among EU investment funds, using a new data set available to ESMA containing detailed (ISIN-level) portfolio holdings for 23 965 funds. In particular, the analysis suggests that EU investment funds whose portfolios are tilted towards more polluting assets (brown funds) distribute their portfolio across a larger number of companies than funds with cleaner portfolios (green funds). Brown funds are also more connected with each other (have more similar portfolios), in comparison with the connections (portfolio similarities) among green funds.

These two findings suggest that climate-related financial shocks are likely to disproportionately affect brown funds. A subsequent forward-looking climate risk scenario exercise appears to confirm this; in addition to total system-wide losses of EUR 0.5 trillion to EUR 1.3 trillion, most brown funds' losses range from about 8 % to 19 % of affected assets, in contrast to green funds' losses ranging from 3 % to 7 %. In addition, brown funds have more systemic impact: they contribute more to total system-wide losses (by virtue of their greater interconnections within the fund universe) than green funds.

This exercise also has broader implications and applications, regarding how both investors and supervisors can rank and compare funds from the perspective of climate risk (in terms of both contribution to and vulnerability from climate risk). This also relates to discussions around ESG ratings for investment funds, and the need for greater fund transparency on exposure to climate-sensitive sectors (in the context of the EU Sustainable Finance Disclosure Regulation (SFDR)). Moreover, the bottom-up portfolio emissions calculations rely on reporting of emissions data from issuers of financial assets purchased by investment funds. In order for systemic risks to be adequately assessed, high-quality disclosures by downstream firms are also crucial, which relates to ongoing work to review the EU Non-Financial Reporting Directive.

ESMA will continue to work on these topics, as part of the Risk Assessment pillar of its Sustainable Finance Strategy.

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Financial stability

Fund stress simulation in the context of COVID-19

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Summary

During the COVID-19-related market stress in 1Q20, investment funds faced a significant deterioration of liquidity in some segments of the fixed income markets combined with large-scale investment outflows from investors. In May, the ESRB issued a recommendation to ESMA requesting a focused supervisory engagement with investment funds exposed to asset categories that were affected by the liquidity stress. This joint supervisory exercise between ESMA and the NCAs took the form of a data-driven assessment of the impact of the liquidity crisis on funds, and an assessment of funds' preparedness for future shocks, involving STRESI exercises under several assumptions. This article presents the results of the stress simulation: while funds have been resilient to the market stress, the fund simulation also highlights existing vulnerabilities. In its response to the ESRB, ESMA concluded that funds needed to enhance their preparedness.

Introduction

The COVID-19 related market stress in 1Q20 led to large market corrections, high volatility and a sudden increase in liquidity risk across the financial system, including in some segments of the investment fund sector. The market stress also brought out inherent valuation issues in asset markets. While the financial system has been resilient during this period, in part thanks to the actions of central banks and regulators around the world, it is prudent to assess the preparedness of the investment fund sector for further liquidity stress episodes.

Against this background, the ESRB issued a recommendation to ESMA suggesting that ESMA and the relevant NCAs across Europe undertake a focused supervisory engagement with investment funds exposed to asset categories that were affected by the liquidity stress, such as corporate debt and real estate (ESRB, 2020). The main objective of this exercise was to assess the preparedness of EU investment funds in case of a resumption of liquidity stress.

ESMA published the results of this supervisory engagement in November (ESMA, 2020). The

report includes an analysis of the impact of the liquidity crisis on funds at the onset of the COVID-19 pandemic, between 17 February and 31 March 2020. The report also contains an assessment of the current preparedness and resilience to a future shock.

This article specifically presents ESMA's (2019) assessment of the resilience of funds exposed to corporate bonds, based on ESMA's STRESI framework. In this context, the quantitative information reported by asset managers was used as input to simulate the impact of liquidity stress similar to the COVID-19 related stress in 1Q20.

Background

COVID-19 related market stress

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. Redemption demands were significant for most fund categories, with outflows of up to 4 % for bond funds and especially those exposed

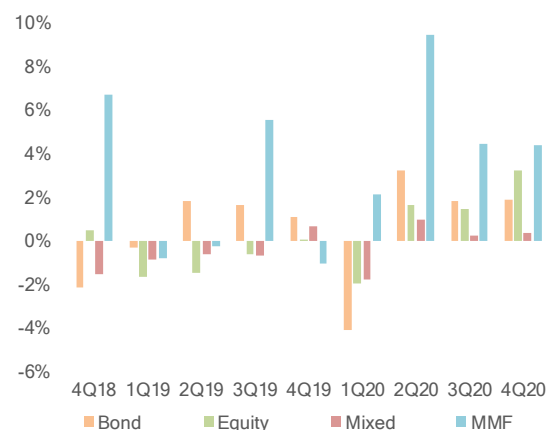
⁽¹³²⁾ This article was written by Naima Asmane-Boudali, Massimo Ferrari and Jean-Baptiste Haquin.

in less-liquid assets, such as corporate HY bonds, which faced cumulative redemptions of 5 % in a deteriorating liquidity environment.

RA.1

Fund flows

Significant outflows in 1Q20



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

As market liquidity plummeted in some segments of the fixed income markets during the market turmoil in March and April, some asset classes were subject to high valuation uncertainty. Considering the deterioration in market liquidity and rising redemption requests, asset managers used tools such as gates and swing pricing, although there is significant variation in the availability of those tools across EU jurisdictions. A small number of funds resorted to suspensions of redemptions. Suspensions of redemptions increased especially for UCITS in March, mainly for bond funds exposed to corporate bonds (around EUR 22 bn of NAV).

ESRB Recommendation on investment fund liquidity

Against this background, the ESRB Recommendation suggested focusing on two market segments.

- Bond and mixed funds with significant exposure to corporate debt: Redemption pressures from open-ended funds with short redemption periods could result in fund managers selling less-liquid assets quickly, thereby contributing to a deterioration in liquidity of the underlying assets, and adverse spillover effects on other financial institutions.

- Real estate funds: Future redemptions could contribute to downward pressure on real estate valuations if accompanied by real estate asset sales in an environment of low transaction volumes. This could have adverse implications for other financial institutions that have exposures to real estate, including those that use real estate as collateral for lending.

In response, ESMA coordinated a data collection exercise with the NCAs⁽¹³³⁾. They collected data from asset managers on the first episode of the crisis (from 17 February to 31 March 2020) and on the situation at the end of June 2020:

- quantitative information on their portfolios, their compositions by rating and asset classes, the type of asset sold to meet redemption and the liquidity profile by maturity;
- qualitative information on the use of LMTs and the difficulties encountered over the reporting period, especially regarding valuation.

To assess the resilience to future shocks, ESMA used the quantitative information collected as input to its stress simulation (STRESI) framework. Since this approach is based on the availability of high-quality liquid assets (HQLA), it was not deemed appropriate for real estate funds (while they can hold significant amounts of cash, assessing the redemption shock against this cash position only would have had less added value). Instead, ESMA used the data collected on real estate funds' portfolio liquidity profiles (i.e. percentage of the fund's portfolio that is capable of being liquidated over a certain period) and redemption profiles (i.e. the shortest period within which the invested funds could be withdrawn or investors could receive redemption payments) to assess the impact of a redemption shock on the portfolio (RA.2).

RA.2

Assessment of real estate investment funds Real estate investment funds exposed to liquidity mismatches

NCAs collected data on open-ended real estate investment funds with a threshold set EUR 500 m of AuM. In jurisdictions where more than 10 funds were above EUR 500 m of AuM, the reporting threshold was set at EUR 1 bn. The resulting sample consists in 92 real estate AIFs from 13 jurisdictions with a total of EUR 294 bn AuM, representing 31 % of the EU sector in February 2020.

⁽¹³³⁾Based on the reporting criteria, 13 NCAs reported data for

funds exposed to corporate debt.

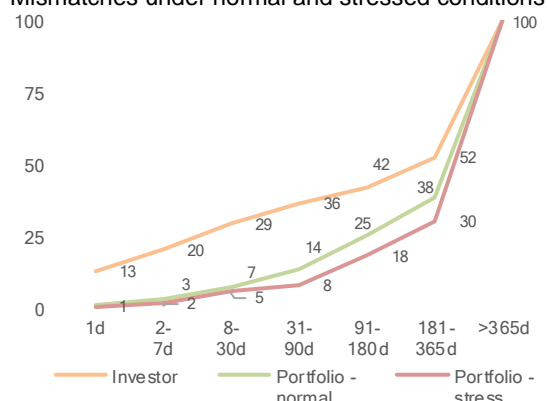
To analyse potential liquidity mismatches due to a redemption shock, managers reported data on the portfolio liquidity and the investor liquidity profiles, as defined in the AIFMD guidelines, under both normal and stressed market conditions.

- **Investor liquidity:** Managers divided the NAV of the AIF into time periods, depending on the shortest period within which the invested funds could be withdrawn or investors could receive redemption payments, taking into account gates when applicable.
- **Portfolio liquidity:** This means the percentage of the fund portfolio that can be liquidated and settled within each of the liquidity periods specified while the fund remains in compliance with its investment objective and policy, and other applicable rules, including treating remaining investors fairly.

This analysis pointed to a potential liquidity mismatch: at the aggregate level, investors can redeem up to 20 % of the NAV within a week, while less than 2 % of the assets can be liquidated within this time frame. This especially holds for real estate investment funds offering daily redemption, which should be able to redeem 38 % of their investors within 1 day on average, while less than 4 % of their portfolio can be liquidated within this timeframe. This assessment is valid under both normal and stressed conditions: owing to the illiquid nature of the assets, the difference between the normal and stressed assessments is limited overall (RA.3).

RA.3
Liquidity mismatches

Mismatches under normal and stressed conditions



Note: Investor and portfolio liquidity profiles of real estate funds, in % of NAV. Funds offering daily to annual redemptions. x-axis: time to liquidate portfolio assets (portfolio liquidity) and delay for investors to redeem their fund shares (investor liquidity); y-axis: % of fund NAV. Sources: NCAs, ESMA.

ESMA STRESI: EU funds more vulnerable

HQLA approach

The ESMA STRESI approach is to assess resilience based on liquidity buckets (RA.4). Assets in the portfolio of funds are classified in

different buckets representing different degrees of liquidity.

RA.4
STRESI HQLA
Liquidity weights by asset type

Asset type	CQS1	CQS2	CQS3 <	CQS3:
Government bonds	100	85	50	0
Corporate	85	50	50	0
Securitised	75	0	0	0
Equities	50	50	50	50
Cash	100	100	100	100

Note: CQS1 refers to AAA to AA ratings, CQS2 to A ratings, CQS3 to BBB ratings and < CQS3 any rating below BBB-. Sources: European Banking Authority, ESMA.

ESMA uses liquidity weights from the Basel Committee, according to which liquidity is based on the asset type (cash, corporate bond, equity etc.) and the credit rating, although other types of weights could be used. The HQLA measure can be applied at the security level (i.e. each security is given a liquidity weight) or by broad asset class.

When liquidity is measured through the bucketing approach, the amount of liquid assets is compared with stressed outflows through a redemption coverage ratio (RCR). If $RCR > 1$ then the fund is resilient, since it has enough liquid assets to cover the redemption shock. If $RCR < 1$, the fund needs to sell less-liquid assets to meet redemption demands from investors.

Redemption shock

ESMA and the NCAs used two sets of redemption shocks to assess the resilience of the funds in the sample. ESMA staff calibrated a redemption shock on the basis of the data collected and assumptions derived from the observation of what happened during the COVID-19 related market stress in February and March 2020. The stressed outflows used in the scenario are based on the data reported. This is the highest of:

- the historical shock based on data collected on redemption requests;
- the historical shock, defined as the highest redemption rate experienced over the period 2017–2019;
- fund redemptions between February and March 2020 as a consequence of the COVID-19-related market stress;

— the hypothetical level of redemptions assumed by fund managers in their internal stress simulation, if available.

When none of these data are available, a redemption shock of 20 % is considered. Unlike previous STRESI exercises, this takes into account gating arrangements, when applicable. For example, the redemption shock will be limited to 5 % if there is a gating arrangement that limits the redemptions accepted on the fund valuation to 5 %.

A second redemption shock scenario was defined by NCAs considering fund characteristics, such as the type and the composition of the investor base or the type of portfolio assets, or based on the comparison with other funds.

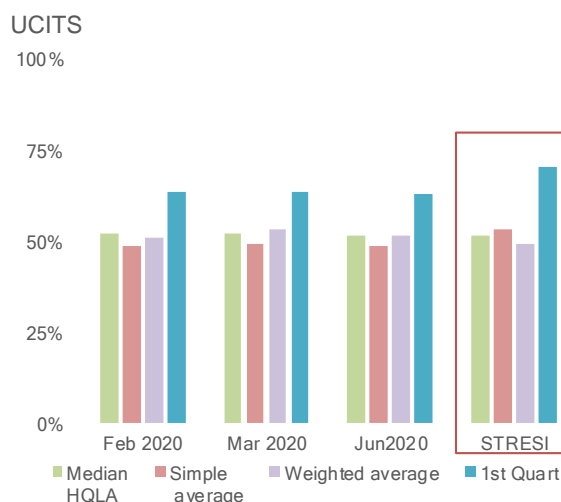
Characteristics of the sample

NCAs collected data on funds with more than EUR 1 bn of exposure to corporate debt. The resulting sample consists of 367 UCITS and 174 AIFs.

- UCITS in the sample are multi-asset funds (e.g. more than 5 % equity on average) predominantly exposed to corporate debt (68 %) with a significant proportion of BBB (19 %) and HY (20 %) corporate bonds.
- AIFs in the sample hold around 50 % of corporate debt. The proportion of HY bond holdings (5 %) was significantly smaller than that of UCITS.

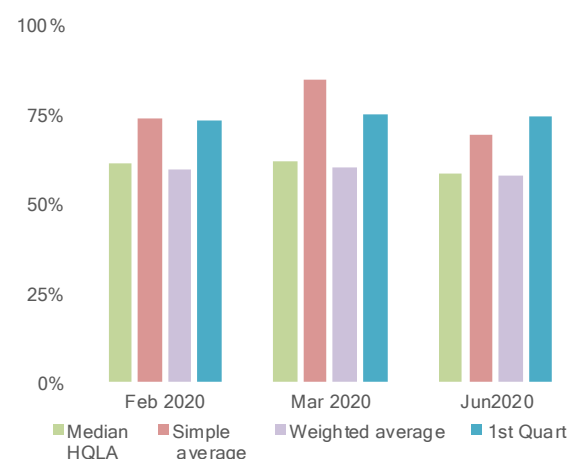
At the starting point of the simulation, in June, the level of HQLA was significantly higher in AIFs (69 %) than in UCITS (53 %). As a comparison, ESMA's 2019 STRESI report found HQLA measures above 50 % for all types of UCITS except HY and EM bond funds.

RA.5
Levels of HQLA
High levels of HQLA on average



Note: HQLA distribution of UCITS funds, in % of investment.
Sources: NCAs, ESMA.

AIFs



Note: HQLA distribution of AIFs, in % of investment.
Sources: NCAs, ESMA.

When differentiating HQLA levels by the redemption frequency of the funds in the sample, most funds analysed, and in particular funds offering daily redemptions, show HQLA levels above 50 % of the respective investments.

RA.6

HQLA vs redemption frequency (%)

Potential liquidity mismatches

Redemption frequency	HQLA			
	< 25 %	25–50 %	50–75 %	> 75 %
UCITS				
Daily	21	24	42	12
Weekly	0	0	0	—
Other	0	—	—	—
Total	21	24	42	12
AIFs				
Daily	7	16	37	18
Weekly	1	—	1	3
Fortnightly	1	—	—	—
Monthly	6	1	2	3
Quarterly	1	1	1	—
Annually	1	—	—	—
Other	—	1	1	—
Total	16	18	42	24

Note: Distribution of funds by redemption frequency, HQLA buckets and fund type, as of June 2020.
Sources: NCAs, ESMA.

Results

The average weekly redemption shock applied in this exercise by ESMA is around 22 %, while the shocks applied by NCAs varied across fund jurisdictions (27 % on average), thus reflecting NCA assessments.

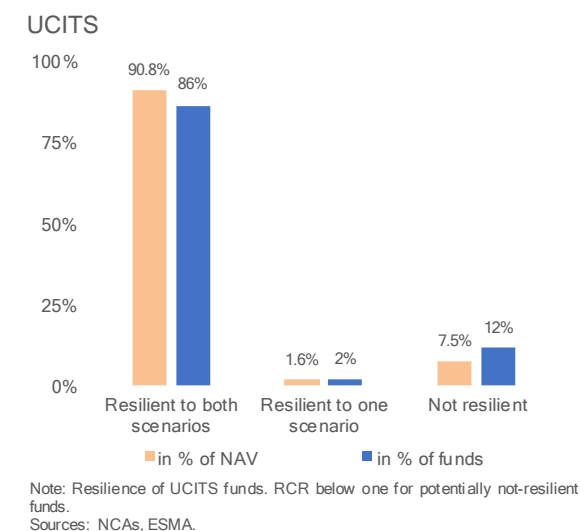
Overall, we find that more than 86 % of AIFs and 90 % of UCITS are resilient to the shocks applied in both the ESMA and the NCA scenario.

However, for UCITS the share of funds with RCR < 1 (9 % in terms of NAV) is significantly higher than in the overall results of the 2019 STRESI exercise for all bond funds categories (3 % on average) except HY funds (41 %).

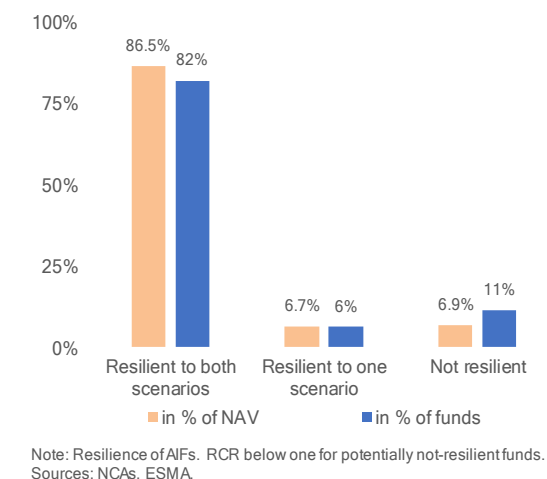
RA.7

STRESI results

Funds overall resilient



AIFs



Interpretation of the liquidation strategy

The assumption underlying the stress simulation is that the liquidity stress is so severe that the manager can only sell the most liquid assets at their market value. Based on the simulation results, 14 % of AIFs and 9 % of UCITS would have to suspend redemption or to liquid assets with a discounted price. This is known as the 'waterfall approach': assets are liquidated in descending order based on their liquidity weights. Funds use cash first to meet redemptions, then IG sovereign bonds and IG corporate bonds, and then HY bonds. However, the data collected pointed to a 'vertical slicing' approach, with funds saving cash on average and maintaining the composition of their portfolio by selling assets pro rata (RA.8).

RA.8

Liquidation strategy

Evidence suggests vertical slicing

Comparing portfolio composition between mid-February and end-June shows that for both UCITS and AIFs portfolio composition remained broadly stable.

During the market stress in February and March, both UCITS and AIFs increased their cash positions, while decreasing especially their portfolio shares in sovereign, IG and HY (especially UCITS) bond positions. In particular, sales of portfolio positions also occurred in less-liquid asset classes. This behaviour suggests a 'vertical slicing' liquidation strategy, which makes it possible to retain the desired level of liquidity following the redemption requests and leave the characteristics of the portfolio unchanged following the sales. These portfolio changes reversed between end-March and end-June.

RA.9

Portfolio changes (%)

Portfolio composition stable

	UCITS	AIFs
Cash	1.0	1.8
Sovereign bond	-3.8	-1.4
AAA-AA corporate	-1.1	-0.9
A corporate	-1.4	-0.7
BBB corporate	-2.9	-1.3
HY corporate	-4.2	-0.7
Equity (regulated market)	-1.5	-1.5
Equity (unregulated market)	0.0	0.0
Collective investment undertakings liquid in 7 days	0.1	-0.6
Loans	-0.2	-1.2
Other corporate	-1.4	-0.1
Unrated corporate	-0.7	-0.1

Note: Portfolio rebalancing across types of instruments (%).
Sources: NCAs, ESMA.

From a fund perspective, vertical slicing is generally the preferred option, as it is in line with the equal treatment of investors laid down in the Regulation. Otherwise, leaving investors would be repaid through the sale of HQLA and remaining investors would keep the less-liquid part of the portfolio.

In contrast, STRESI generally assumes a worst-case scenario in which the possibility of redeeming less-liquid assets is limited and a vertical slicing strategy is not possible. In the S framework, this can nevertheless be analysed in combination with another scenario, in which ESMA assumes that funds maintain vertical slicing and sell less-liquid assets under very stressed

market conditions, thus contributing to the market impact through fire sales.

Conclusion

One objective of the S framework was to use the outcome of supervisory stress simulations to inform asset managers and supervisors, as part of their supervisory analysis, to assess the potential need for mitigating actions.

In the context of the ESRB's Recommendation, supervisors collected a large set of data to analyse the impact of the liquidity stress on funds in the sample: STRESI was used to complement this stocktaking exercise, and contribute to the assessment of funds' preparedness for a potential new stress episode.

The results of the ESMA 2020 STRESI exercise show the overall resilience of the sample to liquidity stress, although the proportion of funds facing liquidity issues is higher than at the onset of the COVID-19 related market stress.

This can be explained by the fact that the COVID-19-related market stress was concentrated over a short period of time, amid significant government and central bank interventions that provided support to the markets in which these funds invest.

Finally, this exercise was an opportunity to review some assumptions and especially the liquidation strategy. Data reported indicate a vertical slicing approach, which is generally considered favourable for investor protection but may not be possible in all market conditions.

References

ESMA (2019), [Stress Simulation For Investment Funds](#), ESMA, Paris.

ESMA (2020), [Report – Recommendation of the European Systemic Risk Board \(ESRB\) on liquidity risks in investment funds](#), November.

ESRB (2020), [Recommendation 2020/4 on liquidity risks in investment funds](#), May.

Investor protection

54 000 PRIIPs KIDs – how to read them (all)

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Summary

This article presents the results of an ESMA pilot exercise to apply natural language processing techniques on a unique dataset of c. 54 000 Key Information Documents that describe structured retail products produced under the Packaged Retail Investment and Insurance-Based Products Regulation. The techniques involved include measuring linguistic richness and semantic uncertainty, as well as sentiment analysis. This work – an application of SupTech – aims to illustrate how these techniques can produce useful measures for European supervisors, policymakers and risk analysts. Information extracted from text opens up new possibilities for supervisory assessments, for example with respect to information completeness and to legal requirements that a document be comprehensible to investors. In addition, text-based information is uncorrelated with (i.e. complementary to) numerical information, which can help policymakers determine if the legislation is working as intended. Lastly, text-based information can identify new sources of financial risks to investors.

Introduction

European retail investors now receive more information than ever, as transparency and disclosure requirements enacted following the 2007–2008 global financial crisis are implemented. The majority of this increased information is in the form of text, located for example in prospectuses and KIDs for funds or structured retail products.

It can be challenging for investors to make sense of so much information. It can also be challenging for supervisors, who are legally tasked with verifying these documents' compliance with a multitude of detailed requirements that span highly technical (and often lengthy) texts, produced by thousands of financial entities, across numerous languages and styles. It is, however, crucial – for investor protection, for orderly financial markets and for financial stability – that supervisors be able to effectively supervise this exponentially increasing amount of regulatory text.

This article summarises recent ESMA efforts to extract information of interest from a specific set of regulatory documents. The aim is to illustrate how natural language processing can assist both supervision and supervisory convergence, as well as evidence-based policymaking and risk-monitoring efforts by the public sector in Europe.

The article applies these perspectives to information extracted from a data set of KIDs for PRIIPs, most of which are structured retail products. Although the total number of KIDs is unknown, there are indications that tens of thousands are available, and that the market is worth at least several hundred billion euro. This market size, coupled with ongoing Joint Committee work to review the PRIIPs KID Regulation (Joint Committee of the European Supervisory Authorities, 2019), makes PRIIPs a worthwhile area for investigation and application of these techniques ⁽¹³⁴⁾.

By law, a KID must be provided to retail investors when they consider purchasing a PRIIP. The structure, content, presentation and length of the KID are tightly controlled by the PRIIPs

⁽¹³⁴⁾ Structured retail products have also attracted some prior interest from both regulators and academics. See for

example Demartini and Mosson (2020) and Célérier and Vallée (2017).

Regulation and PRIIPs KID Delegated Regulation⁽¹³⁵⁾. For example, the PRIIPs KID Regulation specifies dozens of phrases that must be mentioned in specific locations in the KID. The KID must also include a variety of numbers calculated under specific formulae, such as performance under several scenarios. All of this information can be extracted and assessed.

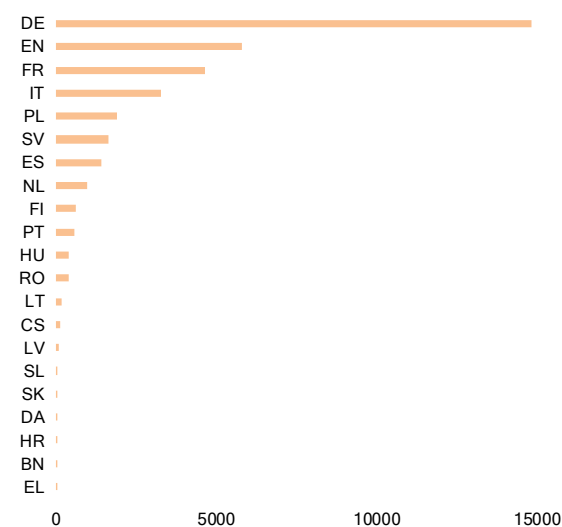
The next section describes the data set and methodology. Subsequent sections illustrate how this information can be used for supervision and supervisory convergence, policy development and risk monitoring. The conclusions connect these results with wider policy discussions.

Data set and methodology

The article uses a unique data set of 54 384 KIDs retrieved from public websites and a specialised commercial data provider, manufactured and sold in the EU by 333 unique issuers. These KIDs describe PRIIPs issued between 1 January 2018 (when the requirement to produce KIDs began) and 31 December 2020. The sample includes KIDs written in nearly all official EU languages – shown in Chart RA.1 below⁽¹³⁶⁾.

German-language KIDs are by far the most prevalent, followed by English-, French- and Italian-language KIDs. However, it is difficult to assess the extent to which this data sample is representative of the overall PRIIPs universe. KIDs are not centralised; there is no single location where they can be found. As a result, the total number of KIDs is unknown.

RA.1
Number of languages included in database
Much variation in available KIDs per language



Note: Number of KIDs grouped by language of document. Duplicate documents have been removed prior to graphing.
Sources: ESMA

In any case, a number of items can be extracted from a KID, such as the presence of certain words or phrases, various cost-related figures, simulated returns under different performance scenarios, the Summary Risk Indicator (SRI, discussed below), and descriptive information such as the product ISIN, issuance date and recommended holding period.

However, there are a number of technical challenges before this can be done. First, KIDs are nearly always provided in PDF format, which implies that text is ‘frozen’ and needs to be unpacked before it can be read and analysed by a computer. The conversion process means that the text loses its intended structure: tables are split, word order is reversed, and words can be duplicated. This inevitable (for PDF documents) step in natural language processing is time-consuming and prone to error, and destroys content. This leads to a recommendation for future policymaking: when a law requires the widespread production of documents, it is essential that these be made available in a flexible format such as open document format, even if in addition to PDF.

⁽¹³⁵⁾Regulation (EU) No 1286/2014 (PRIIPs Regulation) and Commission Delegated Regulation (EU) 2017/653 (PRIIPs KID regulation).

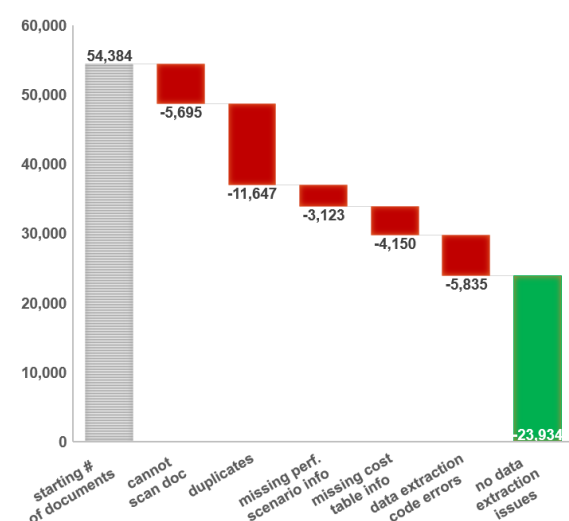
⁽¹³⁶⁾Country tables are not shown, because the same product may be sold in multiple countries. Duplicate products (i.e. the same product but with multiple KIDs across

European languages) have been reduced to a single KID. Where multiple KIDs are available for the same product in the same language; the earliest (i.e. oldest) KID is used as a basis for these assessments. The aim is to focus on primary market issuance as much as possible.

A second technical challenge is in tailoring an algorithm to handle the inevitable idiosyncratic cases that arise when documents are written in multiple languages and styles. Thus, the exercise described in this article could never be a substitute for human review. The techniques outlined below aim to support public-sector agents in observing patterns and in conducting inspections effectively across tens of thousands of documents. It is in no way a recommendation that comprehensive reviews, decisions and/or sanctions be outsourced to machines.

Chart RA.2 below illustrates how these and other technical challenges reduce the data set by more than half. In the end, there remain about 24 000 KIDs that are entirely free from data extraction issues⁽¹³⁷⁾. In addition, 81 % of KIDs in the sample refer to structured retail products, while about 19 % of the sample refer to funds (including, but not limited to, Category 2 products in the PRIIPs KID Regulation)⁽¹³⁸⁾. For the remainder of the analysis, we exclude funds, in order to have as homogeneous a data sample as possible and given that in the PRIIPs KID Regulation, funds use different calculation methodologies to produce some of the metrics discussed below (e.g. performance scenarios). Lastly, insurance-based investment products and multi-option products are not included in the analysis.

RA.2
Reduction in data sample
Types of text extraction issues



Note: The vertical axis is the number of PRIIPs KIDs. 'Cannot scan doc' refers to technical issues when a PDF file cannot be converted to a text document (and instead a series of numbers and symbols appears). 'Data extraction code errors' refers to situations in which a computer code leads to inconsistencies in numerical information being extracted (i.e. numbers from some parts of the KID, e.g. on the stressful performance scenario, can be extracted, while information from elsewhere, e.g. the moderate performance scenario, cannot be obtained); this represents areas where the computer code can be further refined.

Sources: ESMA, SRP, individual financial entities' websites.

Natural language processing and supervision

This section considers how natural language-processing techniques can provide additional metrics to assist supervisors in enforcing compliance with disclosure requirements. We present below some first findings from the analysis of PRIIPs KIDs. This work will be further refined in cooperation with the NCAs going forward, including the consistency of KID phrasing.

Measuring information completeness

One key application is to compare the extent to which each PRIIPs KID includes the specific phrases it is required to mention. In total, there are approximately 65 distinct items that must be

⁽¹³⁷⁾The sample size used in this analysis will vary depending on the topic. For example, assessing the completeness of information disclosures uses a sample closer to 30 000 KIDs, insofar as we seek to examine KIDs that also contain missing information. In addition, linguistic complexity measures do not require performance scenario information, so it is not necessary to focus only on KIDs that include performance scenarios. Where possible, the number of KIDs included in the specific

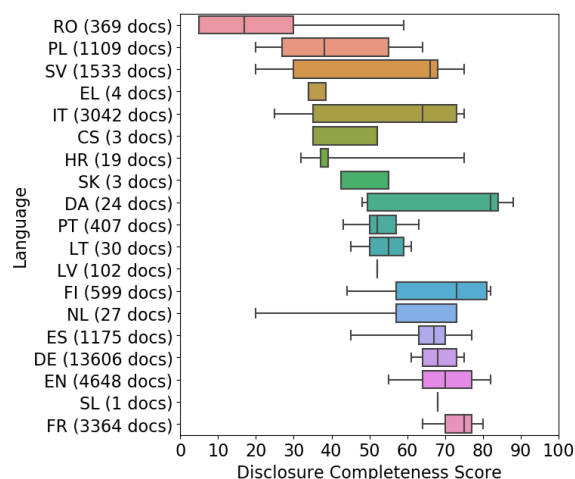
analysis is mentioned.

⁽¹³⁸⁾UCITS and AIFs (the most common fund types) are currently out of scope of the PRIIPs Regulation. These funds must prepare a key investor information document (KIID). Although the KIID is an EU-wide information document, based on EU law, there is national discretion regarding the scope, for example on whether to apply the KIID regime to an AIF.

mentioned verbatim in the KID, regardless of the PRIIP subcategory. As a result, a ‘completeness score’ can be produced, which measures the number of phrases observed relative to the total number required to be mentioned ⁽¹³⁹⁾.

Chart RA.3 below presents the range in completeness scores across EU languages, and shows several interesting facts. First, few KIDs in any jurisdiction achieve 100 % completeness of the required disclosures ⁽¹⁴⁰⁾. For example, for the 5 788 English-language KIDs, most mention between 64 % and 77 % of the required phrases, but in extreme cases only c. 55 % or up to c. 82 %. Second, the completeness score varies substantially across language groups.

RA.3
Range in disclosure completeness score by language
Many required KID phrases are not mentioned



Note: The vertical line in each box shows the median KID completeness score for that language group. Box edges are the 25th and 75th percentile scores, and additional lines (‘whiskers’) illustrate the 10th and 90th percentiles for that language group.

Sources: ESMA, SRP, individual financial entities’ websites.

Chart RA.3 above raises interesting questions related to supervisory convergence across jurisdictions. For example, to what extent can ‘similar meaning’ be tolerated, if a required phrase is not included ⁽¹⁴¹⁾? In addition, what is an acceptable threshold for a less-than-perfect completeness score, before further supervisory assessment should occur?

⁽¹³⁹⁾Phrases that are optional to mention are not included in this analysis; only mandatory disclosures are considered.

⁽¹⁴⁰⁾A small number of KIDs in the data set may still achieve 100 % compliance (outliers are not shown in Chart RA.3).

⁽¹⁴¹⁾Some tolerance is provided in the search function, e.g. for punctuation differences and capitalisation. However, the use of similar words, or word order being reversed in the same phrases, is not permitted, as it is assumed that the legislature had a clear intention in mind (i.e.

Table RA.4 below displays the phrases that are most often missing in KIDs ⁽¹⁴²⁾. It appears that descriptions of the cost tables, performance scenarios and SRI are the most challenging for PRIIPs KID manufacturers to comply with, compared with other required phrases such as standardised table and section headings, or elements to mention at the beginning of the KID. This information can help indicate focus areas for supervision, and/or areas where the legislation is misunderstood and guidance (such as questions and answers and guidelines) may be needed. It may also signal a need to adjust the legislation (see next section) ⁽¹⁴³⁾.

RA.4
Top 10 required phrases not found in KIDs
Descriptive phrases appear most problematic

Asset type	Number of KIDs missing this item	% of KIDs missing this item
AVII (Descr. of costs, sent. 3)	18 244	61
AVII (Descr. of costs, sent. 4)	17 895	59
AV (Perf. Scen., Element C, sent. 1)	10 720	36
AIII.7 (SRI, Element A, sent. 2)	10 195	34
AVII (Descr. of costs, sent. 1)	9 462	31
AVII (Descr. of costs, T2, sent. 1)	9 084	30
AV (Perf. Scen., Element D)	8 843	29.4
AVII (Cost Table 1, row 2 text)	8 744	29.1
PRIIPS Regulation Art. 8(2) (sent. 3)	8 719	29.0
AVII (Descr. of costs, sent. 2)	8 518	28

Note: Table rows refer to regulatory requirements; the top 10 missing phrases in the KIDs data sample (after removal of duplicates) are shown. All rows denoted with ‘A###’ indicate an annex to the PRIIPs KID Regulation. Descr. of costs = presentation of cost information in the KID; Perf. Scen. = performance scenarios; SRI = summary risk indicator; T1 and T2 = Tables 1 and 2; sent. = sentence. See the above-mentioned regulatory text for further details on the specific phrases in question.

Sources: ESMA, SRP, individual financial entities’ websites.

It can be useful to combine the disclosure completeness score with other information sources. For example, Chart RA.5 below illustrates the range in the completeness score

standardisation) when going to the trouble of specifying, directly in the legislation, the phrase to be mentioned.

⁽¹⁴²⁾‘Missing’ here denotes cases where the phrase is entirely absent in the KID or is incorrectly copied from the legislation. See also footnote 141.

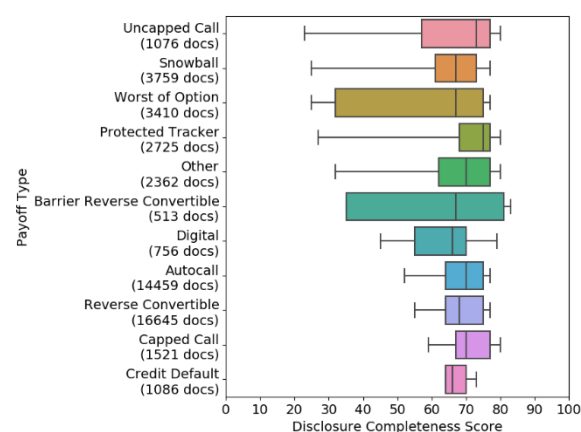
⁽¹⁴³⁾When searching across multiple languages and document formats (i.e. templates from issuers), it is nearly impossible to eliminate false positives (i.e. indicating that a phrase is missing when in fact it is not). Results like those in Table RA.4 can also help indicate if the search algorithms are sufficiently precise.

for the most common PRIIP pay-off types in the data set. As can be seen, most difficulties in complying with the required disclosure phrases appear to be clustered among PRIIPs that include worst of option, autocallable (also known as knock-out) and/or barrier reverse convertible pay-off types. Another application area could be to group KIDs by PRIIP manufacturer, and thus identify, at the level of a supervised entity, manufacturers whose KIDs tend to have particularly low scores.

RA.5

Disclosure completeness score by pay-off type

Certain pay-off types may be worth focusing on



Note: The vertical line in each box shows, within each pay-off type, the range in the disclosure completeness score. Box edges are the 25th and 75th percentiles, and additional lines ('whiskers') illustrate the 10th and 90th percentiles for that pay-off type. One product can contain multiple pay-off types. 'Other' collects all PRIIPs in the data sample for which there are 400 or fewer observations for that pay-off type.

Sources: ESMA, SRP, individual financial entities' websites.

Measuring information complexity

KIDs are required to be written 'in language that is clear, succinct and comprehensible' ⁽¹⁴⁴⁾. These notions are also found in many pieces of EU law that involve disclosure requirements. For example, the Prospectus Regulation requires that

the summary be written 'in language that is clear, non-technical, concise and comprehensible for investors' ⁽¹⁴⁵⁾. Elsewhere, MiFID II stipulates that 'All information, including marketing communications, addressed by the investment firm to clients or potential clients shall be fair, clear and not misleading' and that best execution policies must 'explain clearly, in sufficient detail and in a way that can be easily understood by clients, how orders will be executed by the investment firm for the client' ⁽¹⁴⁶⁾.

'Clarity', 'comprehensibility', 'succinctness' and similar words are subjective concepts (which we refer to collectively as reflecting 'complexity'). Therefore, it can be challenging for supervisors to, first, assess a document according to these concepts and, second, develop an appropriate benchmark with which to compare documents ⁽¹⁴⁷⁾.

At the same time, these requirements are not trivial. For example, the very first recital of the PRIIPs Regulation makes it clear that the main purpose of the KID is to facilitate investor understanding of products that 'can be complex and difficult to understand' ⁽¹⁴⁸⁾. If retail investors are unable to understand the information being provided to them, the investor protection motive mentioned immediately afterwards in the PRIIPs Regulation (recital 2) cannot be fulfilled.

The field of linguistics has developed a number of ways to assess the complexity of a text ⁽¹⁴⁹⁾. These range from basic metrics, such as sentence length, to more complicated econometric-based methods. We now apply several of these to the data set. Importantly, each metric chosen is language-independent, which means that we can safely compare KIDs across

⁽¹⁴⁴⁾Article 6(4)(c) of the PRIIPs Regulation. See also recital 13: 'To meet the needs of retail investors, it is necessary to ensure that information on PRIIPs is accurate, fair, clear and not misleading for those retail investors. This Regulation should therefore lay down common standards for the drafting of the key information document, in order to ensure that it is comprehensible to retail investors. Given the difficulties many retail investors have in understanding specialist financial terminology, particular attention should be paid to the vocabulary and style of writing used in the document. Rules should also be laid down on the language in which the key information document should be drawn up. Furthermore, retail investors should be able to understand the key information document on its own without referring to other non-marketing information.'

⁽¹⁴⁵⁾Article 7(3)(b) of Regulation (EU) 2017/1129. See also recital 27: 'In order to enable investors to make an informed investment decision, that information

[information contained in the prospectus] should be sufficient and objective and should be written and presented in an easily analysable, concise and comprehensible form.'

⁽¹⁴⁶⁾Article 24(3) and Article 27(5) of Directive 2014/65/EU, respectively.

⁽¹⁴⁷⁾Demartini and Mosson (2020) assess complexity by counting the number of product features, and number of pay-off scenarios.

⁽¹⁴⁸⁾Recital 1 of Regulation (EU) No 1286/2014.

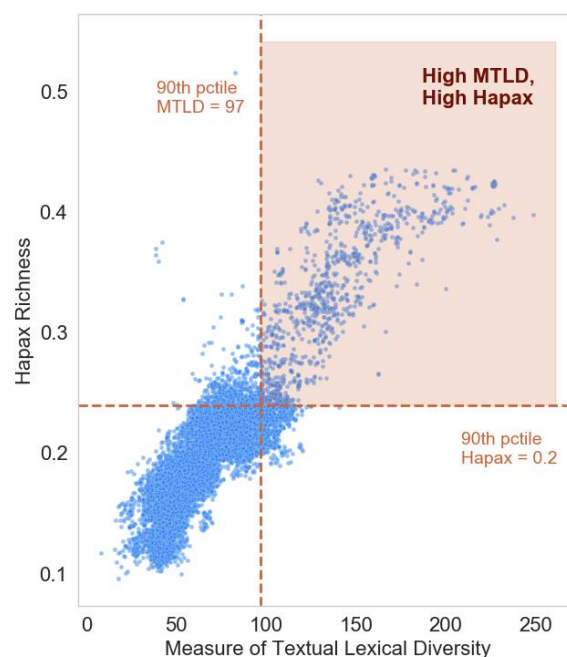
⁽¹⁴⁹⁾These measures can be applied to all types of language, including whether the document relates to a financial product or not. No external benchmark is necessary; the purpose is to identify outliers from within the PRIIPs KID universe, so as to guide supervisors for where to focus any human review efforts. Indeed, the approaches discussed in this section can only be additional to human review, which is necessary to conclusively determine whether a KID is truly clear, succinct and comprehensible

the data set, regardless of the language in which they were written ⁽¹⁵⁰⁾.

The subjectivity associated with these metrics cannot be eliminated; there is no unambiguous threshold beyond which a text can be said to be 'complex'. Nevertheless, these measures can facilitate supervisors' prioritisation of cases for further inspection, by identifying outliers. These can also be combined with further information (e.g. if several outliers are from the same issuer).

To begin with, Chart RA.6 below compares PRIIPs KIDs using two related scores: the measure of textual lexical diversity (MTLD) and the hapax richness. The MTLD is derived from the ratio of the number of unique words to the total number of words in the KID (the type–token ratio), corrected for differences in length ⁽¹⁵¹⁾. Hapax richness measures the number of words that appear only once in the document relative to the total number of words. Both MTLD and hapax richness indicate the linguistic diversity of the text: greater diversity can indicate more precision, but can also indicate the presence of less common words (i.e. jargon) in the KID ⁽¹⁵²⁾.

RA.6
Assessing KIDs using measures of linguistic diversity
Identifying extreme KIDs for further inspection



Note: The chart displays the hapax richness and MTLD for each KID in the sample used for this analysis (18 565 documents). Hapax richness is the number of words that appear only once in the KID, relative to the total number of words. The MTLD is derived from the ratio of the number of unique words to the total number of words in the document, subsequently corrected for differences in document length. Sources: ESMA, SRP, individual financial entities' websites.

Chart RA.6 above demonstrates how visualisations can identify outliers. The MTLD and hapax richness are clearly positively correlated, and 90 % of KIDs are clustered in the blue cloud in the bottom left of the chart. However, there is less clustering and correlation in the top 10 % of the sample (i.e. above the respective 90th percentiles). This can provide an indication for prioritisation: KIDs in this upper-right region could be assessed first to determine if they are truly written in 'language that is clear, succinct and comprehensible'.

Chart RA.7 below assesses KIDs using two measures that examine language from an uncertainty perspective. The first is Yule's I metric, which measures the probability that two randomly selected words in a text are identical ⁽¹⁵³⁾. The second is semantic entropy,

⁽¹⁵⁰⁾This rules out some popular metrics, such as average word and sentence length, the Flesch–Kincaid readability test (Kincaid et al., 1975), the Automated Readability Index (Senter and Smith, 1967) and the fog Index (Gunning, 1952).

⁽¹⁵¹⁾The standard threshold of 0.72 is used. See McCarthy and Jarvis (2010) and Tolochko and Boomgaarden (2019).

⁽¹⁵²⁾An additional approach could be to compare the frequency of words in PRIIP KIDs with the frequency of those words in general. However, the appropriate

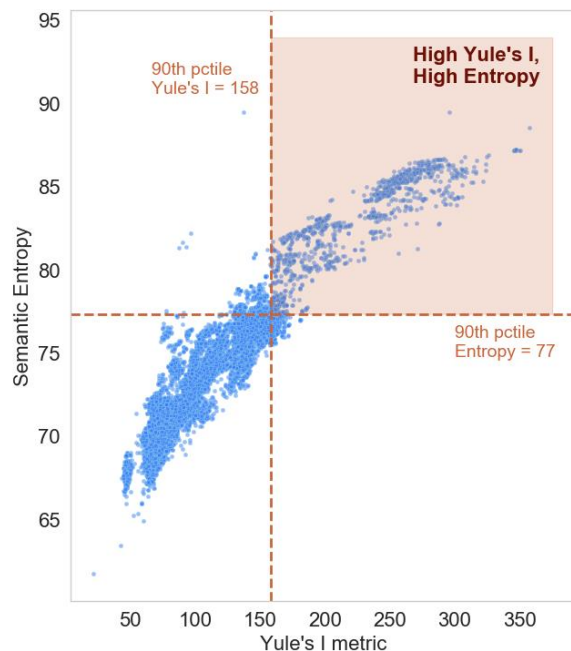
benchmark for these highly specific products is not clear (i.e. literature and the news, which are the most common types of corpus available for natural language processing, are not satisfactory). Moreover, we are working with 19 or 20 languages, so benchmarks would need to be language-specific.

⁽¹⁵³⁾Yule's I metric is calculated as $\frac{M_1 \times M_2}{M_1 - M_2}$, where M_1 is the total number of words in the document, and M_2 is the sum, across all unique words in the document, of the squared frequency of each unique word. See Yule (1944).

which measures how likely it is that a reader can predict the next word after the word they have just read in the text ⁽¹⁵⁴⁾.

RA.7

Assessing KIDs according to linguistic uncertainty Identifying extreme KIDs for further inspection



Note: The chart displays the Yule's I metric and semantic entropy for each KID in the sample used for this analysis (18 614 documents). Yule's I measures the probability that two randomly selected words from a text are identical. Semantic entropy measures how likely it is that a reader can accurately predict the next word after a given word in the KID.

Sources: ESMA, SRP, individual financial entities' websites.

Like the previous chart, Chart RA.7 above also identifies substantial clustering of KIDs in the bottom-left quadrant, which denotes 90 % of the data set yet covers only one third of the chart area. A much smaller share of KIDs (10 % of the sample) exists in the upper-right quadrant, which identifies KIDs with both high Yule's I and high semantic entropy. Extreme values for these linguistic uncertainty metrics may indicate KIDs that are particularly difficult for readers to follow, despite the PRIIPs Regulation requirement (Article 6(4)(c)) that KIDs '*be written in language and a style that communicate in a way that facilitates the understanding of the information*'.

Another area where natural language processing has made a significant contribution is sentiment analysis, which assesses the overall 'feeling' associated with a given text. At first glance, financial documents may seem like a strange area to assess for emotive connotations.

However, sentiment analysis can be useful in assessing uncertainty and possibility ('modality'), as well as positive or negative feeling. This has been assessed, for example, by Loughran and McDonald (2011), who also provide, and regularly update, a set of word lists associated with the above, and other, emotions.

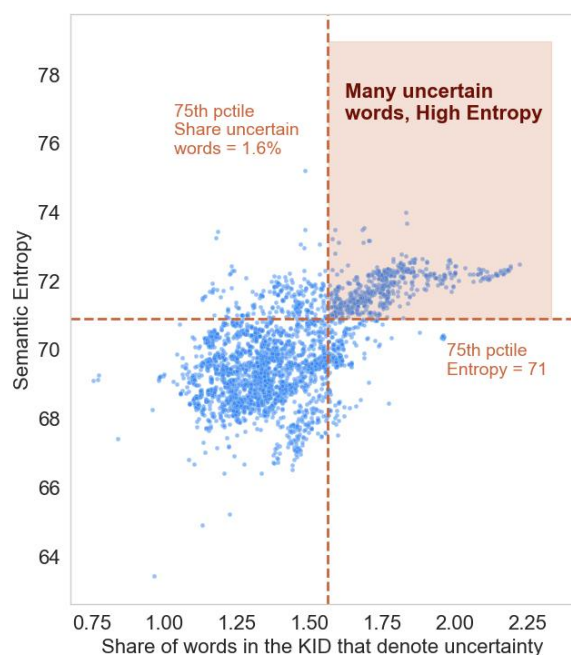
To do this, we count the number of occurrences of words associated with 'uncertainty' and 'modality' in each KID (using only English-language KIDs in the sample). This number is then divided by the total number of words in each KID to form a normalised measure of uncertainty. It seems reasonable to assume that, the more words in a document are associated with a particular emotion, the more likely it is that investors reading that document will enter that emotional state.

This sentiment analysis-derived measure of uncertainty (and modality) is displayed in Chart RA.8 below, alongside the semantic entropy measure discussed above. It is clear from this chart that there is a positive correlation between the two metrics. As in the preceding charts, supervisors could potentially use these metrics to indicate which KIDs to first focus their limited resources on. KIDs with both high numbers of word denoting uncertainty and high semantic entropy may be worthwhile and primary candidates for further inspection, for example.

⁽¹⁵⁴⁾ Calculated as $-100 \frac{\sum p_i \times \log p_i}{\log N}$, where p_i is the probability of observing a specific word in the document, and N is

the total number of words (Shannon et al., 1963; Dale et al., 2000; Tolochko and Boomgaarden, 2019).

RA.8 Identifying KIDs with especially unclear language Identifying extreme KIDs for further inspection



Note: The chart displays the share of each KID containing a set of words deemed to increase the uncertainty associated with understanding the KID according to the dictionary first presented by Loughran and McDonald (2011). 'Uncertain words' in the graph refers to the combination of the 'uncertainty' and 'modal' word lists provided by the above academic paper. The vertical axis provides the semantic entropy for each KID in the sample used for this analysis (3 546 documents). Semantic entropy measures how likely it is that a reader can accurately predict the next word that follows a given word in the KID.

Sources: ESMA, SRP, individual financial entities' websites.

These information complexity metrics can be combined with other information extracted from the KID. For example, the PRIIPs KID Regulation requires an SRI to be produced. The SRI aggregates the estimated credit risk (i.e. issuer default risk) and adverse market price risk associated with the PRIIP, and ranges from 1 (lowest risk) to 7 (highest risk). The necessary simulations and formulae used to produce the SRI are also set out in the PRIIPs KID Regulation.

An investigation was conducted into whether the SRI already, somehow, reflects the fact that a KID is written in more complex language (for example because products with greater risk require more complicated drafting to describe them). If so, the use of these information complexity measures is trivial. However, little co-movement was found

between information complexity measures and the SRI. This supports the idea that information complexity metrics can provide supervisors with complementary insights ⁽¹⁵⁵⁾.

Evidence-based policymaking

In line with the EU's Better Regulation principles, EU law is often reviewed and evaluated, for example to ascertain the effectiveness of certain provisions. However, it can be challenging for policymakers to gather a sufficiently large database to make such assessments, particularly for qualitative provisions. This section illustrates how natural language-processing techniques can support these efforts.

For example, PRIIPs KIDs must include simulated after-cost returns under at least four different performance scenarios. The calculation methodology is specified in detail within the PRIIPs KID Regulation. In particular, the simulations reflect performance under favourable (90th percentile of returns), moderate (50th percentile, i.e. the median), unfavourable (10th percentile) and stress (1st or 5th percentile, depending on the type of product) conditions.

Chart RA.9 below displays the variation in returns across these different scenarios. The simulated returns in both the stress and unfavourable scenarios are, as expected, usually below the moderate scenario returns. However, the simulated moderate and favourable scenario returns (blue and orange boxes, respectively) are both highly similar and clustered tightly (i.e. the boxes are not very wide). This raises the question of whether these scenarios sufficiently distinguish PRIIPs. In doing so, the chart provides evidence in support of the efforts of the Joint Committee of the European Supervisory Authorities in late 2018 / early 2019 to consult on revising the PRIIPs KID Regulation scenario calculation methodologies ⁽¹⁵⁶⁾.

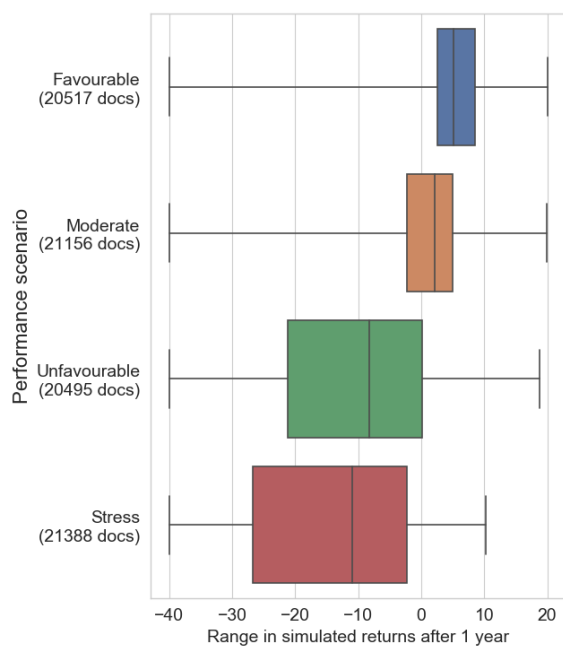
⁽¹⁵⁵⁾ Results, available upon request, are identical using hapax richness, MTL and Yule's I metric.

⁽¹⁵⁶⁾ See Joint Committee of the European Supervisory Authorities (2019). One might think that product-specific differences could be driving such divergences across scenarios. However, the very large sample size suggests that the divergences go beyond product-specific features and are more related to the scenario

calculation methodologies. Moreover, the results (available upon request) are unchanged if the difference between the favourable and moderate scenarios in each individual KID is first taken and the range for that difference is plotted (i.e. take the difference between the two scenarios within each product and then plot that difference).

RA.9

Added value of each performance scenario
Similar favourable and moderate scenarios



Note: The chart presents the range in performance returns of PRIIPs in each performance scenario category (favourable, moderate, etc.), using only scenarios that may occur after 1 year of holding the PRIIP. The methodology for calculating each scenario is set out in the PRIIPs KID Regulation. Similar results are obtained when comparing scenario returns at product maturity (or recommended holding period), rather than 1 year. The vertical line in each box shows the median simulated return in that performance scenario category. Box edges are the 25th and 75th percentiles, and additional lines ('whiskers') illustrate the 10th and 90th percentiles for that performance scenario category.

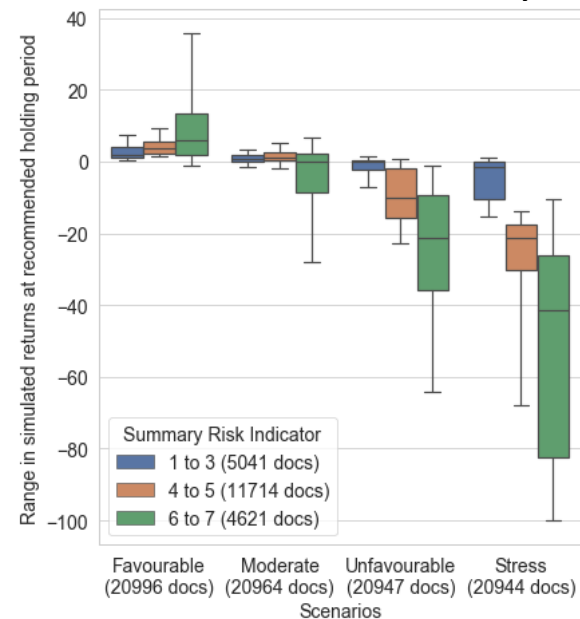
Sources: ESMA, SRP, individual financial entities' websites.

Next, Chart RA.10 below examines the extent to which the SRI varies with each performance scenario across PRIIPs. This can help policymakers assess whether the SRI complies with recital 5 of the PRIIPs KID Regulation, i.e. that 'information on the risks should be aggregated as far as possible and numerically presented as a single summary risk indicator...in order for retail investors to fully understand those risks'.

As can be seen in Chart RA.10 below, in the favourable and moderate scenarios there is little variation in simulated returns across SRI categories within the same scenario. This is sensible, because these scenarios reflect 'upside' or 'moderate' risk for an investor. However, in the more pessimistic unfavourable and stress scenarios (which are likely to more closely reflect the 'risk' situation that the legislature had in mind in the above recital), the SRI is associated with clear differences in simulated returns: the higher the SRI for a PRIIP, the lower the returns within the same scenario. This provides evidence for policymakers that the SRI calculation methodology in the PRIIPs KID Regulation is functioning as intended.

RA.10

Evaluating the summary risk indicator
SRI seems to differentiate PRIIPs effectively



Note: The boxes and vertical lines indicate the range of returns (at the recommended holding period) across PRIIPs grouped by the SRI. The SRI aggregates the estimated credit risk (default risk) and market risk (adverse market price risk) associated with the PRIIP. The necessary simulations and formulae used to produce the SRI are set out in the PRIIPs KID Regulation. The SRI ranges from 1 (lowest risk) to 7 (highest risk). The horizontal line in each box shows the median KID simulated return rate for that specific performance scenario and SRI grouping. Box edges are the 25th and 75th percentile simulated returns across the group, and additional lines ('whiskers') illustrate the 10th and 90th percentiles for that same group.

Sources: ESMA, SRP, individual financial entities' websites.

From words to risks

ESMA and many national authorities are tasked with assessing risks to financial markets, and in particular risks to retail investors. The texts of PRIIPs KIDs also contain insights useful for satisfying these mandates.

For example, following on from the previous section, Chart RA.11 below tracks developments in the average SRI together with those in semantic entropy in PRIIPs issued in each quarter since early 2018. Doing so allows one to observe how estimated product risks to investors (i.e. the SRI) are evolving over time and, in parallel, if the complexity of information provided to investors has moved in the same direction.

RA.11
Evolution in financial risks and linguistic complexity
Increasing product risk, but less complex text



Note: The chart presents the average, for each quarterly issuance period, of the SRI (left-hand side, in red) and the semantic entropy (right-hand side, in blue) of PRIIPs in the data set since the beginning of the legislative requirement to produce a PRIIPs KID. The SRI ranges from 1 (lowest risk) to 7 (highest risk). Semantic entropy measures how likely a reader is able to accurately predict the next word that follows a given word in the KID.
Sources: ESMA, SRP, individual financial entities' websites.

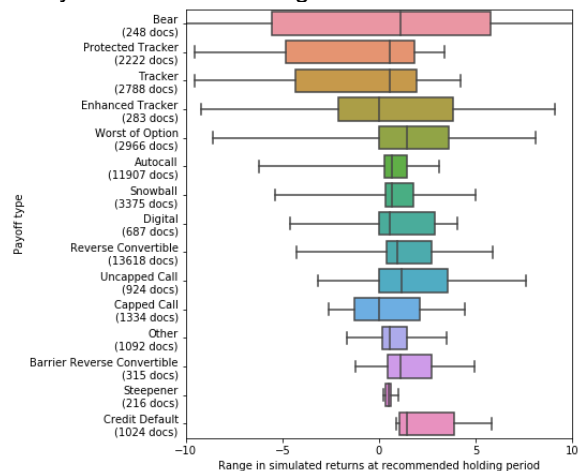
As can be seen from Chart RA.11 above, it appears that the average SRI has, after falling during 2018, returned to and remained at the levels of the start of 2018. This suggests that there is a steady state of PRIIP risk for investors, at around the 'medium' risk level (using the description associated with the numerical SRI categories set out in the PRIIPs KID Regulation).

At the same time, the average uncertainty in KID texts has tended to fall since its peak at the beginning of 2018. This is interesting for several reasons. First, it confirms that the SRI and semantic complexity measures are complementary metrics rather than overlapping ones (as discussed in the previous section). Second, the mostly steady decline in semantic entropy could indicate that PRIIPs manufacturers are improving their compliance with the PRIIPs KID 'clear language' requirements (although human review would be needed to ultimately confirm this). Third, and following on from the previous point, although PRIIPs sold to retail investors are often around a 'medium' risk level, the clarity of presentation of those risks may be improving in parallel.

Risk to investors will also depend on the pay-off type of the PRIIP, and here as well text-based

extraction methods may provide useful information for risk-monitoring efforts. To demonstrate this, Chart RA.12 below presents the variation in simulated moderate scenario returns across the data set, grouped by PRIIP pay-off type. Interestingly, a non-negligible share of PRIIPs in many pay-off type categories appear to offer negative returns were the moderate scenario to materialise, despite this being the 'middle' scenario (i.e. neither favourable nor unfavourable). It is unlikely that many issuers would voluntarily present such figures to potential retail investors, which demonstrates the wisdom of requiring, in the PRIIPs KID Regulation, that performance returns be expressed **net** of costs. However, there may be other reasons why simulated returns under the moderate scenario are negative (i.e. even without removing costs from the returns), such as the PRIIP pay-off type. In any case, this approach could help authorities identify the PRIIP types on which they should focus their efforts to make sure that investors are aware of the risks when making an investment.

RA.12
Moderate scenario returns across pay-off types
Many cases of low or negative scenario values



Note: The chart presents the range in moderate scenario returns (after costs) at the product maturity / recommended holding period for PRIIPs grouped by pay-off type. The vertical line in each box shows, within each pay-off type, the median moderate scenario returns (after costs) at the recommended holding period. Box edges are the 25th and 75th percentiles, and additional lines ('whiskers') illustrate the 10th and 90th percentiles for that pay-off type. One product can contain multiple pay-off types. 'Other' collects all PRIIPs containing pay-off types that have 150 or fewer observations in the data sample.
Sources: ESMA, SRP, individual financial entities' websites.

Conclusion

This article has presented the results of a recent ESMA pilot exercise to apply natural language-processing techniques on a unique data set of c. 54 000 PRIIPs KIDs produced between 1 January 2018 and 31 December 2020. These tools – a form of SupTech – can help supervisors,

policymakers and risk assessors within the European public sector meet their respective mandates in areas that have seen a sizeable increase in regulatory documentation.

Natural language-processing techniques can help identify the extent to which regulatory documents mention required words and phrases. These techniques can also help in an area that can be challenging to assess, but is crucial for investor protection: the widespread legal requirement that documents be written in language that is clear and comprehensible. Linguistic complexity metrics, as well as sentiment analysis, can help supervisors to identify which documents, in preference to others, should be subjected to comprehensive supervisory scrutiny. Moreover, language-independent linguistic complexity measures can be useful in developing common benchmarks across the EU, which is useful for supervisory convergence.

Policymakers can also benefit from these techniques, which uncover additional areas in which to assess key legislative provisions. For example, data extracted from the KID help illustrate the effectiveness of the PRIIPs KID performance scenario calculation methodology (assuming, of course, that issuers comply with the calculation requirements). It also demonstrates that the SRI calculation methodology successfully distinguishes (*ex ante*) PRIIPs that carry greater risks for investors.

Risk-monitoring departments can also use natural language-processing techniques to refine their risk assessment activities. For example, the joint EU-wide joint evolution in the SRI and linguistic complexity over time suggests that the tendency of PRIIPs to remain around the 'medium' risk level may be tempered by less complexity in the language used to describe these products. Pending further human review of individual documents, this may help mitigate concerns about a return to the situation feared in recital 1 of the PRIIPs Regulation, namely that 'Existing disclosures to retail investors ... often do not help retail investors to compare different products, or understand their features. Consequently, retail investors have often made investments without understanding the associated risks and costs and have, on occasion, suffered unforeseen losses.'

Information extracted from PRIIPs KIDs can also be combined with information from other databases, for example to identify PRIIP pay-off types in which simulated returns under the

moderate performance scenario are negative for investors. This can help identify PRIIP types for which authorities may wish to particularly ensure that investors are aware of the risks when making an investment.

Natural language processing opens up powerful new possibilities for public entities to better meet their mandates and, ultimately, for more effective investor protection. European policymakers can continue to support the development of these activities by ensuring that, when a law requires the widespread production of documents, these are made available in a flexible format such as open document format, even if in addition to PDF. Centralisation of document provision is also crucial for supervisors, policymakers and risk analysis departments to have an overview (and thus sufficiently large sample sizes) of the universe of text available. European efforts such as the Commission's digital finance strategy and European strategy for data are likely to prove highly beneficial in this regard.

ESMA will continue to explore and apply these techniques where relevant, in conjunction with the European System of Financial Supervision.

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Investor protection

ESG ratings: Status and key issues ahead

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Summary

As sustainable investing gains traction, ESG ratings are growing in importance for investors and issuers, while gaining attention from global media. This article describes the market for ESG ratings, including types of ratings and key providers, and presents several use cases. In the absence of a regulatory framework, several issues and risks reduce the potential benefits of these ratings. The lack of a common definition and of comparability, together with transparency issues, could be ultimately detrimental to the transition towards a more sustainable financial system. To illustrate the impact of these issues on investors, our analysis focuses on the specific case of ESG benchmark construction.

Introduction

Global sustainable investing has gained enormous traction in recent years, with estimates putting the total value of assets following sustainable investing strategies at EUR 45 trillion in 2020, twice the 2016 value (J.P. Morgan, 2020). This includes more than EUR 2.5 trillion in institutional assets tracking ESG ratings and scores (*The Economist*, 2019).

Still, the market is in its infancy, and in new markets of this type the identification and generation of reliable and comparable market data typically plays a central role in its development. With estimated global spending on ESG data at EUR 500mn according to Opimas (2020), including 60 % from Europe, the market for ESG data is still small, despite its rapid growth. In comparison, global revenues of financial data service providers were EUR 26 bn in 2019 ⁽¹⁵⁸⁾. However, with annual growth expected to average 20 % over the coming years, several large players have made the development of ESG data-related products a central part of their business strategy.

ESG ratings and scores are of particular interest. These form a broadly homogeneous product group offered by companies aiming to provide

investors with an objective data-driven third-party assessment of ESG-related aspects. Under the European Green Deal, such assessments are bound to grow in importance even though they are currently unregulated, while the firms producing them are bound to gain influence albeit they remain largely unsupervised (AMF and AFM, 2020).

Reflecting these expectations, media coverage has grown significantly in the last 2 years. The view that ESG ratings are 'not ready yet for the weight they are being asked to bear' appears to prevail, with many articles conveying the view that rating methodologies are opaque, and their ratings subjective and inconsistent (see *The Economist*, 2019; *Financial Times*, 2020a,b).

This article takes stock of the current situation. First, we explore the diversity of ESG rating products, the specificities of this market and its key players. Second, we summarise the issues documented in the literature and media, in particular with regard to the lack of comparability and reliability of ratings. Third, we present some use cases and illustrate the impact that these issues can have. In particular, our analysis shows that the choice of ESG rating provider has significant implications for the composition of ESG indices, which can lead to material

⁽¹⁵⁷⁾ This article was authored by Julien Mazzacurati, with research assistance from Klaas Lenaerts and Carolina Asensio.

⁽¹⁵⁸⁾ 'Burton-Taylor releases annual financial market data/analysis industry vendor rankings', 27 August 2020.

differences in financial outcomes. We then conclude by summarising the key risks arising from the current state of the market.

The market for ESG ratings

Main types of ESG ratings

There is no official or common definition of ESG ratings. In a recent letter to the European Commission, ESMA (2021) proposed the following broad definition: ‘ESG rating means an opinion regarding an entity, issuer, or debt security’s impact on or exposure to ESG factors, alignment with international climatic agreements or sustainability characteristics, issued using a defined ranking system of rating categories.’

ESG ratings, scores and other quantitative ESG assessments (‘ESG ratings’ henceforth) can measure different aspects. Based on the definitions used by some providers, they can be regrouped into two main categories.

- **ESG risk ratings** are the most common form, measuring the exposure of entities to ESG risks and how these risks are managed. Examples of such ratings include MSCI (‘resilience to long-term, industry material ESG risks’), Sustainalytics (‘exposure and management of material ESG issues affecting a company’s enterprise value’), S&P (‘exposure of an entity’s operations to ESG risks and opportunities’) and FTSE Russell (‘exposure to, and management of, ESG issues’).
- **ESG impact ratings**, on the other hand, measure the impact of entities on ESG factors. This category would include ratings from providers such as Refinitiv (‘relative ESG performance, commitment and effectiveness’), Moody’s (‘willingness and capacity to integrate sustainability criteria’), ECPI (‘sustainability measure’), Sensefolio (‘ESG involvement’) and Inrate (‘environmental and social impacts’).

Differences between such ‘risk’ ratings and ‘impact’ ratings can be thin, as they are built using comparable methodologies and tend to rely on similar metrics. ESG ratings can also be backward-looking or forward-looking, depending on their goals. Most ESG ratings cover corporate issuers but a few providers also offer ratings focusing on local governments or countries.

A myriad of alternative products also exists. These span, for example, the extent to which a firm discloses ESG-related information (Bloomberg), or ESG relevance scores looking at whether ESG issues influence the normal credit rating of a firm (Fitch Ratings). While such alternative products may not be ESG ratings in the traditional sense, they also signal that there are material ESG risks that could affect a firm’s valuation or viability. Others produce ratings focusing on one of the three pillars (environmental, social or governance), such as governance quality scores from ISS and climate risk ratings from 427.mt. Within the environmental category, a number of providers offer carbon risk ratings, including firms with large coverage (Moody’s, MSCI, Sustainalytics) and more specialised ones (Trucost, Carbon Delta, StyleAnalytics).

This wide variety of ratings mirrors to a large extent the diversified demand coming from multiple types of clients and how the information is put to use. A large majority of asset managers favour such variety, even as many support greater standardisation and transparency (Sustainability, 2020a).

ESG ratings versus credit ratings

Both ESG and credit ratings are data-driven assessments sold by third-party providers. However, ESG ratings have some specific characteristics (other than the object they try to measure) that clearly differentiate them.

A credit rating is an opinion regarding the creditworthiness of an entity or instrument based on a ranking system of rating categories. Under the requirements of the CRA Regulation⁽¹⁵⁹⁾, a credit rating is expected to include substantial analytical input from an analyst (through qualitative factors or a qualitative judgement). Credit scores, on the other hand, are not required to have a qualitative element. They are a measure of creditworthiness derived from summarising and expressing data, based only on a pre-established statistical system or model. In an ESG context, no such distinction between ratings and scores exists, and current ESG data limitations imply that both ESG ratings and scores need to rely on some form of qualitative input.

Unlike credit ratings (among which both issuer- and instrument-level ratings are common) ESG

⁽¹⁵⁹⁾ Regulation (EC) No 1060/2009 on credit rating agencies.

ratings tend to be at issuer level – although some rating providers map issuer ratings and listed securities. This is mainly because most financial securities finance not ESG-specific activities but the whole range of activities of the issuer (with the exception of use-of-proceeds bonds or impact bonds). In addition, ESG-related issues and data (CO₂ emissions, gender pay gap, etc.) are usually associated with overall company characteristics rather than specific activities.

Another fundamental difference between credit ratings and ESG ratings is the payment model. The ‘issuer pays’ model, mainly used by CRAs and widely blamed for contributing to ratings inflation before the 2008 financial crisis, is not yet fully replicable in the context of ESG ratings, as not all issuers currently attach informational value to their ratings. Instead, the ‘investor pays’ model appears to be commonly used. Investors pay a fee depending on the type and range of products they wish to access, as well as the level of granularity and method of access to data: ‘headline’ ESG ratings or underlying information, current or historical ratings, delivery channel, etc. ⁽¹⁶⁰⁾.

ESG ratings are also unique in that most cover three distinct pillars, yielding different environmental, social and governance scores subsequently aggregated into a single ESG score. This responds to the demand for a simple, unique ESG score, including for portfolio management purposes. However, it is problematic for several reasons. Given the greater availability of quantitative metrics and ongoing policy efforts, environmental ratings are likely to achieve standardisation and credibility sooner than, for example, ratings on social-related issues (Berg et al., 2019). Furthermore, aggregation is not straightforward: some rating providers simply give equal weights to all three pillars for lack of a better approach, while others apply weights reflecting the materiality of the issues considered in each pillar.

Lastly, assessing the accuracy of ESG ratings constitutes a major challenge. This stems primarily from measuring outcomes of a qualitative nature with a long-term horizon, such as shareholder engagement and social issues. It

also implies that ESG ratings may remain in a state of permanent relativity. The most basic accuracy test for a credit rating is the default or not of the instrument or issuer, leading the credit rating scale to flow naturally from safest to defaulted for all businesses. In comparison, there is currently no easy way to perform *ex post* assessments of the quality of ESG ratings.

ESG rating providers

In line with the absence of a regulatory definition of ESG ratings, there is no clear understanding of the criteria under which firms may or may not ‘qualify’ as ESG rating providers. Reflecting this, estimating the total number of firms active in the market for ESG ratings is a challenge. A study from SustAinability (2020b) estimated that there were over 600 ESG ratings and rankings globally in 2018; other studies by SSgA (2019) and KPMG (2020) found the number of rating providers to be somewhere between 125 and 150. Among them, there appears to be currently around 10 to 15 major providers (SustAinability, 2020a).

Regardless of its actual size, the industry appears to have experienced significant consolidation in recent years. This has often occurred through large companies buying their way into the market, such as S&P and Moody’s acquiring, respectively, the ESG rating arms of RobecoSAM (January 2020) and Vigeo Eiris (April 2019), itself the result of an earlier merger in 2015. Other examples include MSCI buying GMI Ratings (2014), the purchase of Oekom Research by ISS (2018), Morningstar’s two-step acquisition of Sustainalytics (in 2017 and 2020) and the take-over of Beyond Ratings by the London Stock Exchange Group (2019) ⁽¹⁶¹⁾. A study from the AMF (2020) identified as many as 30 instances of ESG mergers and acquisitions since 2009.

There are no data on ESG ratings’ market shares, reflecting the absence of a common definition and the fact that few providers make available financial disclosures on their ESG-related rating activity. A recent survey of 319 sustainability experts found that MSCI and Sustainalytics were the most frequently cited providers, followed by CDP and ISS (SustAinability, 2020b). The

⁽¹⁶⁰⁾A detailed analysis of providers’ fee structure is available from SustAinability (2020a).

⁽¹⁶¹⁾See ‘S&P Global finalizes acquisition of the SAM ESG Ratings and ESG Benchmarking Business from RobecoSAM’, 10 January 2020, ‘Moody’s acquires majority stake in Vigeo Eiris, a global leader in ESG assessments’, 15 April 2019, ‘MSCI to acquire GMI

Ratings’, 27 June 2014, ‘Oekom research AG to join Institutional Shareholder Services’, 15 March 2018, ‘Morningstar Inc. completes acquisition of Sustainalytics’, 6 July 2020, and ‘London Stock Exchange Group acquires Beyond Ratings’, 3 June 2019.

number of companies covered by ESG rating providers varies from c. 4 000 to 12 000 (RA.1). However, this number is not representative of relative market shares, since clients usually pay to access a range of ratings at once – making coverage a marketing tool – while many providers sell an array of products based on their data and research (corporate ratings, country ratings, city ratings, governance ratings, carbon risk ratings, etc.) ⁽¹⁶²⁾.

RA.1

Number of corporate ESG ratings from selected providers
More than 8 000 companies rated on average

ESG rating provider	Number of companies rated
Bloomberg	11 700
FTSE Russell ^a	7 200
ISS	4 000
MSCI	8 500
Refinitiv ^b	10 000
S&P Global	7 300
Sustainalytics	12 000

Note: Number of corporate ESG ratings from selected ESG rating providers based on publicly available information. The numbers may cover more than one ESG rating product type.

^a Number of rated securities.

^b Number of companies for which ESG data are available.

Sources: Company websites, ESMA.

Most ESG rating providers base their assessments, to varying degrees, on publicly available data, such as corporate reports and disclosure or news items. Some also explicitly mention that they rely on AI techniques to analyse information. Finally, a number of firms rely in addition on information obtained directly from issuers, through questionnaires and interviews, or on third-party data. The number of ESG analysts per provider varies from fewer than 20 to more than 200, reflecting their size, presence (local or international) and focus on technology (AMF, 2020).

Based on their core business area, ESG rating providers can be broadly categorised as follows:

- **CRAs:** Several CRAs started offering ESG ratings as an additional service to their clients, including S&P, Moody's and Fitch Ratings.
- **Benchmark administrators:** Some index providers such as MSCI and FTSE Russell produce ESG ratings and use them to create ESG indices.
- **Data vendors:** Data platforms (e.g. Bloomberg and Refinitiv) make ESG ratings available to

clients subscribing to their services, while fund data providers such as Morningstar or Refinitiv Lipper use ESG ratings to rank funds based on their portfolios.

- **Specialised firms:** A number of smaller specialised providers for which ESG risk metrics and analytics form the core of their business have not been acquired. This category includes for example Sensefolio, RepRisk, HIP Ratings, Qivalio and EcoVadis SAS.
- **Consultancies:** Some consultancy firms (e.g. Apex Group, Mercer) produce ESG ratings on specific aspects or segments of the market (unlisted companies and fund investment strategies respectively) to inform their investors.

There is some overlap between these categories, with the recent market consolidation trend reflecting a broader strategy by large conglomerates to offer multiple types of financial data-related services. For example, ratings from MSCI and Sustainalytics serve as input to both benchmark indices and fund ESG ratings. Alternatively, providers can be categorised based on their business model, e.g. those specialised in ESG-related products and services vs those offering in addition non-sustainability-related products and services (SustAinability, 2020a).

Literature: performance and consistency in focus

Most of the literature focuses on the relationship between ESG ratings and asset performance, without a clear consensus emerging. A comprehensive review of the existing literature on the topic by Boffo et al. (2020a) finds that industry research tends to find a positive correlation between ESG scores and performance, whereas academic research generally shows a negative one. This may reflect disagreement between ESG rating providers, including on materiality and how to measure it. For example, highlighting the impact of such disagreement, Gibson et al. (2019) show empirically that higher dispersion in ESG ratings from six providers about social and governance factors leads to overvaluation of S&P 500 shares and subsequent negative returns. Using multiple approaches, Boffo et al. (2020a) also find no clear evidence that ESG-oriented

⁽¹⁶²⁾Sustainalytics claims to be 'The largest independent provider of ESG research and ratings', while MSCI advertises itself as 'The world's largest provider of ESG indices' (which are based on MSCI ESG ratings).

Arguably, market shares could be calculated in various ways: client spending on ESG ratings and data, ESG-rating provider revenues, assets under management following ESG ratings, etc.

portfolio indices and funds systematically outperform non-ESG peers.

The divergence between ESG ratings is documented by Berg et al. (2019), who use ratings from five prominent data providers. They find that ESG ratings are only 60 % correlated, compared with 99 % for credit ratings from the largest CRAs. This is mainly explained by differences in measurement (i.e. measuring the same object in different ways) and aggregation rules, leading the authors to draw the conclusion that standardisation of the measurement procedures is required.

Disagreement between ESG ratings is confirmed by Billio et al. (2020), who attribute it to a lack of commonality in the definition of environmental, social and governance components. Disagreement leads in particular to discrepancies among ESG indices, with very low agreement rates on the constituents of comparable indices (in terms of coverage and sector composition) from four different providers, even after controlling for geographical differences. In the next section, we illustrate how disagreement between ESG rating providers can impact benchmark composition.

Escrig-Olmedo et al. (2019) aim to understand to what extent the criteria used by ESG rating providers in their assessment processes have evolved over the last 10 years. They highlight that providers have a clear commercial character, since they market diverse products and services (sustainability indices, sector and thematic research reports, benchmarks, etc.), leading to a significant increase in their bargaining powers. This implies a biased concept of sustainability if four basic principles are not guaranteed in this business: balance among sustainability dimensions, intergenerational perspective, stakeholder approach and life-cycle thinking.

Coverage by global media and analysts of ESG ratings has grown significantly in the last 2 years, in line with growing investor interest and widespread acknowledgement that the relevance of ESG ratings is bound to increase. Some ESG rating providers have successfully turned this into a profit⁽¹⁶³⁾. But, despite the higher demand for third-party sustainability advice, the view that ESG ratings are 'not ready yet for the weight they are being asked to bear' appears to prevail, with many articles conveying the view that rating methodologies are opaque, and their ratings

subjective and inconsistent (see *The Economist*, 2019; *Financial Times*, 2020a,b).

Both the academic literature and the media also question the broader usefulness and reliability of ESG ratings in achieving sustainable outcomes. Boffo et al. (2020b) find a positive correlation between high environmental scores and high level of CO₂ emissions and waste. In the same vein, a recent study highlighted that a third of the 33 climate funds sold in the UK are invested in oil and gas companies. Such issues, as well as the inclusion of well-known polluters in mainstream ESG indices, are easily picked up by the press, raising questions in the investment community about the value of ESG ratings and labels. Other examples of ESG rating divergence are not lacking, with Tesla frequently cited as receiving a top ESG score from one ESG rating provider while another gives it the lowest grade. Investors may not understand the differences because the methodologies are proprietary – or rely on confidential data from a third-party commercial provider – nor is the issuer always in a position to explain its scores publicly (*Financial Times*, 2020c,d; *Responsible Investor*, 2020).

The user case: applications of ratings

Despite their shortcomings, there is broad agreement that ESG ratings will increasingly be integrated into business decision-making. A recent CFA study (2020) of 2 800 investment practitioners found that 85 % already took environmental, social and/or governance factors into consideration when investing, mainly driven by demand from clients. The examples in this section show how ESG ratings are currently used.

Investors and issuers

Asset managers use ESG ratings to construct portfolios according to their mandates (e.g. thematic investing) or to monitor and manage certain types of exposure (e.g. climate related). In the most direct way, ESG ratings can be used as a screening tool to identify relative outperformers and underperformers within a sector, or to exclude certain companies from a portfolio (negative screening), e.g. because of major controversies or other ESG-related issues.

⁽¹⁶³⁾MSCI's ESG research division has experienced an annual increase in turnover of 30 % in 2 years

(*Financial Times*, 2019).

However, not all investors rely on ESG ratings to the same extent. According to a survey conducted among professional investors (SustainAbility, 2020b), most use ESG ratings only as one of several inputs in a larger process. They can be incorporated into existing valuation models, serve as indicators signalling that further research into an issuer is warranted or benchmark a company's ESG performance against its broader sector. Many investors rely on in-house ESG expertise, either because they find it more reliable or because it allows them to tailor the research specifically to their needs, which can help reduce the effect of disagreement between external rating providers.

Green bonds and sustainability-linked instruments provide other examples of how ESG ratings can serve as an input. Second-party opinions ahead of a green bond issuance frequently involve an assessment of the issuer's sustainability credentials, which some external reviewers provide either in the form of an ESG rating or based on information and processes available from a pre-existing rating⁽¹⁶⁴⁾. Some sustainability-linked bonds and loans see their interest or coupon rates increase if the ESG rating of the issuer falls below a predetermined threshold.

ESG ratings can also be used by non-financial firms, for example to assess the financial and sustainable performance and regulatory compliance of customers or suppliers, to manage their own image and improve disclosure, or to inform voting decisions by shareholders. Another survey among 'sustainability professionals' shows that 72 % of corporate respondents use ESG ratings to inform their decision-making (SustainAbility, 2019). They also use them to compare themselves against competitors.

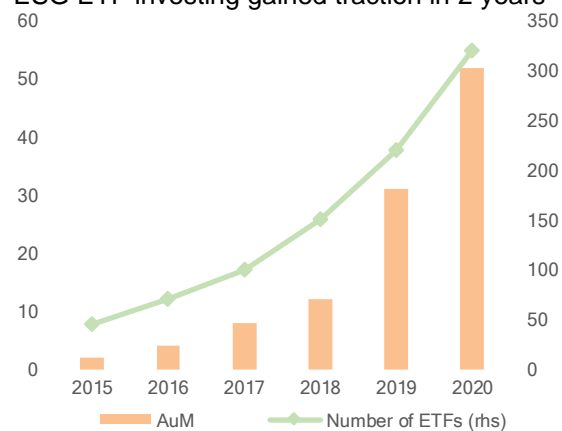
ESG rating-based products

There are broader applications for ESG ratings in the sphere of financial services. Integration allows some CRAs to feed the data underpinning ESG ratings into credit ratings. Similarly, ESG ratings are used by index providers to create new indices. S&P Dow Jones offers a range of ESG indices based on SAM's (formerly RobecoSAM)

Corporate Sustainability Assessment, which it acquired in early 2020; several STOXX sustainability indices rely on ESG ratings from Sustainalytics; and MSCI's 1 500 ESG indices are constructed using its own ESG ratings⁽¹⁶⁵⁾.

The lack of consistency between ratings documented by Berg et al. (2019) or Billio et al. (2020), and confirmed by others⁽¹⁶⁶⁾, is particularly problematic in the context of ESG index construction. Companies may or may not qualify for an ESG rating-based index depending on the rating provider, while growing sums of money are being allocated to these indices through passive investing. The market for ESG benchmarks is highly concentrated: in December 2020, 17 out of the largest 20 ESG ETFs tracked ESG indices from the same index provider, according to data from ETFGI, with combined assets of EUR 57 bn. With global ESG ETF assets tripling to EUR 121 bn in 2020 and more than half of new European ETFs integrating sustainable criteria into their investment process, the magnitude of these issues seems likely to further increase, including in Europe (RA.2)⁽¹⁶⁷⁾.

RA.2
Number and AuM of European ESG ETFs
ESG ETF investing gained traction in 2 years



Note: Assets under Management of European ETFs, EUR bn, and number of ETFs (right axis)
Sources: Refinitiv Lipper, ESMA

Index replication

To illustrate how the choice of ESG rating provider matters in index construction, we focus

⁽¹⁶⁴⁾This is the case, for example, for second-party opinions from ISS-ESG and Vigeo Eiris. See examples in the International Capital Market Association's sustainable bonds database (<https://www.icmagroup.org/sustainable-finance/green-social-and-sustainability-bonds-database/#508>).

⁽¹⁶⁵⁾'How does S&P Global ratings incorporate ESG risks into its ratings analysis', 21 November 2017.

⁽¹⁶⁶⁾A study by SSgA (2019) finds a 53 % correlation between four leading ESG rating providers. Boffo et al. (2020a) find average correlations across three rating providers of 21 % and 18 % respectively for the S&P 500 and STOXX Europe 600 constituents.

⁽¹⁶⁷⁾'TrackInsight reports record assets in European, North American and ESG ETFs', 7 December 2020. ETF Stream, 'The year of ESG', 10 December 2020.

first on the constituents of the Euro STOXX ESG Leaders 50 Index. The benchmark administrator uses ratings from Sustainalytics to identify global 'ESG Leaders' from the 1 800 constituents of the STOXX Global 1800 Index. Out of these global 'Leaders', the 50 largest EA companies (by market capitalisation) form the Euro STOXX ESG Leaders 50 Index. However, not all ESG rating providers agree on the 'ESG Leadership' credentials of these companies. Between 62 % and 72 % of the companies identified by Sustainalytics as 'Leaders' are deemed to be so by MSCI and Refinitiv; the three providers agree on only 40 % of the index constituents (RA.3).

RA.3

Euro STOXX ESG Leaders 50: constituents' rankings
Disagreement on ESG leaders' ratings

	Sustainalytics	MSCI	Refinitiv	RepRisk
Leader	50	32	37	11
Average	—	18	13	26
Laggard	—	—	—	13

Note: Number of companies from the Euro STOXX ESG Leaders 50 Index (based on ratings from Sustainalytics) by ESG rating and rating provider. 'Leader' includes AAA and AA (MSCI and RepRisk), A+, A and A-. 'Average' includes BBB, BB and B (MSCI and RepRisk), B+, B and B- (RepRisk). 'Laggard' includes everything below. Differences in ratings may be due to definitions, methodologies or data sources, but also adjustments made to account for relative differences in company size, sector and domicile. All ratings as of December 2020. Sources: Datastream, MSCI, Refinitiv EIKON, RepRisk, STOXX, ESMA.

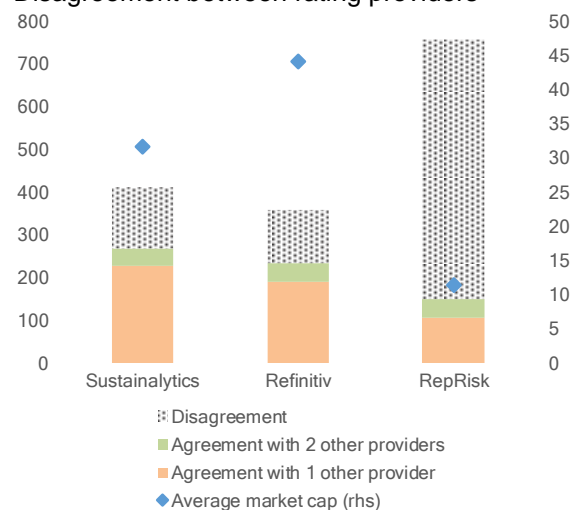
As highlighted by Berg et al. (2019) and Billio et al. (2020), such differences reflect to a large extent fundamental differences in measurement methodologies, including data sources⁽¹⁶⁸⁾ and the absence of standardised definitions.

We then replicate the methodology underpinning the STOXX Global ESG Leaders Index to identify 'ESG Leaders' using ESG ratings from alternative providers, starting from the same original pool of 1 800 companies⁽¹⁶⁹⁾. To qualify as an 'ESG Leader', a company must i) score in the top 50 %

in all three pillars (environmental, social, governance), and ii) score in the top 25 % in at least one pillar⁽¹⁷⁰⁾. Out of the 1 800 companies, 413 (23 %) pass both thresholds according to Sustainalytics, thus composing the STOXX Global ESG Leaders Index. We apply the same criteria to ESG ratings downloaded from Refinitiv and RepRisk and find that 359 (20 %) and 759 companies (42 %) respectively would qualify as 'ESG Leaders' (RA.4)⁽¹⁷¹⁾.

RA.4

Number and market caps of global ESG Leaders
Disagreement between rating providers



Note: Number of companies from the STOXX Global 1800 index identified as 'ESG Leaders' according to three ESG rating providers, and average market capitalisation (right axis), EUR bn. 'Agreement' means that a company would qualify as 'ESG Leader' according to at least two ESG rating providers. 'ESG Leaders' must score in the top 50% in all three pillars (environmental, social, governance) and in the top 25% in at least one pillar. Ratings and data as of December 2020. Sources: STOXX, Refinitiv EIKON, RepRisk, ESMA.

The highest rate of agreement is between Sustainalytics and Refinitiv, with 156 companies identified as 'ESG Leaders' based on the ESG ratings of both firms. This corresponds to 38 % and 43 % respectively of the total numbers of 'Global ESG Leaders' identified using their ratings.

Again, methodologies and data sources play a key role here and lead to significant skews in the

⁽¹⁶⁸⁾For example, RepRisk ratings are based on ESG risk incidents documented by media sources, non-governmental organisations, etc. as opposed to company disclosures. RepRisk: ESG data science and quantitative solutions, www.reprisk.com.

⁽¹⁷⁰⁾Sustainalytics also applies a 'Global Standards Screening', which screens news items from non-governmental organisations and media for incidents in potential violation of the UN Global Compact. While no such assessment is available in Refinitiv, we looked at companies' ESG controversy scores and found that around half of 87 companies with a 'poor' controversy performance according to Refinitiv were included in the Global STOXX ESG Leaders index.

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⁽¹⁷¹⁾MSCI makes a large number of its corporate ESG ratings publicly available on its website, but these cannot be downloaded in bulk and are therefore out of scope for this exercise.

data due to company size. Both Sustainalytics and Refinitiv base their ratings on a wide array of metrics weighted according to an in-house materiality assessment. Sustainalytics ratings aim to assess companies' exposure to and management of ESG risks using a combination of public data, information obtained directly from issuers, alternative data sources and own estimates. In contrast, Refinitiv ratings exclusively rely on publicly available information. While the latter approach promotes greater transparency, it is skewed towards larger companies that have sufficient resources to dedicate time and staff to non-financial reporting. RepRisk ratings rely on an alternative approach, capturing reputational risk exposure to ESG issues based on ESG risk incidents sourced from global media, NGOs, local news sources, etc. This approach also favours transparency but penalises larger companies more exposed to public scrutiny (despite some adjustments being made in the scoring). The existence of such biases is reflected in the size of companies that qualify as 'ESG Leaders', with average market capitalisation nearly five times higher for companies identified as 'ESG Leaders' using Refinitiv ratings than using RepRisk ratings.

Lastly, to illustrate the implications from these differences for indices that use ESG scores as a weighting scheme, we create a synthetic index replicating the methodology of the Euro STOXX ESG Leaders 50 Index using Refinitiv ratings as of December 2020⁽¹⁷²⁾. Since 18 March, the replicated index has outperformed its benchmark by a cumulative 12 pps, reflecting their different compositions (RA.5).

RA.5
ESG equity indices performance
Annual returns diverge by 8 percentage points



Note: Euro STOXX ESG Leaders 50 Index and replication index using Refinitiv ESG ratings, rebased with 1/1/2020=100.
Sources: Datastream, RefinitivEIKON, STOXX, ESMA

The 50 constituents from both indices have a comparable average market capitalisation of EUR 52 bn, i.e. EUR 2.6 trillion combined. The indices have 30 constituents in common (60 % overlap), with half of the companies in the replicated index that are not part of the benchmark seeing gross returns in excess of 70 % since 18 March. This mainly reflects differences in sectoral composition: these outperformers operate mainly in the automobile and other industrial sectors, which experienced large share price increases in November related to COVID-19 vaccine announcements, while telecom companies included in the benchmark index underperformed (see 'Sustainable finance', above, pp. 46–47).

While such differences can work in both directions, they are far from trivial: a retail investor buying EUR 10 000 worth of ESG ETF shares in March may in theory find herself or himself better or worse off by EUR 1 000 at the end of the year, as a result of the choice of ESG rating provider made by the benchmark provider. Asset managers with in-house expertise and financial resources value variety in ESG ratings and depth of analysis across providers. However, for retail investors buying ESG rating-based products such as ETFs, the full implications of the choice of ESG rating provider on their investments are

⁽¹⁷²⁾The index constituents are weighted based on the normalised environmental, social and governance scores (as of 2020) of each company relative to its peers. Owing to the scoring methodology and resulting number of 'ESG Leaders' with no reputational risk (i.e.

a 0 score), RepRisk ratings are not suitable to compute company weights that could be used in this particular exercise. For a full description of the methodology, see STOXX (2020).

not as clear and may entail significant search costs.

Risks ahead: more transparency needed

The current situation creates several risks. First, the absence of a common definition prevents authorities and investors from mapping the market, and leaves the definition of ESG risk to rating providers. This leads to misunderstandings about the objectives and comparability of ESG ratings, and high rates of disagreement between providers on the ESG credentials of companies.

The second problem concerns the transparency of methodologies that underpin ESG ratings. To produce ratings, providers use proprietary methodologies in line with their objectives and definitions. Methodological differences may stem from conscious choices in terms of scope, factor weights or aggregation methods. They may also reflect measurement divergence of the same attributes, such as the type of indicators or metrics used, or, more fundamentally, differences in the quality and consistency of ESG-related company disclosures. The French and Dutch securities markets authorities point out that such transparency issues may lead to investment misallocation, mismatches between expectations and ESG outcomes, or even greenwashing, while they prevent the integration of sustainability risks and opportunities in the investment-making process (AFM and AMF, 2020).

The current situation reflects in part the current state of the legislation; future improvements in the consistency and scope of climate-related disclosures following revisions of the EU Non-Financial Reporting Directive⁽¹⁷³⁾ should help. ESG rating providers have currently little choice but to rely on data of uneven quality that might penalise the absence of disclosure, and benefit larger firms able to afford disclosure (see for example *Financial Times*, 2020e). One related problem regularly cited by investors is the lack of information regarding the assumptions made where data are incomplete, insufficiently granular or simply unavailable (Boffo et al., 2020a).

The third risk stems from competition in the ESG rating market. While the recent wave of acquisitions may help reduce heterogeneity to some extent and arguably raise standards in the

ESG rating market, it leads to greater concentration of the market within a few large rating providers. In the medium term, the risk is of recreating an oligopoly situation similar to that of the credit rating market. Oligopolistic markets enable firms to exercise market power to increase prices or reduce quality of output. Typical competition-related issues that can lead to significant consumer detriment include pricing above competitive levels, risk of collusion, entry barriers, and reduced innovation and efficiency. The AMF and AFM (2020) also highlight the risk of reduced coverage for smaller issuers.

Finally, risks of conflicts of interest may originate from the coexistence of ESG rating service provision with other business areas. 'Ratings shopping' by issuers should be limited given the predominance of the 'investor pays' model. Instead, such conflicts may arise in the context of other products or services being sold to investors. For example, ratings from benchmark administrators may be influenced by their core activity, either to suit investors' needs in terms of, for example, representativeness or underlying liquidity, or simply to ensure sufficient robustness of index composition. Even though ESG rating service provision is typically carried out in separate legal entities, commercial interests or regulatory requirements concerning other business activities may lead to conflicting priorities. Similar issues may also arise within asset managers, financial data providers and firms carrying out green bond verification or certification. The risk of ratings inflation from such potential conflicts of interest may contribute to a lack of comparability and trust.

Conclusion

ESG ratings are useful in that they allow investors to obtain an external opinion on the sustainability credentials of companies and countries. ESG rating providers can play a valuable role through structured assessments based on rigorous methodologies, extracting value across thousands of issuers from ESG disclosures through their rating process (Boffo et al., 2020a). Thus, they have an important role to play in facilitating the transition to a more sustainable economy, allowing the optimal allocation of capital to cleaner companies and infrastructures. In addition, ESG ratings and providers incentivise

⁽¹⁷³⁾Directive 2014/95/EU as regards disclosure of non-financial and diversity information by certain large

undertakings and groups.

companies to improve their ESG credentials and levels of disclosure.

However, these benefits are hampered by several key concerns. The absence of a common definition for ESG ratings leads to investor and issuer confusion and misunderstandings. While the existence of different methodologies and approaches reflects the diversity of client needs, varying degrees of methodology and data transparency further limit the comparability of these ratings and the ability to understand what the main drivers and limitations are. Our analysis shows that these matters have a very significant impact on the composition of ESG indices, while a growing amount of money tracks these indices through passive ESG funds and ETFs. The coexistence of ESG ratings with other business activities in several ESG rating firms, such as credit ratings, benchmark construction, consulting services or asset management, further creates fertile ground for potential conflicts of interest.

This has significant implications for investor protection, with potential misalignment between investor expectations and investment outcomes, but also for sustainable development in the long run because of the potential mispricing of ESG-related information (Van Heijningen, 2019). The inconsistency of ESG ratings also leads to issues down the investment value chain: investment misallocation may result, either unintentionally through ESG rating-based indices, or intentionally from greenwashing and product mis-selling. These issues are ultimately detrimental to investor confidence and to the transition towards a more sustainable financial system.

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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
AIFMD	alternative investment fund managers directive
AMF	Autorité des Marchés Financiers
AuM	assets under management
BIS	Bank for International Settlements
bps	basis points
BTC	bitcoin
CA	cryptoasset
CBDC	central bank digital currency
CCP	central counterparty
CD	certificate of deposit
CDO	collateralised debt obligation
CDS	credit default swap
CI	closet indexing
CLO	collateralised loan obligation
CMBS	commercial mortgage-backed securities
CNAV	constant net asset value
Consob	Commissione Nazionale per le Società e la Borsa
COVID-19	coronavirus disease 2019
CP	commercial paper
CPMI-IOSCO	Committee on Payments and Market Infrastructures – International Organization of Securities Commissions
CRA	credit rating agency
DE	debt to equity
DeFi	decentralised finance
DLT	distributed ledger technology
DTO	derivatives-trading obligation
EA	euro area
Ebitda	earnings before interest, taxes, depreciation and amortisation
ECB	European Central Bank
EEA	European Economic Area
EM	emerging market
EONIA	euro overnight index average
ESG	environmental, social and governance
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
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
FSMA	Financial Services and Markets Authority
FTSE	Financial Times Stock Exchange
GBS	Green Bond Standard
GDP	gross domestic product
GM	growth market
HQLA	high-quality liquid assets
HY	high yield
IC	interest coverage
ICE	Intercontinental Exchange
ICT	information and communication technology

IG	investment grade
IMMFA	International Money Market Funds Association
IPO	initial public offering
IRD	interest rate derivative
ISIN	International Securities Identification Number
KID	key information document
KIID	key investor information document
LIBOR	London inter-bank offered rate
LMT	liquidity management tool
LSE	London Stock Exchange
LVNAV	low-volatility net asset value
MiFID II	revised markets in financial instruments directive
MiFIR	markets in financial instruments regulation
MMF	money market fund
MMFR	money market fund regulation
MTF	multilateral trading facility
MTLD	measure of textual lexical diversity
NACE	Statistical Classification of Economic Activities in the European Community
NAV	net asset value
NCA	national competent authority
NFC	non-financial corporation
OTC	over the counter
PDF	portable document format
PEPP	pandemic emergency purchase programme
pps	percentage point
PRIIP	packaged retail and insurance-based investment product
RCR	redemption coverage ratio
RegTech	regulatory technology
RoE	return on equity
S&P	Standard & Poor's
SMEs	small and medium-sized enterprises
SOFR	secured overnight financing rate
SRI	summary risk indicator
STO	share-trading obligation
Stresi	stress simulation
SupTech	supervisory technology
TRV	Report on trends, risks and vulnerabilities
UCITS	undertakings for collective investment in transferable securities
VNAV	variable net asset value
WAL	weighted average liquidity
WAM	weighted average maturity
WLA	weekly liquid assets

Currencies and countries abbreviated in accordance with ISO standards, except EL (Greece) and UK (United Kingdom)

