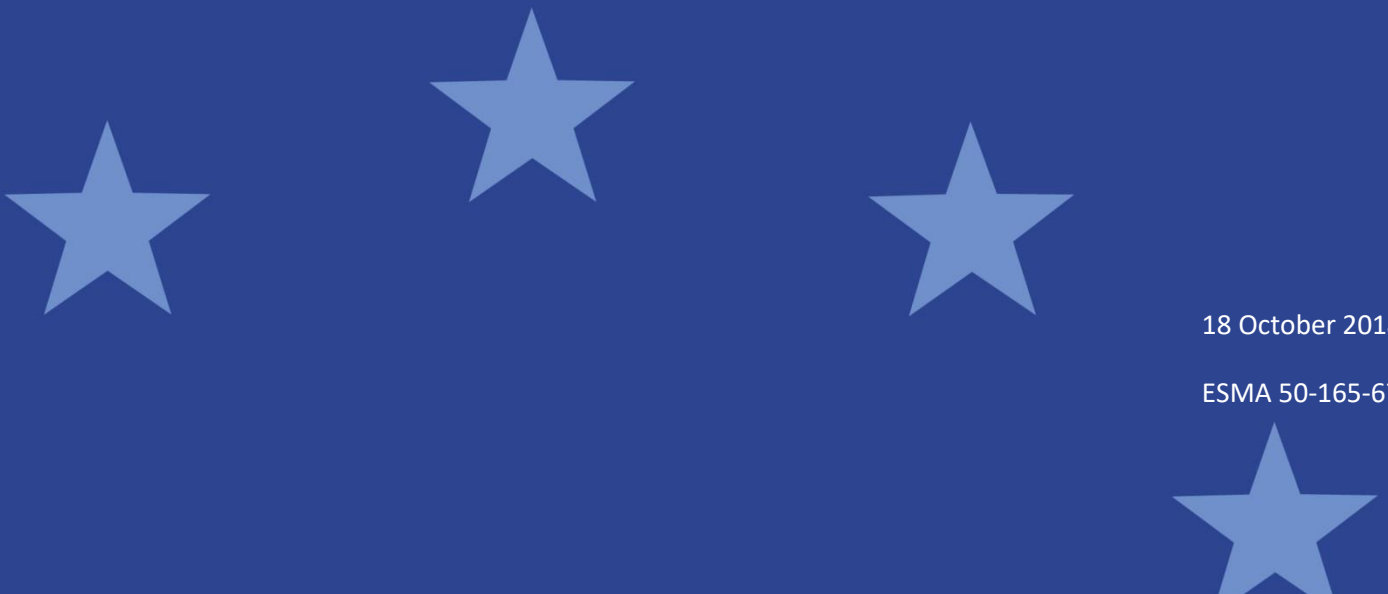




European Securities and
Markets Authority

ESMA Annual Statistical Report
EU Derivatives Markets
2018



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ESMA Annual Statistical Report on EU Derivatives Markets 2018

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Editorial

Dear reader –

With this edition, the European Securities and Markets Authority presents its first statistical report on EU derivatives markets, to be published in future on an annual basis.

Collecting data on derivatives market activities and making operational use of them has been one of the important policy initiatives in response to the global financial crisis. In 2008, G20 leaders identified derivatives markets as a potential source of financial stability risks and subsequently agreed to require mandatory reporting of derivatives contracts. In the EU, this commitment was translated into reporting requirements under the European Markets and Infrastructure Regulation (EMIR), such that since February 2014 the details of any derivative contract and its modification need to be reported to a Trade Repository (TR).¹

Most importantly, EMIR derivatives data will help supervisory authorities in their daily oversight of entities with derivatives exposures. Complementing this entity-level work, this Report provides, for the first time, a comprehensive market-level view of EU derivatives, based on a complete set of EMIR data as reported by all TRs in the EU. Its primary objective is to contribute to our risk assessment work at ESMA, complementing the ESMA Report on Trends, Risks and Vulnerabilities and ESMA's Risk Dashboards, through which we will continue to monitor developments and risks on a quarterly basis. In doing so, this report will also inform our regulatory assessment of derivatives markets. And – through the data standardisation and statistical methods developed for this analysis – we aim to facilitate entity oversight in supervisory authorities and contribute to their convergence.

The report contains three elements. First, in the chapter on market monitoring, we provide an analysis of structures and trends in European derivatives markets during each reporting period, building on the indicators developed for risk monitoring. Second, the chapter on statistical methods is dedicated to topical issues in developing and exploring derivatives data. Third, the derivatives market statistics chapter offers a full list of indicators and metrics monitored by ESMA.

With this first edition of the report, we are still at an early point in exploring, analysing and displaying key statistics on EU derivatives markets. EMIR data offer unprecedented reach and detail on derivatives transactions and exposures, the largest part of which remains to be developed for market statistics, such as clearing, margining, and collateralisation. In addition, derivatives markets evolve quickly, and so do statistical and analytical techniques. Thus, future editions of this Report will include more extensive data coverage, more risk indicators, and possibly also revisions of data and methods. To help us improve our reporting, we would be grateful if readers could send any feedback or suggestions on this report to risk.analysis@esma.europa.eu.

Operationalising the use of derivatives data has been – and will continue to be – a challenging task for IT experts, data managers, statisticians and analysts across numerous institutions involved in derivatives market oversight in Europe and around the world. We thank all colleagues in our community, especially at the Bank for International Settlements, at the European Systemic Risk Board and in national authorities, for their invaluable advice on our reporting so far, as well as ESMA staff for their dedicated work.

We at ESMA are pleased to share this part of our surveillance work with a wider audience, and we hope that our report will contribute to the understanding of the risks in EU derivatives markets.

¹ Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories (EMIR), Article 9.

Executive summary

Market monitoring

Market structure: At the end of 2017, TRs reported a total of 74mn open transactions amounting to a gross notional amount outstanding of around EUR 660tn, including both OTC and ETD derivatives. In notional terms, at the end of 2017, interest rate derivatives dominate the market, accounting for 69% of the total amount outstanding, followed by currency derivatives (12% of the total), while all other asset classes, i.e. equity, credit and commodity derivatives, accounted for less than 5% of the total amount outstanding each. Investment firms and credit institutions are the main participants in derivatives markets, and account for more than 95% of trading activity in notional terms. Concerning the remaining maturity of derivatives, short-term maturities prevail in terms of notional amount with 61% of derivatives having less than one year remaining maturity. Concentration among market participants, measured as the share of notional amount traded by the first five counterparties, is highest for commodity derivatives, accounting for 67% of the total notional amount, followed by equity derivatives (51%) and credit derivatives (40%).

Market trends: The European derivatives markets as a whole increased in size during 2017, starting with a notional amount of EUR 605tn and reaching EUR 660tn in 4Q17. Central clearing rates increased, from 25% to 27% for credit derivatives (CDs) and from 40% to 58% for interest rate derivatives (IRDs). These clearing rates also include contracts concluded before the clearing obligation came into force. Over-the counter (OTC) derivatives still dominated the market overall, however the share of exchange traded derivatives (ETD) increased from 13% to 17% (notional), although the trend was heterogeneous across asset classes. Concentration and the level of interconnectedness increased significantly in commodity derivatives markets, and to a lesser extent in IRD markets. Finally, the share of short-term maturities (less than one year) increased for IRDs, going from 35% to 48% while it decreased for currency derivatives, going from 95% to 85%.

Statistical methods

Fundamental issues in EMIR data handling and statistics: EMIR data provide a vast source of detailed information on European derivatives markets. As these data cover the whole EU derivatives market, consisting of an exhaustive number of market participants trading a wide range of asset classes and products within the asset classes, they are rather complex. This makes the data cleaning and preparation procedures necessary to enable processing and aggregation challenging. These procedures, such as reconciliation of transactions and outlier detection, are explained in detail in this section and can be applied to other projects using the EMIR dataset. In this explanatory article, we also detail the known data quality limitations and their possible impact on the analysis in this report.

Measuring central clearing in OTC markets: Increasing the central clearing of derivatives contracts has been one of the prominent regulatory objectives since the global financial crisis. Measuring progress towards this objective is not as straightforward as it may seem. This section provides an explanation of the methodology used for the estimation of clearing rates for different asset classes. Using EMIR data from TRs we provide evidence on the impact of the clearing obligation on the level of clearing for the classes of instruments subject to it.

Market monitoring

Market structure

At the end of 2017, TRs reported a total of 74mn open transactions amounting to a gross notional amount outstanding of around EUR 660tn, including both OTC and ETD derivatives. In notional terms, at the end of 2017, interest rate derivatives dominate the market, accounting for 69% of the total amount outstanding, followed by currency derivatives (12% of the total), while all other asset classes, i.e. equity, credit and commodity derivatives, accounted for less than 5% of the total amount outstanding each. Investment firms and credit institutions are the main participants in derivatives markets, and account for more than 95% of trading activity in notional terms. Concerning the remaining maturity of derivatives, short-term maturities prevail in terms of notional amount with 61% of derivatives having less than one year remaining maturity. Concentration among market participants, measured as the share of notional amount traded by the first five counterparties, is highest for commodity derivatives, accounting for 67% of the total notional amount, followed by equity derivatives (51%) and credit derivatives (40%).

EMIR data on EU derivatives

The statistics presented in this report are based on the reporting requirements specified in the European Markets and Infrastructure Regulation (EMIR)² and the Regulatory Technical Standards adopted for its implementation.

The article “Fundamental issues in EMIR data handling and statistics” in the chapter Statistical Methods presents details on the statistical standards and methods used. In a nutshell, these include the following:

Coverage: All derivatives transactions involving at least one counterparty domiciled in the EU³, as received from the TRs registered by ESMA⁴ are covered. The statistics encompass all derivative instruments, underlyings, maturities, currencies, counterparties, and trading venues.⁵

Measurement: All statistics are based on EMIR trade-state data, i.e. data including all outstanding transactions at the end of the

reference day, based on the state of each transaction along the derivatives life cycle.⁶ Statistics are presented as the number of contracts outstanding, or the notional value of contracts outstanding⁷.

Reporting period and periodicity: The reporting period is the calendar year 2017. Data are reported on an approximately quarterly basis.⁸

EU markets: Larger than previously measured

The trade state reports record a total of 74mn open transactions amounting to a **gross notional amount outstanding** of around EUR 660tn at the end of 2017, including both OTC derivatives and ETD derivatives. The semi-annual survey of the OTC derivatives market by the Bank for International Settlements (BIS) captures a large portion of the global OTC market and represents a benchmark against which aggregate OTC volumes from the EMIR dataset can be compared.⁹ According to the BIS survey, the total

² Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories (EMIR).

³ EMIR also applies in the European Economic Area, so all statistics presented in the report also include data as reported by entities domiciled in Iceland, Liechtenstein and Norway, unless indicated otherwise.

⁴ At the end of 2017, the following Trade Repositories were registered by ESMA in accordance with Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories (EMIR): DTCC Derivatives Repository Plc (DDRL, previously DTCC Derivatives Repository Ltd.), Krajowy Depozyt Papierów Wartościowych S.A. (KDPW), Regis-TR S.A., UnaVista Limited, CME Trade Repository Ltd. (CME TR), ICE Trade Vault Europe Ltd. (ICE TVEL), Bloomberg Trade Repository Limited and NEX Abide Trade Repository AB. Of the eight TRs registered at the time, six reported during the reporting period.

⁵ See El Omari, Y., M. Haferkorn and C. Nommels (2017) “EU derivatives markets – a first-time overview”, in ESMA Report on Trends, Risks and Vulnerabilities No. 2 2017,

for an overview of derivatives markets at the beginning of 2017.

⁶ See the section ‘Fundamental issues in EMIR data handling and statistics’, pp. 20-24 for a detailed description of the data used for the report.

⁷ Notional amounts outstanding are defined as the nominal or notional value of all transactions concluded and not yet settled at the reporting date. All figures are presented as gross values, without any form of netting.

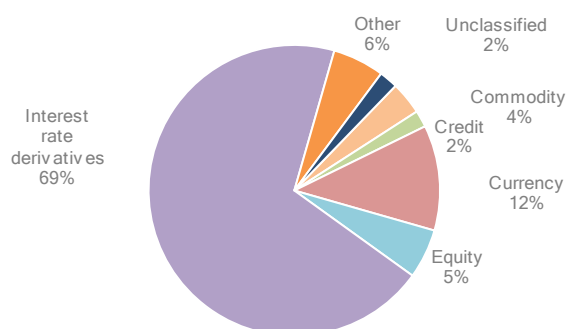
⁸ The 2018 report is based on the following four dates: 24/02/2017, 26/05/2017, 25/08/2017 and 27/10/2017. The dates were selected on the basis of data availability from TRs. To ensure comparability across the reporting dates, no data from after 01/11/2017, when updated RTS regarding EMIR reporting came into force, were used.

⁹ The BIS semi-annual survey provides information from a limited set of derivatives dealers, which report their aggregate derivatives positions on a global consolidated basis, including the positions of their foreign affiliates (after netting intra-group positions). About 70 major derivatives dealers from 13 countries participate in the

notional amount of outstanding OTC derivatives stood, globally, at USD 532tn at the end of 2017. This is comparable to the value of around EUR 542tn observed for EU OTC derivatives in the EMIR dataset. The comparison between the two datasets is not straightforward, as the EMIR reporting requirements apply to only EEA-resident entities. Differences in coverage may also be due to differences in the nature of data collection, with EMIR data being based on mandatory reporting unlike the BIS survey data.¹⁰

Across **instruments**, IRDs dominate the market, accounting for 69% of the total amount outstanding (ASRD.1). Currency derivatives follow, accounting for 12% of the total notional, while the other asset classes are all below 5% of the total notional. The overall picture is different and more diversified when the number of outstanding derivative transactions is considered. Equity derivatives and currency derivatives account for 38% and 32% of the outstanding derivatives positions at the end of 2017 respectively; followed by commodity derivatives (15%) and interest rate derivatives (8%) (ASRD-S.2).

ASRD.1
Gross notional amount outstanding by asset class
IR main underlying in terms of notional



Note: Gross notional amount outstanding by asset class, in % of gross notional amount outstanding.
Sources: TRs, ESMA.

Overall, in notional terms, the USD is the main **currency** of denomination of the derivatives traded in the EEA (33%), followed by EUR (28%), and GBP (11%). For the commodity segment, the EEA derivatives denominated in USD account for 91% of the total notional amount, while only 7% are denominated in EUR and 2% in GBP. The EUR is the most used currency for EU credit

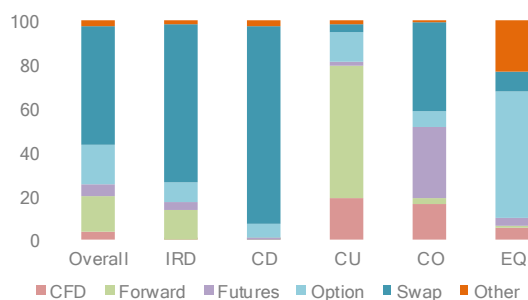
BIS' semi-annual survey; See Abad et al. (2016) "Shedding light on dark markets: First insights from the new EU-wide OTC derivatives dataset", ESRB Occasional Paper Series No. 11/September 2016.

¹⁰ See https://www.bis.org/statistics/d5_1.pdf. Other considerations limiting the comparability between the two aggregates include the different consolidation perimeter. The BIS survey includes positions on a global

derivatives, accounting for 51% of the total notional amount, closely followed by USD (47%). The denomination of interest rate derivatives is more diversified with 37% of the total notional of EEA derivatives in USD, 31% in EUR, 10% in GBP and 4% in JPY (ASRD-S.9).¹¹

There are five main types of derivatives contracts: forwards, futures, options, swaps and contracts for difference (CFDs). Swaps are the most common contract type in terms of notional amount, accounting for 50% of the total amount outstanding, driven by the already mentioned predominance of interest rate derivatives in terms of notional amount. Swaps are the main **contract type** used for credit derivatives (91% of total credit derivatives gross notional amount outstanding) and account for 41% of the commodity derivatives. For currency derivatives forwards are the most used contract type (60% of the total outstanding) followed by CFDs and options (19% and 14% of the total amount outstanding, respectively). For equity derivatives, options are the most used contract type, accounting for 58% of the total amount outstanding in notional terms (ASRD.2). In terms of the number of derivatives contracts, the most common contract types are CFDs (57%), futures (14%) and swaps (12% of the market).

ASRD.2
Gross notional amount by contract type
Swaps and options most frequently used



Note: Gross notional amount outstanding by instrument type, in % of gross notional amount outstanding by asset class.
Sources: TRs, ESMA.

Derivatives may be used by financial institutions to manage potential maturity mismatches in their balance sheets in the light of specific market trends. For instance, in the case of interest rate derivatives, shorter maturities may suggest that investors are positioning and hedging at the short

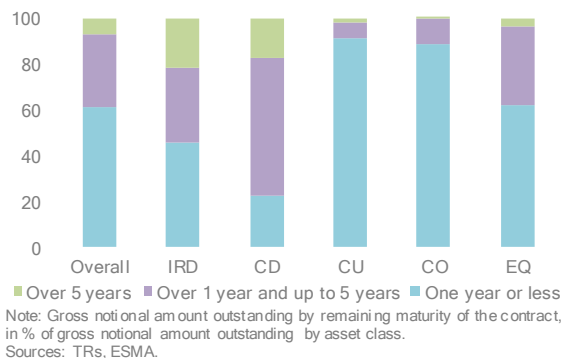
consolidated basis, while intra-group trades are considered in the aggregates presented in this report.

¹¹ According to BIS (2016), at the global level activity in USD-denominated OTC IRD contracts overtook activity in euro-denominated instruments between April 2013 and April 2016. For more details, see Ehlers, T. and E. Eren "The changing shape of interest rate derivatives markets", BIS Quarterly Review, December 2016.

end of the yield curve, possibly in response to changing expectations about the outlook for monetary policy. Overall, concerning the remaining **maturity** of the derivatives, short-term contracts prevail in terms of notional amount, with 61% of contracts having less than one-year maturity.

ASRD.3

Gross notional amount by remaining maturity

Majority of short-term contracts

Differences exist across derivatives asset classes. Commodity and currency derivatives have the shortest maturities, with respectively 89% and 91% of the contracts having a maturity of less than one year. For credit derivatives, 60% of the contracts in terms of notional amount have a maturity of between one year and five years, while for equity derivatives and IRDs respectively 62% and 46% of the contracts have less than one-year maturity. Maturities longer than five years are not very common, representing around 7% of total notional amount (ASRD.3).

Outstanding derivatives contracts: OTC derivatives continue to dominate

The trading and execution of derivatives contracts plays a central role in market integrity, efficiency and transparency. In response to the global financial crisis, policy makers have been concerned with bringing contracts that can be standardised to regulated markets (ETD), and reduce the number of contracts concluded over the counter.¹²

Derivatives executed in a regulated market or on an OTC basis have very different characteristics in terms of levels of standardisation, liquidity and post-trading processes such as central clearing.¹³ ETD markets are markets for derivatives contracts traded on regulated markets.¹⁴ ETDs have become more widely used in response to regulatory requirements, as the standardisation of contracts, liquidity, the reduction of default risk and transparency have become determining factors in investment strategies. However, ETDs are still less common than OTC derivatives.¹⁵

This global trend is corroborated by EMIR data for the EU. The overall share of exchange-traded transactions remains low, at 14% of the total number of derivatives. Currency and credit derivatives are mostly traded **OTC** with around 97% of the total number of trades, followed by interest rate derivatives (92%). For commodity and equity derivatives, OTC percentages are lower, although still very high (65% and 53% of the total, respectively). The higher incidence of

¹² The MiFIR trading obligation moves OTC trading in liquid derivatives into organised venues. Trading derivatives on-venue brings transparency to derivatives trading, benefiting investors and regulators alike. Enhanced transparency provides better information on prices, liquidity and risk thus fostering market integrity. MiFIR outlines the process for determining which derivatives should be traded on-venue. The trading obligation for derivatives under MiFIR is closely linked to the clearing obligation under EMIR. Once a class of derivatives needs to be centrally cleared under EMIR, ESMA determines whether these derivatives, or a subset of them, should be mandatorily traded on-venue on a regulated market (RM), multilateral trading facility (MTF), organised trading facility (OTF) or an equivalent third-country trading venue. The trading obligation applies only to classes of derivatives that are sufficiently liquid and available for trading on at least one trading venue. In a RTS, ESMA decided to make the following fixed-to-float interest rate swaps and CDS indices subject to compulsory on-venue trading: Fixed-to-float interest rate swaps denominated in EUR; fixed-to-float interest rate swaps denominated in USD; fixed-to-float interest rate swaps denominated in GBP; and Index CDS – iTraxx Europe Main and iTraxx Europe Crossover. Commission Delegated Regulation (EU) 2017/2417 of 17 November 2017 supplementing Regulation (EU) No 600/2014 of the European Parliament and of the Council on markets in financial instruments with regard to regulatory technical standards on the trading obligation for certain derivatives (Text with EEA

relevance). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.343.01.0048.01.ENG

¹³ IMF (2017) "Markets: Exchange or over-the counter", Finance & Development, July 2017.

¹⁴ Exchange-traded derivative is a derivative that is traded on a regulated market or on a third-country market considered to be equivalent to a regulated market in accordance with Article 28 of this Regulation (MiFIR), and as such does not fall within the definition of an OTC derivative as defined in Article 2(7) of Regulation (EU) No 648/2012, according to Article 2 under MiFIR (Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012).

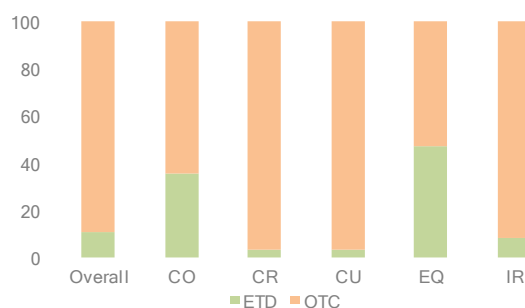
¹⁵ See Dek, M., T. De Renzis and L. Ionita (2018) "Exchange-traded derivatives in the EU – an overview", in ESMA Report on Trends, Risks and Vulnerabilities, No.1 2018, for an overview of the EU ETD market in 2H16, ahead of MiFID II/MiFIR implementation. The main findings of the article show that, in the current EU ETD market structure, derivatives contracts are characterised by a narrow range of exchange traded products on standardised markets, as opposed to the increasing diversity of OTC traded derivatives instruments.

ETD trades is driven by the underlying contract type. For instance, futures are used more in cases of equity and commodity derivatives (ASRD.4).

ASRD.4

ETD vs OTC notional amount

OTC dominating



Note: Share of gross notional amount outstanding, by asset class, in %.
Sources: TRs, ESMA.

Central clearing: Requirements for IRD and CD

In order to increase financial stability and enhance resilience in OTC markets, EMIR introduced the obligation to centrally clear certain classes of OTC derivatives contracts through central counterparties (CCPs)¹⁶. In particular, the clearing obligation applies to EU firms that are counterparties to an OTC derivatives contract including interest rate, currency, equity, credit and commodity derivatives. EMIR identifies two categories of counterparties to whom the clearing obligation applies: Financial counterparties (FC) such as banks, insurers, and asset managers, and non-financial counterparties (NFCs) which include any EU firm whose positions in OTC derivatives contracts (unless for hedging purposes) exceed the EMIR clearing thresholds.¹⁷ The OTC derivatives subject to the clearing obligation are specified in ESMA's Public Register for the Clearing Obligation, and include certain OTC interest rate derivatives classes (such as the basis swaps, Fixed-to-Float Interest Rate Swaps, Forward Rate Agreements, and Overnight Index Swaps

identified in this Register) and certain OTC credit derivatives classes (certain European untranching Index CDS Classes).

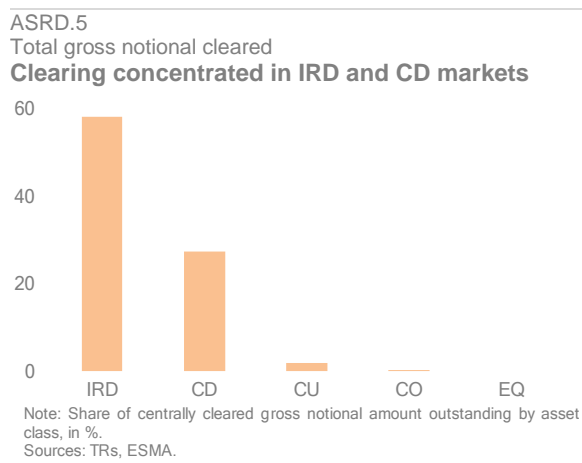
These regulatory provisions are clearly reflected in the evidence from EMIR data. At the end of 2017, **central clearing** occurred mainly in two OTC markets, the credit and the interest rate derivatives markets, where clearing obligations are in place. In 4Q17, 58% and 27% of gross notional amount were cleared for IRDs and CDs respectively (ASRD.5).¹⁸ These statistics, however, are subject to substantive dynamics over time. First, this report is based on stock measures from trade state data, as opposed to flow measures from transaction data. Therefore, OTC transactions that were concluded before the clearing obligation came into force are included in the statistics. Looking at CD and IRD contracts concluded in the course of 2017, clearing rates are significantly higher and thus it can be expected that the stock of centrally cleared CD and IRD OTC contracts will increase over time, as pre-clearing obligation contracts mature. Second, novation of a trade through a CCP replaces what would have been a single contract between two counterparties (clearing members) into two positions, between the CCP and each of the counterparties, resulting in some form of double counting that tends to overestimate central clearing rates. Third, a set of trades, previously netted bilaterally between counterparties, can be netted multilaterally within the CCP when they are cleared. The netted positions resulting from central clearing tend to result in underestimations of the central clearing rates. Our methodology for central clearing rates deals with an overestimation due to double counting but an assessment of the effect of netting is not covered and is left for future work. The same effect holds for netting reached through compression services offered by third parties.¹⁹

¹⁶ As of 31 December 2017, 16 CCPs were authorised to operate in the EU, incl. Nasdaq OMX Clearing AB, European Central Counterparty N.V., KDPW_CCP, Eurex Clearing AG, Cassa di Compensazione e Garanzia S.p.A. (CCG), LCH SA, European Commodity Clearing, LCH Ltd, Keler CCP, CCP Austria Abwicklungsstelle für Börsengeschäfte GmbH (CCP.A), LME Clear Ltd, BME Clearing, OMIClear - C.C., S.A., ICE Clear Netherlands B.V., Athens Exchange Clearing House (Athex Clear) and ICE Clear Europe Limited (ICE Clear Europe).

¹⁷ Intra-group transactions are exempted from central clearing under certain conditions. Pension funds are exempted from central clearing until 15 August 2018.

¹⁸ See section 'Measuring central clearing in OTC markets', p. 25-31 for an extensive analysis of central clearing in EEA OTC derivatives markets.

¹⁹ Portfolio compression is defined in MiFIR as a risk reduction service in which two or more counterparties wholly or partially terminate some or all of the derivatives submitted by those counterparties for inclusion in the portfolio compression and replace the terminated derivatives with another derivative whose combined notional value is less than the combined notional value of the terminated derivatives.



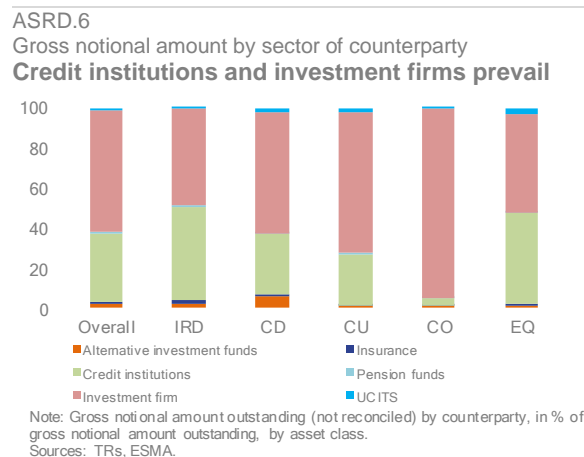
Counterparties: High concentration in key segments

The landscape of counterparties engaged in derivatives transactions plays a crucial role in market and supervisory risk assessments, as it reflects the risks that individuals or groups of entities expose themselves to in the market.

EMIR data strongly confirm the central role of **investment firms and credit institutions** in the derivatives industry. They are the main participants in derivatives markets, trading almost 95% of the market in notional terms (ASRD.6) (63% and 32%, respectively). This result has to be interpreted carefully as investment firms and credit institutions may act as intermediaries and conduct trading on behalf of end clients. However, EMIR data do not allow the identification of the end clients.

Across different asset classes, the relative shares attributable to credit institutions and investment firms vary, with investment firms trading 95% of commodity derivatives but less than 40% of currency derivatives and equity derivatives, where credit institutions have the majority of transactions in terms of notional amount. **Alternative investment funds** seem to be active mostly in credit derivatives (around 6% of the market notional amount) and interest rate derivatives markets (around 3% of the market notional amount). **UCITS funds** are minor players in the market. Their exposure in the market is higher than 2% of the total notional amount in only the credit derivatives and the equity derivatives segment (ASRD.6). This result

is in line with recent analysis on the use of CDS by UCITS funds.²⁰



We use three different indicators to analyse the **concentration** among market participants in the EU derivatives markets.

First, we use the share of notional amount traded by the largest five counterparties. Based on this simple measure, concentration is higher for commodity derivatives, accounting for 69% of the total notional amount held by the largest five counterparties, followed by currency derivatives (66%) and credit derivatives (40%).

Second, we look at the number of counterparties involved in the market. Here, we find very low numbers of counterparties for credit derivatives (fewer than 10,000 counterparties), interest rate derivatives (230,000 different counterparties), currency derivatives (more than one million counterparties), equity derivatives (600,000 counterparties) and commodity derivatives (around 600,000 counterparties) are less concentrated based on this measure.

The third indicator we employ to analyse concentration in derivatives markets is the Herfindahl-Hirschman Index (HHI), the most commonly utilised measure of concentration. The HHI captures both the number of firms and the dispersion of the market shares. A higher HHI is associated with higher concentration, i.e. less competition, in a market, whereas a smaller HHI is associated with a more competitive, i.e. less concentrated market. The concentration, as measured by the HHI, is higher for currency derivatives (0.24) and for interest rate derivatives (0.21) (ASRD.7). From an analytical perspective, there are several ways to assess levels of concentration, including a comparison with other

²⁰ Braunsteffer, A., C Guagliano, O. Kenny, J. Mazzacurati "The use of CDS by UCITS investment funds - Evidence from regulatory data", ESRB Working Paper, forthcoming. Guagliano, C. J. Mazzacurati "Drivers of CDS usage by

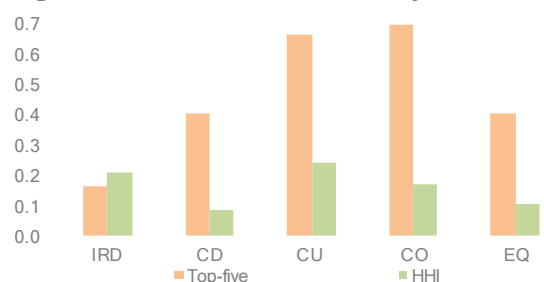
EU UCITS funds", ESMA Report on Trends, Risks and Vulnerabilities Report, No. 2 2018.

financial markets (e.g., equity markets, bond markets), with other financial sector industries (e.g., the banking sector and the asset management industry) and with the competition standards used by the European Commission to measure the impact of mergers on concentration. In this report, we follow the EC guidelines on the assessment of horizontal mergers as a benchmark. According to the guidelines – which are widely used to provide an indication for concentration levels in a market – an HHI value of below 0.1 indicates low concentration levels and an HHI value of between 0.1 and 0.2 indicates medium concentration levels. Our assessment below is from an analytical perspective for the purpose of this statistical report only. We find that the levels of concentration in IRD, currency derivatives and commodity derivatives markets are medium.²¹ For credit derivatives and equity derivatives, the concentration level is low as indicated by HHI values of below 0.1.

ASRD.7

HHI and top-five counterparties

Higher concentration for commodity derivatives



Note: Market share of top-five counterparties and HHI calculated on aggregated gross notional positions of counterparties. Top-five in %, HHI normalised between 0 and 1.

Sources: TRs, ESMA.

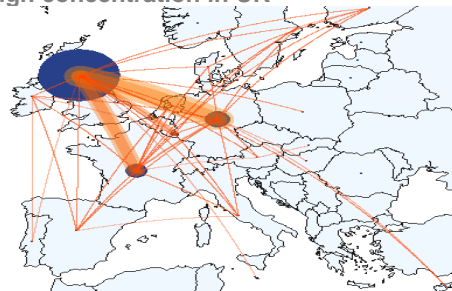
Finally, we explore the cross-border dimension of derivatives exposures in the EU. We map the derivatives exposures using the reporting counterparty's domicile information. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the country (i.e., the sum of all individual exposures). The thickness of the line is

proportional to the gross notional amount outstanding between counterparties from the two countries. While there is some heterogeneity across asset classes, the **geography of EU derivatives markets** shows that the majority of the market in terms of counterparties is domiciled in the UK. Credit derivatives are confirmed to be a very concentrated market when the geographical perspective is considered with most of the trading focused in the UK (ASRD.8).

ASRD.8

Credit derivatives: Geographical network

High concentration in UK



Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.

Source: ESMA.

The UK is also the main market for trading commodity derivatives and interest rate derivatives while for equity derivatives the large majority of trading occurs between the UK and France (ASRD-S.10 to ASRD-S.14). The analysis provides a unique insight into the geography of EU derivatives markets exposures. However, such geographic data are based on a first counterparty basis and may not reflect the ultimate risk holders. As already mentioned, EMIR data do not allow the identification of the end clients. Therefore, we may overestimate the role of large dealers in the market that are mostly domiciled in some EU countries.

²¹ Council Regulation (EC) No 139/2004 of 20 January 2004 on the control of concentrations between undertakings and "Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings" <https://eur-lex.europa.eu/legal->

[content/EN/TXT/HTML/?uri=CELEX:52004XC0205\(02\)&from=EN](https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52004XC0205(02)&from=EN). Article 19 and Article 20 of these European Commission Guidelines refer both to levels and to changes in the HHI following a merger.

Market trends

The European derivatives markets as a whole increased in size during 2017, starting with a notional amount of EUR 605tn and reaching EUR 660tn in 4Q17. Central clearing rates increased, from 22% to 27% for credit derivatives (CDs) and from 49% to 58% for interest rate derivatives (IRDs). These clearing rates also include contracts concluded before the clearing obligation came into force. Over-the-counter (OTC) derivatives still dominated the market overall, however the share of exchange traded derivatives (ETD) increased from 13% to 17% (notional), although the trend was heterogeneous across asset classes. Concentration and the level of interconnectedness increased significantly in commodity derivatives markets, and to a lesser extent in IRD markets. Finally, the share of short-term maturities (less than one year) increased for IRDs, going from 35% to 48% while it decreased for currency derivatives, going from 95% to 85%.

EU derivatives: +9% outstanding in 2017

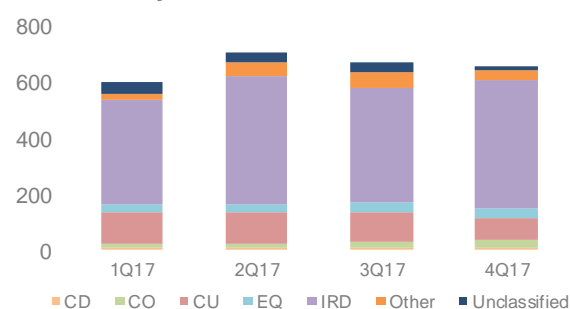
This section is based on available EU-wide derivatives market data from 2017 and presents the main market developments observed in European derivatives markets in 2017. Future reports will benefit from longer time series and thus allow for richer market trend analysis of, for example, long-term developments and seasonality.

The European derivatives markets as a whole increased in **size** during 2017, starting with a gross notional amount of EUR 605tn in 1Q17 and reaching around EUR 660tn in 4Q17, with a peak at EUR 705tn in 2Q17. The increase was most pronounced for commodity derivatives, with notional amounts outstanding more than doubling from EUR 11tn to EUR 24tn. However, the commodity derivatives market remains comparatively small. Gross notional amounts in interest rate derivatives, the largest derivatives market increased by 20%, from EUR 378tn in 1Q17 to EUR 459tn in 4Q17. For equity derivatives the increase was higher (33%), from EUR 27tn to EUR 36tn. Currency derivatives decreased in size over the reporting period shrinking from EUR 113tn to EUR 77tn (-32%), while credit derivatives remained stable at EUR 12tn (ASRD.9).

ASRD.9

Gross notional amounts outstanding by asset class

Dominated by IRDs



Note: Gross notional amount outstanding, by asset class, in EUR tn.
Sources: TRs, ESMA.

In terms of **contract types**, while, in notional terms, swaps and options account for the majority, CFDs dominate if the number of transactions outstanding is considered, amounting to 29% of all transactions in 1Q17, and 57% in 4Q17. This difference is particularly accentuated for equity, currency and commodity derivatives (ASRD-S.40, ASRD-S.52 and ASRD-S.64).

Maturity: Stable distribution

Concerning the **residual maturity** of the derivatives over the reporting period, the distribution of total gross notional across maturities was, overall, stable during 2017, with around 60% of the notional amount being of short-term maturity (less than one year), one third of the amount being of between one year and five

years maturity, and less than 10% being of longer term maturity.



Nevertheless, the picture is less straightforward when individual asset classes are considered. While for credit, commodity and equity derivatives the maturity distribution did not evolve much, for IRDs, the share of short-term maturities increased from 35% in 1Q17 to 45% in 4Q17. On the other hand, the share of short-term contracts decreased from 95% in 1Q17 to 91% in 4Q17 for currency derivatives (ASRD.10).

OTC clearing: Central clearing rising

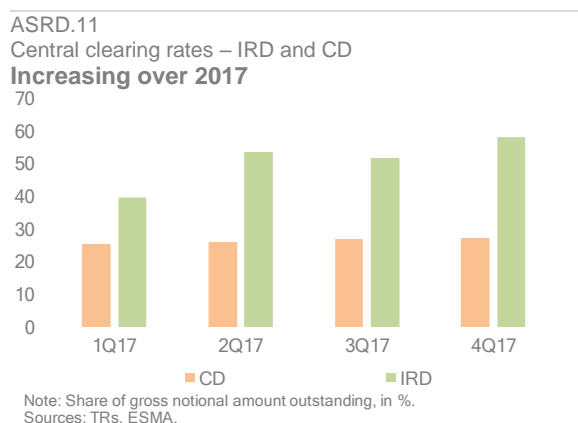
The **central clearing** rate of outstanding OTC derivatives is a very important feature for OTC derivatives, as cleared trades have risk mitigation mechanisms that render them similar to the ETD trades. Centrally cleared derivatives are subject to robust counterparty risk management techniques, such as initial and variation margin collection, that enable more transparency and a more efficient use of collateral through multilateral netting. Nevertheless, while the clearing rates are an important risk monitoring tool, their calculation is not straightforward and this is discussed at length in the statistical methods section (pp. 25-31). Several dynamics affect the trends of central clearing.

In addition to market developments, regulatory efforts to increase central clearing tend to drive the central clearing rates up while multilateral netting and other compression mechanisms tend to drive the central clearing rates down. Indeed, if for example a CCP nets a set of gross positions transforming them into a smaller set of netted positions, the total notional amount going through the CCP is reduced and thus the clearing rate is also reduced. Therefore, more transactions going through central clearing can result, through more

efficient multilateral netting, in a lower central clearing rate.

As mentioned in the previous section, central clearing occurs mainly in two OTC markets, the credit derivatives and the interest rate derivative markets. Following the entry into force of the different clearing obligations, clearing rates increased during 2017. For OTC credit derivatives, which are mostly made up of single-name and index CDS the overall rate of central clearing increased in 2017, starting at 25% and ending the year at 27%. The bulk of the trades were cleared by EU CCPs (60% in 4Q17). For OTC IRDs, which are by far the asset class in which central clearing occurs most frequently, the clearing rates oscillated between a lower bound of 40% in 1Q17 to 58% in 4Q17, almost entirely cleared by EU CCPs (96% in 4Q17) (ASRD.11). To put this result into perspective, this report is based on stock measures from trade state data, as opposed to flow measures from transaction data. Therefore, OTC transactions that were concluded before the clearing obligation came into force are included in the statistics. Looking at CDs and IRDs contracts concluded in the course of 2017, clearing rates are significantly higher, which explains the increase of central clearing rates during the course of 2017.

Finally, virtually no central clearing occurs in OTC markets for all other asset classes (less than 3% for currencies and less than 1% for commodity and equity).



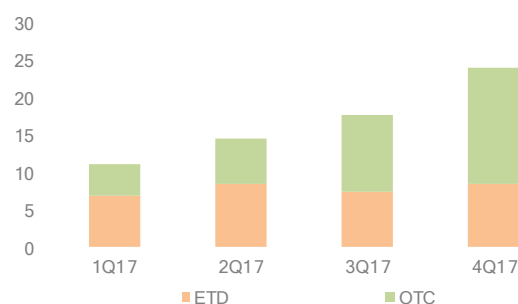
Execution: Small but increasing share of of ETDs

An important characteristic to monitor in derivative markets is the type of execution. In general, trades executed **OTC** are, especially when not cleared, subject to more counterparty risk than **ETD**, as they are less standardised and less

liquid. Consequently, a similar effort to the one related to the clearing obligation has been conducted internationally to encourage activity on organised trading platforms²².

Overall, the notional amounts of ETDs remained at a relatively low level throughout 2017, oscillating between 9% (in 1Q17) and 12% (in 2Q17) of the total. For interest rate and credit derivatives, trading happened mostly OTC (only 9% and 3%, respectively, of the total notional amount were accounted for by ETDs on average in 2017). The ETD share was much more important for equity derivatives for which this segment has grown in importance, starting at 39% of the entire market in 1Q17 and reaching 47% in 4Q17. For commodity derivatives, an interesting trend occurred: the rate of trades executed on exchanges decreased steadily over the year, declining from 61% to 35%, mostly because of a surge in OTC notional amounts and the number of trades, while ETD amounts remained stable (ASRD.12). Finally, the rate of ETD trades for currency derivatives jumped from less than 1% in 1Q17 to 9% in 3Q17 and then went down again to 3% in 4Q17.

ASRD.12
ETDs vs. OTC derivatives – Commodity derivatives
Increase in OTC trades



Note: Gross notional amount outstanding by type of market, in EUR tn.
Sources: ESMA.

Concentration: Significant increase

For risk assessment, another structural feature to monitor in derivatives markets is their level of **concentration**. As described in the previous section, we measure concentration using the HHI indicator, the market share of the top-five market participants and the number of unique counterparties for each asset class at each date. The concentration in the commodity market has increased significantly in terms of both HHI values and the exposure of its top-five

participants, from 0.08 to 0.17 for the former and from 45% to 69% for the latter. However, the number of counterparties active in this market has increased over the reporting period (around 621 thousand counterparties) (ASRD-S.69 and ASRD-S.70). The concentration is low for equity derivatives, although it did increase slightly over the year, with the HHI value at 0.06 in 4Q17, compared with 0.05 in 1Q17, and the market share the top-five participants increasing from 32% to 40% in the same period. The number of counterparties involved in the equity derivatives market increased to around 600 thousand (ASRD-S.45 and ASRD-S.46). IRDs are characterised by a high number of counterparties active in the market, around 230,000, and by a relatively low concentration, even though the HHI value increased from 0.11 to 0.21; the market share of the top-five participants decreased from 20% to 16%, and the number of counterparties declined slightly (ASRD-S.21 and ASRD-S.22). For currency derivatives, market concentration evolved over the reporting period, as the HHI value started at 0.25 in 1Q17, went down to 0.16 in 2Q17 and then jumped again to 0.24. The exposures of the top-five participants increased from 58% in 1Q17 to 66% in 4Q17 while the number of unique counterparties increased to more than one million (ASRD-S.57 and ASRD-S.58). Concentration in credit derivative markets, as measured by the HHI and the top-five participants' exposures, was stable over the course of 2017, at around 0.08 and 40% respectively. The number of counterparties increased over the year to around ten thousand, although remaining particularly low (ASRD-S.33 and ASRD-S.34).

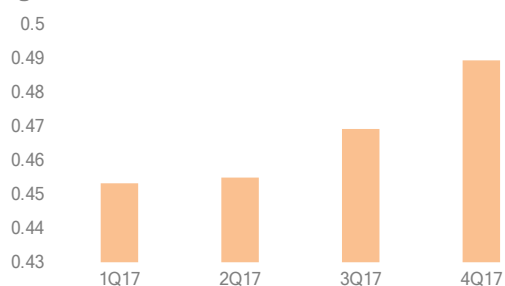
Interconnectedness: Interlinkages become closer

For **interconnectedness**, we look at a set of network indicators. The degree-interconnectedness indicator is the simplest measure used to analyse networks and it is based on the number of counterparties every participant has. Overall, in 2017, the number of counterparties of every market participant increased across derivatives categories, pointing to an increase in interconnectedness of the system (ASRD.13). A different trend, confirmed by other indicators, seems to characterise

²² <http://www.fsb.org/2017/06/otc-derivatives-market-reforms-twelfth-progress-report-on-implementation/>

interest rate derivatives that experienced a decline in level of degree-interconnectedness.

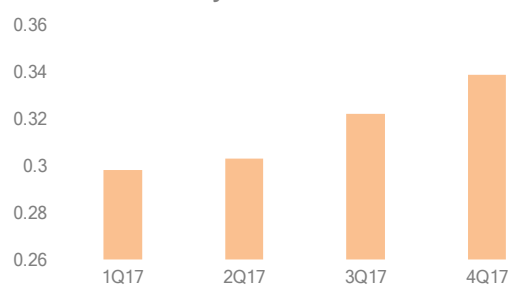
ASRD.13
Degree-Interconnectedness – CD derivatives
Higher interconnectedness



Note: The degree-interconnectedness indicator measures the number of counterparties every market participant has. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

Betweenness-interconnectedness represents the degree to which participants stand between each other; participants with a high level of betweenness-interconnectedness will have the potential to diffuse market stress between many counterparties. For credit derivatives, the level of betweenness-interconnectedness increased over the year, indicating an increase in interconnectedness in the credit derivatives markets, as there was a higher proportion of market participants entering transactions with many other market participants (ASRD.14).²³ This might reflect the evolving structure of the credit derivatives market from a purely inter-dealer market to a market with CCPs between the dealers.

ASRD.14
Betweenness-Interconnectedness – CD derivatives
Increased over the year

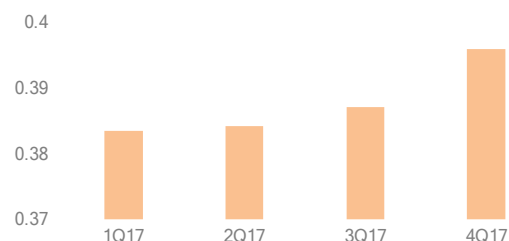


Note: The betweenness-interconnectedness indicator is based on the tendency of one participant to be standing between many other participants in credit derivatives markets. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

The two other interconnectedness measures capture the indirect part of interconnectedness. The eigenvector-interconnectedness indicator is a recursive measure that indicates the tendency

of participants to be exposed to other central participants. It measures how well connected a participant is, and how many links its connections have within the network. With the exception of interest rate derivatives, participants increased their influence over the whole network, not just those directly connected to it, signalling increased interconnectedness.

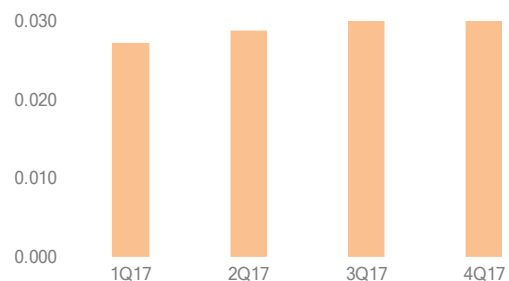
ASRD.15
Eigenvector-Interconnectedness – EQ derivatives
Increased influence over the network



Note: The eigenvector-interconnectedness indicator measures a participant's influence based on the number of links it has to other participants within the network. Eigenvector then goes a step further by also taking into account how well connected a participant is, and how many links their connections have, and so on through the network. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

This trend is particularly clear for equity derivatives (ASRD.15).

ASRD.16
Closeness-Interconnectedness – CU derivatives
Larger relative distance between counterparties



Note: The closeness-interconnectedness indicator calculates the shortest paths between all participants, then assigns each participant a score based on its sum of shortest paths. It ranges between 0 (lowest interconnectedness) and 1000 (highest interconnectedness).
Sources: TRs, ESMA.

The closeness-interconnectedness indicator is based on the average distance between all the market participants (e.g., two counterparties that are not trading with each other but that are both trading with the same third counterparty would have a distance of two). Closeness gives an idea of which participants have the potential to influence the entire network quickly. Interconnectedness measured by the closeness indicator decreased for interest rate, credit,

²³ See Statistical Annotations, p.44, for more details around the construction of the concentration and the interconnectedness indicators.

currency and commodity derivatives while it increased for equity derivatives (ASRD.16).

Contracts for Difference: Very large increase in outstanding trades in 2017

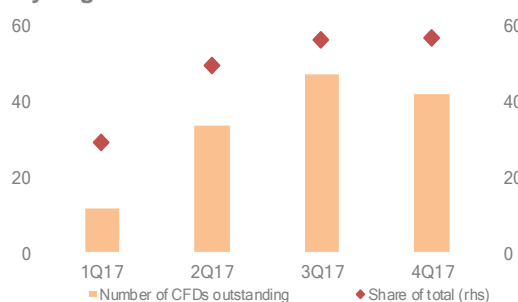
CFDs are cash-settled derivatives contracts designed to give the holder (long or short) exposure to an underlying, and, in contrast to most other derivatives, do not have a predetermined expiry date.

In terms of volume, this sub-market is of limited importance, considering that CFDs constitute less than 1% of the gross notional amount outstanding of derivatives in the EU. In terms of number of contracts, however, this market segment had risen to an unprecedented size in recent years. Thus, outstanding CFD transactions more than doubled during 2017 and made up almost 60% of all derivatives outstanding in 4Q17 (ASRD.17). This high number of transactions reflects the widening use of this type of contract among a growing number of retail clients, as opposed to professional investors.

ASRD.17

CFDs – Number of derivatives

Very large increase in number of CFDs



Note: Number of derivatives outstanding in mln. CFD share of total number of derivatives outstanding, in %.

Sources: TRs, ESMA.

In the light of the high risks involved in these transactions, ESMA imposed, as part of its product intervention powers, a restriction on the marketing, distribution and sale of CFDs to retail investors (ASRD.18). The restrictions have applied since 1 August 2018²⁴, and their effects, as a result, cannot be seen in the 2017 statistics charted in this report. EMIR data will, however, be used to monitor the impact of the product intervention measures and reporting to the public

in our semi-annual Trends, Risks and Vulnerabilities Report as well as in future editions of the Annual EU Derivatives Market Report.

ASRD.18

ESMA's product intervention measures

Restricting the provision of CFDs to retail investors

The measures adopted by ESMA, as part of its product intervention powers, including a restriction on the marketing, distribution and sale of CFDs to retail investors, have applied since 1 August 2018.

ESMA, along with NCAs, had identified a significant investor protection concern in relation to CFDs offered to retail investors. The measures, which apply to firms across the EEA, have been taken to protect retail investors.

The intervention measures relate to CFDs, which are cash-settled derivatives contracts designed to give the holder (long or short) exposure to an underlying. These CFDs include, inter alia, rolling spot forex products and financial spread bets. Unlike some other products such as options, CFDs are cash-settled and do not have a predetermined expiry date. They are typically offered with leverage which amplifies returns. However, a source of detriment to investors is the high leverage, as financing costs and transaction costs (such as bid-ask spreads) are typically based on the investment's total value. An additional source of risk identified was that high leverage exacerbates the risk of sudden price movements depleting much or all of an investor's margin, or even leaving the investor owing money to providers. In the case of the Swiss franc event of January 2015, for instance, when the franc rose suddenly against the euro following a policy announcement by the Swiss National Bank, many retail investors were left owing very large sums of money to firms.

Investor protection concerns relate to the complexity and lack of transparency of the products. In the case of CFDs, excessive leverage is also a concern.

NCAs' analyses of CFD trading across different EU jurisdictions have shown that 74% to 89% of retail accounts typically lost money on their investments, with average CFD trading losses per client ranging from EUR 1,600 to EUR 29,000 in recent years.

The agreed restrictions on the marketing, distribution and sale of CFDs to retail investors are as follows:

- leverage limits on opening positions;
- a margin close-out rule on a per-account basis; negative balance protection on a per-account basis, standardising practices between providers and preventing investors' margins from being eroded close to zero;
- negative balance protection ensuring that investors are not placed in a position of owing money to providers;
- preventing the use of incentives by a CFD provider; and
- a firm-specific risk warning delivered in a standardised way.

MiFIR gives ESMA the power to introduce temporary intervention measures on a three monthly basis. Before the end of the three months, ESMA will review the product intervention measures and consider the need to extend them

²⁴ https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.136.01.0050.01.ENG&toc=OJ.L:2018:136:TOC

for a further three months.

Bottom line: Clearing obligation works, all else differs across market segments

Finally, focusing on the different asset classes the following main trends can be identified from 2017:

- **Interest-rate derivatives:** IRDs increased in size in terms of both the notional amounts and the number of transactions outstanding. Clearing rates increased in this market, from 40% in 1Q17 to 58% in 4Q17. Concentration, as measured by the HHI, increased in 2017, though remaining at a low level.
- **Credit derivatives:** CDs were rather stable in size but clearing rates increased, from 25% in 1Q17 to 27% in 4Q17. Interconnectedness increased across measures.
- **Equity derivatives:** For equity derivatives, notional amounts increased while the number of transactions oscillated over the year. The number of CFDs, by far the largest category in terms of number of transactions, doubled over the course of the year. Concentration and interconnectedness were broadly stable.
- **Currency derivatives:** Currency derivatives saw a surge in the number of CFD positions outstanding between 1Q17 and 2Q17, with no consequence on the notional amounts outstanding as these contracts, mainly used by individual investors tend to have relatively small notional amounts. The concentration in this market decreased over the period, potentially because of the increase in the number of CFD investors.
- **Commodity derivatives:** For commodity derivatives, the market evolved significantly, with a large increase in notional amounts and numbers of transactions outstanding, even though remaining a relatively small market. This increase in market size was mostly due to an increase in the number of OTC contracts (for some commodity swaps and CFDs). In terms of market participants, investment firms have been most active in the market. Concentration and interconnectedness increased over the year.

Statistical methods

Fundamental issues in EMIR data handling and statistics

EMIR data provide a vast source of detailed information on European derivatives markets. As these data cover the whole EU derivatives market, consisting of an exhaustive number of market participants trading a wide range of asset classes and products within the asset classes, they are rather complex. This makes the data cleaning and preparation procedures necessary to enable processing and aggregation challenging. These procedures, such as reconciliation of transactions and outlier detection, are explained in detail in this section and can be applied to other projects using the EMIR dataset. In this explanatory article, we also detail the known data quality limitations and their possible impact on the analysis in this report.

Introduction

Derivatives are characterized by an exceptionally high degree of heterogeneity compared with cash market instruments. In particular, the dependence on the underlying, different pay-off profiles and the life cycle of a derivative, with all the (potential) steps in between (clearing, compression and netting), drives not only the complexity of the instruments, but also the reporting. A number of public authorities provide market overviews and risk analyses related to derivatives markets (El Omari et al., 2017). At a global level, BIS continues to provide regular insight on the global derivatives markets drawn from its survey of dealers (BIS, 2018). Among European institutions, in particular the ECB and the ESRB made significant progress in exploiting EMIR derivatives data, resulting in the publication of several research papers (e.g., Abad et al., 2016, Bellia et al., 2017, D'Errico et al., 2018) providing the groundwork for other studies including this report.²⁵

Background

In the light of the financial crisis in 2007, the G20 leaders decided, at the Pittsburgh Summit in 2009 to overhaul financial market regulation to address financial stability risks. A key focus area was opaque OTC derivatives markets, which were identified as a major driver of the contagion that occurred during the financial crisis. Concerning this market segment, the G20 leaders agreed to implement risk mitigation and

reporting measures to foster financial stability and transparency. In the EU, these agreed measures are implemented under EMIR.²⁶ This legislation is based on three main pillars: the clearing of OTC derivatives, increased risk mitigation measures and a reporting obligation for derivatives traded in the EEA. While the first two pillars are explored in the article 'Measuring central clearing in OTC markets' (pp.25-31), the present article focuses on the reporting obligation of derivatives laid out in Article 9 of EMIR.

The reporting obligation applies to all counterparties concluding derivatives transactions located in the EEA and needs to be fulfilled within a working day of the conclusion of the trade. This includes, in particular, CCPs, which have experienced a significant uplift of clearing activity following the clearing obligation for OTC transactions introduced and enforced by EMIR. The introductory steps of the clearing obligation are further explained in the article 'Measuring central clearing in OTC markets' (pp.25-31).

EMIR assigns the collection of derivatives data to private entities, namely TRs. TRs collect the information and pre-filter and redistribute the data in accordance with the access rights laid out in Article 81(3) of EMIR. ESMA handles the registration and authorisation process of the TRs and supervises them. As of 1 August 2018, eight TRs are authorised: Bloomberg, CME, DTCC, ICE, KDPW, NEX Abide Trade Repository AB, Regis-TR and Unavista.²⁷

²⁵ We gratefully acknowledge the discussions with colleagues at BIS, the ECB and the ESRB as well as with experts from NCAs, which have contributed significantly to this report.

²⁶ Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories. [https://eur-](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012R0648)

[lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012R0648](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012R0648).

²⁷ For an updated list of registered TRs see <https://www.esma.europa.eu/supervision/trade-repositories/list-registered-trade-repositories>.

The data reported to TRs and consequently distributed to authorities²⁸ cover all asset classes (e.g., equity derivatives, interest rate derivatives) and instrument types (e.g., swaps, forwards) traded on exchanges and OTC markets.

EMIR-originated data are provided at different levels of granularity to the authorities. The highest level of granularity is trade activity (also referred to as flow data), which provides various messages to update the status of open transactions. Each message has a certain action type that defines the content and consequently the status of the transaction (e.g., new trade, modified, cancelled/terminated).

As trade-activity is very granular and for most analysis of derivatives markets too exhaustive (in particular when investigating systemic risks), TRs also provide a further level of data aggregation, trade-state data (also referred to as stock data). In this aggregation the trade-activity messages are applied to each transaction. Furthermore, a filter is introduced to remove transactions that are closed or have matured. Thus, trade-state data provide information about only outstanding transactions at the time of aggregation by the respective TR at the end of a day. It is important to note that intraday trading-activity is only partially captured, depending on how contracts are closed. The derivatives that are closed by taking the opposite direction of the trade (e.g., selling a contract to close a long position) are included. By contrast, derivatives that are cancelled/terminated (i.e., no second trade is concluded to close the position) are excluded by the TRs in the aggregation process.

Data intake and selection

The data intake resulting from the previously explained procedure is based on the following two central data sources: direct download from the respective TRs and through the TRACE²⁹ system developed and maintained by ESMA. For this report, we use data from both sources depending on the availability of the intake

channel at the time of data preparation. The data were requested and transferred from the following six TRs: CME, DTCC, ICE, KDPW, REGIS, and Unavista.³⁰ As we are interested in the derivatives outstanding in the EEA we make use of the pre-aggregated trade state data. We choose four end-of-the-month dates in 2017, 24 February, 26 May, 25 August and 27 October.

On 1 November 2017 the new EMIR RTS, which was published in January 2017 by ESMA, came into force.³¹ This RTS mandates a major overhaul of derivatives reporting. In particular, it increases the number of fields from 89 to 129 (e.g., collateral reporting and position vs transaction reporting) and it updates the level of validation to further enhance the quality of regulatory reporting. The implementation of the RTS and related challenges in the adjustments of the TRs and reporting counterparties lead to structural differences in the data before and after 1 November 2017.³² Hence, for this report the last data point is taken before the entry into force of the new EMIR RTS to ensure the comparability of the results. Overall, the data intake resulted in a dataset of about 400 million records to which the data cleaning procedures described below are applied.

Enriching the data with reference information

To exploit the full potential of the information provided, the data need to be linked with other data sources. First, notional amounts are reported in different currencies and, for comparability, they need to be converted to a single currency: EUR in our case. The reference rates for the conversion are provided by the ECB³³. As the rates provided by the ECB do not include all observed currencies we further utilize our commercial databases to obtain additional currency rates. As a reference date, we use the date of the trade state file: all transactions reported in one observation date are converted with the relevant exchange rates of the same date. In cases of misreporting of notional

²⁸ These authorities are for example ESMA, the EBA, EIOPA, the ESRB, supervising authorities of CCPs, (national) competent authorities, members of the ESCB, relevant Union authorities and market authorities. Depending on their mandate, the data are filtered by notional currency and/or counterparty location.

²⁹ ESMA's TRACE systems provides a single point of access to Trade Repository Data to authorities.

³⁰ During 2017, the Bloomberg TR was registered but had no derivatives outstanding, so it was not included. NEX Abide Trade Repository AB was registered after the observation period; consequently data from this TR were not used for this report.

³¹ Commission Delegated Regulation (EU) 2017/104 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0104&from=EU>.

³² For CME and Unavista two different data points were used because of data provision issues related to data reported to CME (26 August instead of 25 August) and to Unavista (17 February instead of 24 February).

³³ For ECB: Euro foreign exchange reference rates https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/index.en.html

currency 1 (i.e. no conversion-rate could be obtained), a value 0 is used. In this way, the contract is still considered for the calculation of outstanding contracts but not for notional aggregations. Furthermore, the reader should be aware that the number of derivatives refers to the number of rows in the dataset. As EMIR allows for position-based reporting (reporting of many similar derivatives in one row), this could lead to an underestimation of the number of standardized outstanding derivatives contracts, compared with other publications.

To identify the counterparties involved in a derivatives transaction, we use Legal Entity Identifier (LEI) information provided by the Global Legal Entity Identifier Foundation (GLEIF).³⁴ This step is necessary to determine whether or not a record should be paired and reconciled, which is determined on the basis of the location of the counterparty. This step is explained in detail in the next sub-section.

To distinguish between OTC derivatives and ETDs we make use of market identifier codes (MIC, ISO 10383) using the field venue of execution. If the value in this field is either XXXX,XXX,XX or XOFF we classify the derivative as OTC traded. For other values, we check if they are in the MIC list³⁵ (excluding the aforementioned OTC MICs) and classify them as an ETD. The remaining records are not assigned to either of the two categories and are excluded from the aggregations, showing the distinction between ETDs and OTC derivatives. This poses a limitation for the charts in which ETD/OTC aggregations are shown.

Pairing and reconciliation

The data reported under EMIR are transmitted by each market participant residing in the EEA. For this reason, a derivatives transaction concluded in the EEA is reported by both counterparties, i.e., the buyer and the seller. In cases of one EEA and one non-EEA counterparty, only one report is observed in the data³⁶. This double-reporting regime results in an important data preparation step: pairing and reconciliation of the derivatives that are reported twice (one from the perspective of each counterparty).

First, each record is investigated to determine whether or not it falls under the double-reporting regime (and therefore should be reconciled). This is conducted by evaluating the address of the corresponding LEI in the field "ID of the other counterparty". If this fails (i.e., a client code is reported instead), the field "Contract with non-EEA counterparty" is used. When two reports must be reconciled, they are matched using the "Trade ID". Next, both reports are checked for consistency using the counterparty fields. If consistency is established, one of the two records is selected (reconciled).

This procedure is not always successful for reports that must be reconciled, i.e., where two reports should be observed. For the remaining (unpaired) reports a different and more basic treatment approach is used: The notional amount is halved and the record is counted as a half trade. The rationale for this is that the second report is expected to be in the data but cannot be matched against the first report, because of problems related to data quality.

This procedure builds on the assumption that both counterparties reported the data to the TRs, i.e., it assumes the completeness of the data reported. This assumption cannot be verified or dismissed at this point, thus representing a limitation of our analysis.

Records with one EEA and one non-EEA counterparty are at this stage the least problematic: these reports do not need to be reconciled. For these records only one report is expected, and it can be directly used for the calculation without a further preparation step.

Classification of asset classes and contract types

To identify the asset class and the contract type, EMIR data-reporting requirements specify reporting fields that are filled in consistently for OTC transactions. On the other hand, the data reported for ETDs use a wide variety of identifiers, which makes their classification less straightforward. Therefore, we make use of several internal proprietary databases to classify asset classes and contract types. Even though the development of this method was conducted carefully and tested several times by manual

³⁴ GLEIF Concatenated Files – LEI Data – GLEIF <https://www.gleif.org/en/lei-data/gleif-concatenated-file/download-the-concatenated-file#>.

³⁵ ISO 10383 - Codes for exchanges and market identification (MIC) <https://www.iso20022.org/10383/iso-10383-market-identifier-codes>.

³⁶ The multiple reporting regime has implications for the clearing rate calculations, as detailed in the section 'Measuring central clearing in OTC markets', pp.25-31.

verification against data samples, the outcome might not be as perfect as in the case of directly reported asset classes and contract types. If the classification fails, for example because of inconsistent reporting, the record is treated as unclassified. Hence, this step may represent a limitation of the analysis and should be considered in the interpretation of the results.

Concentration and network measures

The concentration of derivatives notional values is one of the key indicators for assessing systemic risk (Markose et al., 2012). We reflect this by using two concentration measures for notional amounts to capture distinct dimensions of market concentration. First, we use the market share of the top-five entities. As this would automatically demonstrate the exposure of CCPs (which are the largest market participants in the cleared segments), they are excluded using the list of registered CCPs LEIs.³⁷ Second, we utilize the HHI, a common measure used to quantify competition within markets. In addition, we use the following network measures to quantify interconnectedness: degree, betweenness, eigenvector and closeness interconnectedness. These are based on both counterparty fields and are explained in the 'Market trends' section.

The method for calculating the value of these indicators poses certain limitations. First, as EMIR reporting is conducted on the legal-entity level, two financial cooperations being located in two jurisdictions but belonging to the same group would still be counted as two distinct entities, despite legally being one. Thus, the above mentioned measures could be biased, depending on the nature of the market. Second, it should be kept in mind that changes in these indicators could be driven by the large intragroup transactions of international financial cooperations.

Outlier identification and treatment

Outliers introduce a significant bias when working with heterogeneous data sets, in particular they skew aggregations (e.g., when sums or averages are calculated) (Aggarwal, 2015). In EMIR data, outliers can derive from reporting mistakes (e.g.,

wrong value entered, misreported currency, wrong asset class) or IT issues (wrong transformation of numerical values, transmission errors). A two-step procedure is needed to, first, identify the erroneous values and, second, treat them appropriately in the analysis.

Different methodologies may be envisaged to identify outliers in the sample. Previous reports based on EMIR-derived data used fixed maximum thresholds, e.g., a notional amount of EUR 10bn (Abad et al. 2016). This is a valid approach if only one asset class is considered. However, we analyse a large degree of heterogeneity in terms of instruments and asset classes reflecting the richness and the depth of the derivatives markets. Therefore, in our report we follow a different approach to calculate the different outlier thresholds, taking into account the wide variety of derivatives characteristics observed in the data set. In particular, we identify, following an iterative process (by observing and evaluating distributions), the main characteristics determining the notional amount: intragroup (yes/no), instrument (e.g., swap/future), asset class (e.g., equity, interest rate), notional currency 1³⁸ (e.g., EUR, USD), and compression (yes/no).

For the actual calculation of the threshold to identify the outliers we log-normalize the notional amount and calculate the median. Then, we obtain the threshold by adding four times the standard deviation to the median value. This exercise results in about 2,600 individual outlier thresholds, which are applied to all records before the aggregation. To further increase the robustness of the approach, we also consider records with a notional amount of more than EUR 10bn as outliers, if they are not captured by the aforementioned procedure.

With reference to the second step of the procedure, i.e., how to deal with the outliers identified, the scientific literature proposes several methods. In particular, the most common approaches are to replace extreme values with percentiles (an approach known as 'winsorising') or to exclude the outliers from the analysis. In this report, we remove the outliers identified from the calculation focusing on the notional amount. The reasoning behind this approach is the following: if the fundamental field "notional amount" has

³⁷ List of CCPs authorised to offer services and activities in the Union https://www.esma.europa.eu/system/files_force/library/cps_authorized_under_emir.pdf.

³⁸ The dataset has two currency fields: Notional Currency 1 and Notional Currency 2. While Notional Currency 1 is the currency used to assign the currency to the number

reported in the field Notional amount, Notional Currency 2 is used for cross-currency derivatives. See "Commission Delegated Regulation (EU) 2017/104 of 19 October 2016" for further explanations of the data used.

quality problems, it is likely that other basic fields (e.g., asset class) will exhibit issues as well. However, the records identified are still included for all the calculations that do not include notional amounts (e.g., the number of counterparties, as the LEI information is deemed to be reliable given that checks are carried out by TRs upon receipt of data). Even though we employ this rigorous outlier removal procedure, there is still a small chance that outliers remain undetected and skew the aggregation.

Results of and statistics from the cleaning process

The cleaning process was applied to the whole data set before further aggregations were made (ASRD.19). In total, the uncleaned value at the time of the data intake amounts, for the 4 days, to a notional value of EUR 67,268tn (or EUR 16,817tn on average per day) of OTC and ETD transactions. This is equivalent to 31 times the global outstanding OTC volume reported by BIS for 2H17³⁹ and highlights the need for an outlier analysis and removal procedure. Therefore, as a first step we remove the outliers following the methodology described in the previous subsection. This procedure results in a strong decrease in notional amounts to 6% of the original value while 99.993% of the records are retained. As a second step, we address double reporting, as explained above in the 'Pairing and reconciliation' sub-section. The resulting sample shows a further reduction in the notional amount as contracts that are reported twice contribute their notional amount only once to the aggregated statistics.

Furthermore, we can infer from the results of this process how much trading among EEA entities is conducted by calculating the amount of relative notional volume removed. For each asset class the larger the amount of trading volume removed, the larger the volume traded among EEA entities. For instance, we observe that IRDs are traded more among EEA entities than CDs.

Finally, in the last step, we remove the expired trades and trades without maturity dates, removing a total notional amount of EUR 9tn (0.003%) and arriving at the final dataset.

ASRD.19

Cleaning and reconciliation results

EMIR data need complex cleaning steps

	Raw	Outliers Removed	Double Reporting Removed	Expired Trades Removed
Commodity	991	118	77	77
Credit	25,285	67	51	51
Currency	12,676	886	635	630
Equity	2,215	120	85	85
Interest Rate	22,516	2,263	1,529	1,526
Other	3,586	587	330	329
Total	67,269	4,041	2,707	2,698

Note: Total notional amounts in EURtn. 'Raw' indicates the total notional amount before any outlier identification and treatment. 'Outliers removed' indicates the total notional amount after the removal of the outliers. 'Double reporting removed' indicates the total notional amount after the removal of double reporting; 'Expired trades removed' indicates the total notional amount after the removal of expired trades.

Source: TRs, ESMA.

References

- Abad, J., Aldasoro, I., Aymanns, C., D'Errico, M., Fache Rousova, L., Hoffmann, P., Langfield, S., Neychev, M., and Roukny, T. (2016). "Shedding light on dark markets: first insights from the new EU-wide OTC derivative dataset". ESRB Occasional Paper Series No 11/September 2016.
- Aggarwal, C.C. (2015). "Data mining: The textbook". Springer International Publishing.
- Bellia, M., Panzica, R., Pelizzon, L. and Peltonen, T. (2017). "The demand for central clearing: to clear or not to clear, that is the question". ESRB Working Paper Series No 62.
- BIS (2018). "Triennial Survey of foreign exchange and OTC derivatives trading" <https://www.bis.org/statistics/derstats3y.htm>.
- D'Errico, M., Battiston, S., Peltonen, T. and Scheicher, M. (2018). "How does risk flow in the credit default swap market?". Journal of Financial Stability Vol. 35, pp. 53-74.
- El Omari, Y., Haferkorn, M. and Nommels, C. (2017). "EU derivatives markets – a first-time overview". ESMA Report on Trends, Risks and Vulnerabilities No 2 2017.
- Markose, S., Giansante, S., Shaghghi, A.R. (2012). "Too interconnected to fail' financial network of US CDS market: Topological fragility and systemic risk". Journal of Economic Behavior & Organization Vol. 83 No 3, pp. 627-646.

³⁹ BIS (2018).

Measuring central clearing in OTC markets

Increasing the central clearing of derivatives contracts has been one of the prominent regulatory objectives since the global financial crisis. Measuring progress towards this objective is not as straightforward as it may seem. This section provides an explanation of the methodology used for the estimation of clearing rates for different asset classes. Using EMIR data from TRs we provide evidence on the impact of the clearing obligation on the level of clearing for the classes of instruments subject to it.

The importance of central clearing in OTC markets

Across jurisdictions, regulatory reforms after the financial crisis aimed to reduce systemic risk in financial markets, encouraging higher transparency in OTC markets through central clearing for standardised contracts and risk mitigation arrangements for non-cleared instruments.⁴⁰ Among these regulatory reforms, EMIR lays down rules regarding derivatives contracts, CCPs and TRs in line with the commitments made by the G20 leaders at the Pittsburgh Summit in September 2009. In order to increase financial stability and enhance resilience of OTC markets, EMIR includes the obligation to centrally clear certain classes of OTC derivatives contracts through CCPs and introduces risk mitigation techniques for non-centrally cleared instruments. This section provides an overview of the clearing obligation under EMIR and – using the data reported to TRs under EMIR – analyses the developments of central clearing in OTC markets, with a particular focus on the instruments subject to the clearing obligation.

Central clearing by CCPs aims to reduce the overall exposures of counterparties and consequently the related risk, thus increasing

resilience in derivatives markets. Central clearing enhances transparency, allowing for a centralised risk management and reducing systemic risk through multilateral netting, collateralisation and loss mutualisation. A CCP interposes itself between two counterparties and, through a process called novation, assumes rights and obligations with both counterparties, becoming the buyer of the seller and the seller of the buyer. With novation, a CCP is able to perform multilateral netting and compression⁴¹, thus reducing the counterparties' exposures.⁴² For instance, ISDA reports that approximately USD 448tn in notional amount outstanding for IRS was removed through compression between 2003 and March 2015⁴³. ISDA estimates that, as of December 2015, the notional amount of IRD had been reduced by approximately 67% as a result of portfolio compression.⁴⁴

In a centralised clearing model, a CCP is able to insulate the default of single counterparties, preventing the propagation of defaults. Effective clearing mitigates systemic risk by lowering the risk of defaults propagating from counterparty to counterparty.⁴⁵ Adequate collateralisation, through the use of initial margins and variation margins by clearing members, and loss mutualisation increase the resilience of the financial system. Moreover, the requirements of high quality collateral by CCPs reduce

⁴⁰ The FSB coordinates a periodical evaluation with other standard-setting bodies (SSB) of the progresses in implementation and the effects of G20 reforms (<http://www.fsb.org/wp-content/uploads/P290617-2.pdf>). The FSB also coordinates the Derivative Assessment Team (DAT) that focuses on the analysis on the incentives to centrally clear OTC derivatives. A public consultation was conducted in August 2018 (<http://www.fsb.org/wp-content/uploads/P070818.pdf>)

⁴¹ MiFIR Regulation defines portfolio compression as a risk reduction service in which two or more counterparties wholly or partially terminate some or all of the derivatives submitted by those counterparties for inclusion in the portfolio compression and replace the terminated derivatives with another derivative whose combined notional value is less than the combined notional value of the terminated derivatives.

⁴² See Cont and Kokholm (2014).

⁴³ ISDA (2015), "The impact of Compression on the Interest Rate Derivatives Market", Research note (<https://www.isda.org/a/hSiDE/compression-report-july-2015-final.pdf>)

⁴⁴ ISDA (2016), "Derivatives Market Analysis: Interest Rate Derivatives", Research Note (<https://www.isda.org/a/bSiDE/otc-derivatives-market-analysis-july-2016-v3.pdf>)

⁴⁵ See Duffie and Zhu (2010).

counterparty credit risk.⁴⁶ At the same time, as shown by Duffie et al. (2014), the benefits of netting and diversification cause a reduction of collateral demand, although with large distributional consequences. Cecchetti et al. (2009), in addition to counterparty risk reduction and operational efficiency, first explain how the introduction of CCPs facilitates data collection, thus contributing to improve market transparency and second describe how a CCP may help to reduce the contribution of derivatives to the procyclicality of the financial system.

The crucial role of CCPs in the financial system may pose relevant challenges to financial stability. Fragilities in the correct function of these market infrastructures, such as the level of concentration of individual clearing participants or the level of interconnectedness of CCPs, may have serious implications for systemic risk. EMIR addresses these risks in two ways: it specifies that CCP risk management and governance standards to be supervised by the relevant national competent authority (ASRD.20). At EU-wide level, ESMA, in accordance with Article 21(6) of EMIR, performs EU-wide stress tests to assess the resilience of EU CCPs and, in line with the EMIR mandate, issues recommendations to address shortcomings where needed.⁴⁷

ASRD.20

Title IV of EMIR sets organisational requirements, conduct of business rules and prudential requirements for CCPs.

CCP prudential requirements under EMIR

Margin requirements	A CCP shall impose, call and collect margins to limit its credit exposure from its clearing members and other CCPs. Such margins shall be sufficient to cover potential exposures that the CCP estimates will incur until the liquidation of relevant positions. CCPs shall call and collect margins on an intraday basis to cover any position exposures and movements.
Default funds	To limit its exposures to its clearing members further, a CCP shall maintain a pre-funded default fund to cover losses that exceed the losses to be covered by margin requirements, arising from the default, including the opening of an insolvency procedure, of one or more clearing members.
Other financial resources	A CCP shall maintain sufficient pre-funded available financial resources to cover potential losses that exceed the losses to be covered by margin requirements and default fund. Such pre-funded financial resources shall include dedicated resources of the CCP, shall be freely available to the CCP and shall not be used to meet the capital requirements.

Liquidity risk controls	A CCP shall at all times have access to adequate liquidity to perform its services and activities. To that end, it shall obtain the necessary credit lines or similar arrangements to cover its liquidity needs. A CCP shall measure, on a daily basis, its potential liquidity needs.
Default waterfall	A CCP shall use the margins posted by a defaulting clearing member prior to other financial resources in covering losses. Where the margins posted by the defaulting clearing member are not sufficient to cover the losses incurred by the CCP, the CCP shall use the default fund contribution of the defaulting member to cover those losses. A CCP shall use contributions to the default fund of the non-defaulting clearing members and any other financial resources only after having exhausted the contributions of the defaulting clearing member. A CCP shall use dedicated own resources before using the default fund contributions of non-defaulting clearing members. A CCP shall not use the margins posted by non-defaulting clearing members to cover the losses resulting from the default of another clearing member.
Collateral requirements	A CCP shall accept highly liquid collateral with minimal credit and market risk to cover its initial and ongoing exposure to its clearing members. It shall apply adequate haircuts to asset values that reflect the potential for their value to decline over the interval between their last revaluation and the time by which they can reasonably be assumed to be liquidated.
Investment policy	A CCP shall invest its financial resources only in cash or in highly liquid financial instruments with minimal market and credit risk. A CCP investment shall be capable of being liquidated rapidly with minimal adverse price effect.
Default procedures	A CCP shall set out in detail the procedures to be followed in the event of a default of the clearing member. A CCP shall take prompt action to contain losses and liquidity pressures resulting from defaults.
Review of models, stress testing and back testing	A CCP shall regularly review the models and parameters adopted to calculate its margin requirements, default fund contributions, collateral requirements and other risk control mechanisms. It shall subject the models to rigorous and frequent stress tests.

Note: Organisational requirements, conduct of business rules and prudential requirements for CCPs as prescribed by Title IV of EMIR.
Source: EMIR

Article 4 of EMIR includes the obligation to clear certain classes of OTC derivative contracts through CCPs.⁴⁸ The clearing obligation applies to EU entities that are counterparties to an OTC derivative transaction. EMIR identifies two main categories of counterparties to which the clearing obligation applies: FCs (banks, insurers, asset managers, etc.) and NFCs (any EU firm whose positions in OTC derivative contracts, unless these contracts are used for hedging purposes, exceed the EMIR clearing thresholds).

EMIR also defines the process for the identification of asset classes subject to clearing

⁴⁶ ECB (2017), Research Bulletin n. 41.

⁴⁷ ESMA, (2018), "EU-wide CCP Stress Test 2017" (<http://firds.esma.europa.eu/webst/ESMA70-151-1154%20EU-wide%20CCP%20Stress%20Test%202017%20Report.pdf>)

⁴⁸ Article 4 of Regulation (EU) No 648/2012: "Counterparties shall clear all OTC derivatives contracts pertaining to a class of OTC derivatives that has been declared subject to clearing obligation in accordance with Article 5(2) [...]".

by ESMA: the ‘bottom-up’ and ‘top-down’ approaches. In the ‘bottom-up’ approach described in Article 5(2), the determination of the classes to be subject to the clearing obligation is based on the classes that are already cleared by authorised or recognised CCPs. The ‘top-down’ approach, defined in Article 5(3), allows ESMA to identify, on its own initiative, the classes of derivatives subject to the clearing obligation for which no CCP has yet received authorisation.

ASRD.21

Clearing obligation by category of counterparty Gradual introduction of the clearing obligation

Cat.	Entities covered	IRDs in G4 currencies	IRDs in NOK, PLN, SEK	European index CDS
1	CM for at least one of the classes of OTC derivatives subject to clearing	21 June 2016	9 Feb 2017	9 Feb 2017
2	FCs and AIFs that are not CM and whose aggregate month-end average of outstanding gross notional amount of non-centrally cleared derivatives in 1Q16 is above EUR 8 bn	21 Dec 2016	9 Aug 2017	9 Aug 2017
3	FCs and AIFs that are not CM and that do not exceed the threshold for category 2	21 June 2019	21 June 2019	21 June 2019
4	NFCs not included in the other categories	21 Dec 2018	9 Aug 2019	9 May 2019

Note: Clearing obligation phases of entities for instruments subject to clearing obligation.
Source: ESMA.

For the classes of derivatives currently subject to the clearing obligation, different phases of the clearing obligation have been defined, depending on the counterparty’s nature (ASRD.21).⁴⁹

Finally, FCs and NFCs involved in an OTC derivative transaction not cleared by a CCP are required to implement risk mitigation techniques under Article 11 of EMIR. Such risk mitigation measures include a timely confirmation of the

terms of the contract, portfolio reconciliation and compression, dispute resolution procedures and the exchange of collateral.⁵⁰

Methodology for clearing rate calculation

EMIR data represent a valuable source of information to assess the progress of central clearing in derivatives markets. It is the first time that data from TRs have been used to estimate the level of notional amount cleared for outstanding contracts in the EEA.⁵¹ The exercise is not straightforward, as the issue of multiple reports, generated by all counterparties subject to clearing reporting obligation (i.e. clients, investment firms, clearing members, CCPs), poses technical challenges.

First, we provide an explanation of the methodology we have used to compute clearing rates. Second, we provide an estimation of the total notional amount cleared for different asset classes. Finally, we evaluate the level of central clearing for the instruments subject to clearing obligation.

We define the clearing rate as the share of cleared outstanding notional amount over the total outstanding notional amount for contracts with at least one counterparty located in the EEA. In this definition, we also include the notional amount cleared through CCPs located outside the EEA.

$$(1) \text{ Cleared notl. (\%)} = \frac{\text{Notional cleared}}{\text{Notl.uncleared} + (\text{Notl.cleared})}$$

The number of reports received by TRs related to a single transaction varies according to the number of counterparties involved in the chain (e.g., customer vs. broker vs. clearing member) and their location (EEA vs non-EEA entities). Moreover, if the transaction is cleared, the CCP with the reporting obligation (i.e., the CCP domiciled in the EEA), must also report the two different positions with the counterparties resulting from novation. This represents one of the major difficulties in the estimation of clearing rates in EU derivatives markets, as the methodology to estimate clearing rates has to

⁴⁹ See “Commission Delegated Regulation (EU) 2015/2205” for IRDs in G4 currencies (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2015.314.01.0013.01.ENG), “Commission Delegated Regulation (EU) 2016/1178” for IRDs in NOK, PLN and SEK (<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1178&from=EN>), and “Commission Delegated Regulation (EU) 2016/592” for European Index CDS (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2016.103.01.0005.01.ENG).

⁵⁰ For an extensive overview of the clearing obligation and risk mitigation techniques under EMIR see: <https://www.esma.europa.eu/regulation/post-trading/otc-derivatives-and-clearing-obligation>.

⁵¹ BIS estimates clearing rates from comprehensive data from CCPs and from large dealers. See Wooldridge (2017) and BIS (2018).

consider the different reports related to a derivatives contract along the clearing chain.

In order to explain the reporting logic and the issue of multiple reporting, we provide examples of different reporting cases related to a single cleared transaction. With these examples, we show how the number of reports related to a single transaction varies according to the location of the counterparties involved. For the sake of simplicity, we consider only the reports by two counterparties (e.g., clearing members) and the CCP, ignoring the reports from other counterparties involved in the clearing chain.

First, when the two counterparties and the CCP, are located in the EEA, there will be six reports related to a single transaction (ASRD.22).

ASRD.22

Case 1: EEA counterparties with an EEA CCP

Six reports related to a derivative

CTPY ID	Other CTPY ID	Dual-sided reporting
CTPY1	CTPY2	Yes
CTPY2	CTPY1	Yes
CTPY1	CCP (EEA)	Yes
CCP (EEA)	CTPY1	Yes
CTPY2	CCP (EEA)	Yes
CCP (EEA)	CTPY2	Yes

Note: EMIR reporting obligation for clearing members and a CCP: two EEA clearing members clearing through a CCP in the EEA.
Source: ESMA.

When both counterparties are located in the EEA and clear a transaction through a non-EEA CCP (which has no reporting obligation), there will be four reports related to a single transaction (ASRD.23).

ASRD.23

Case 2: EEA counterparties with a non-EEA CCP

Four reports related to a derivative

CTPY ID	Other CTPY ID	Dual-sided reporting
CTPY1	CTPY2	Yes
CTPY2	CTPY1	Yes
CTPY1	CCP (non EEA)	No
CTPY2	CCP (non EEA)	No

Note: EMIR reporting obligation for Clearing Members and a CCP: EEA clearing members clearing through a CCP located outside the EEA.
Source: ESMA.

When an EEA counterparty is trading with a non-EEA counterparty through an EEA CCP, the reporting counterparties are the counterparty residing in the EEA and the CCP. Thus, there are four different reports related to a single transaction (ASRD.24).

ASRD.24

Case 3: EEA counterparty trading with a non EEA counterparty and an EEA CCP

Four reports related to a derivative

CTPY ID	Other CTPY ID	Dual-sided reporting
CTPY1	CTPY2	N
CTPY1	CCP (EEA)	Y
CCP (EEA)	CTPY1	Y
CCP (EEA)	CTPY2	N

Note: EMIR reporting obligation for Clearing Members and CCP: EEA Clearing Member trading with a non-EEA Clearing Member and clearing through a CCP in EEA.
Source: ESMA

Finally, when an EEA counterparty is trading with a non-EEA counterparty and the contract is cleared through a non-EEA CCP, only the counterparty located in the EEA has a reporting obligation and will report the transactions with the counterparty and the CCP. There is no dual-sided reporting for this transaction and the number of reports will be reduced to two (ASRD.25).

ASRD.25

Case 4: EEA counterparty trading with a non-EEA counterparty and a non-EEA CCP

Only two reports related to a derivative

CTPY ID	Other CTPY ID	Dual-sided reporting
CTPY1	CTPY2	N
CTPY1	CCP (non EEA)	N

Note: EMIR reporting obligation for clearing members and a CCP: EEA clearing member facing a non-EEA clearing member and clearing through a non-EEA CCP located outside the EEA.
Source: ESMA

In the light of these considerations, Equation (1) is developed as follow:

$$(2) \text{ Cleared notional (\%)} = \frac{\frac{CN_{EEA}}{2} + CN_{Non-EEA}}{UN + \left(\frac{CN_{EEA}}{2} + CN_{Non-EEA}\right)}$$

where:

- CN_{EEA} (Cleared Notional_{EEA}) is the outstanding notional amount of contracts with one EEA CCP as counterparty.
- $CN_{non-EEA}$ (Cleared Notional non-EEA) is the outstanding notional amount cleared by a non-EEA CCP.
- UN (Uncleared Notional) is the outstanding notional amount uncleared.⁵²

In our data, cleared transactions (and the corresponding notional amounts) are identified as records where one of the two counterparties is a CCP (i.e. the reporting counterparty or the other

⁵² The total notional amount used for the clearing calculation includes only cleared transactions. Moreover, as explained later, additional filters have been applied to the data to better identify cleared and uncleared transactions. For these reasons, the total notional amounts considered

here are not directly comparable with the total notional amounts shown in the 'Markets structure' and 'Market trends' sections.

counterparty). When the clearing is carried out by a CCP domiciled in the EEA, the formula takes into account the multiplication of reports for the reporting of the CCP, as described above. For this reason the total notional amount, after de-duplication, is divided again by two.

For instance, if we focus on the case of two EEA counterparties trading with an EEA CCP (ASRD.22), and we assume that the market consists of one cleared contract with a notional amount of 1, the total notional amount for transactions with a CCP as a counterparty, after removal of double reporting, is 2 (0.5 for each of the four dual-sided transactions with a CCP). Therefore, the total notional amount must then be divided by two, in order to get the accurate amount of notional value cleared of 1.

This methodology may introduce bias in the case of two EEA counterparties clearing through a non-EEA CCP (ASRD.23). In order to quantify the impact of the bias, we have mapped the field “CCP” (a field reporting the LEI of the CCP that executed the clearing) to the location of the two counterparties. The potential impact of the bias is small, as this type of transaction represents around 1.16% of records (0.07% of the notional amount) of all cleared transactions.

In order to identify OTC transactions, only records with ‘Venue of execution’ “XXXX” and “XOFF” (respectively the MIC codes for OTC and off-exchange transactions for listed instruments) have been retained. Cleared transactions are identified as records where one of the two counterparties is a CCP. Uncleared trades are identified in records where the ‘Cleared’ field is reported as “N” and the CCP field is empty. Intragroup transactions (i.e. records with the ‘Intragroup’ field reported as “Y”) are excluded from the calculation.

Clearing in EU OTC markets

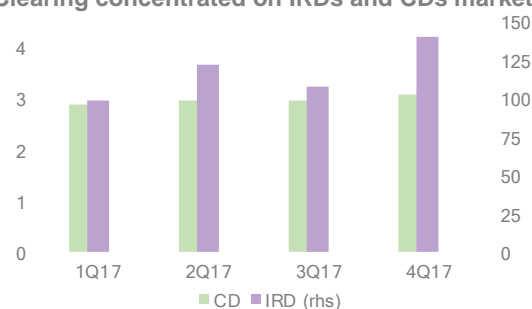
Central clearing occurs mainly in two OTC markets, the credit derivatives and the IRDs markets, which are also the markets subject to clearing obligations. Over time, central clearing is subject to diverging dynamics. On the one hand, the novation of a trade through a CCP replaces what would have been a single contract between two counterparties (clearing members) into two positions between the CCP and each of the counterparties, resulting in some form of double counting that tend to overestimate central clearing rates. On the other hand, a set of trades,

previously netted bilaterally between counterparties, can be netted multilaterally when they are cleared. The multilaterally netted positions resulting from central clearing tend to result in underestimations of the central clearing rates. Our methodology for central clearing rates deals with overestimation due to double counting but an assessment of the effect of multilateral netting is left for future work.

ASRD.26

Total gross notional amount cleared

Clearing concentrated on IRDs and CDs markets



Note: Total outstanding gross notional amount cleared by asset class, in EUR tn.
Sources: TRs, ESMA

In 2017, clearing rates varied between 40% and 58% of gross notional amount for IRD. For CD gross notional amounts, 2017 clearing rates varied between 25% and 27% (ASRD.26).

For other asset classes, the outstanding amounts cleared were much lower. For currency derivatives, 2017 clearing rates were between 2% and 3% of gross notional amount; cleared transactions are virtually non-existent for equity and commodity derivatives.⁵³

Impact of the clearing obligation

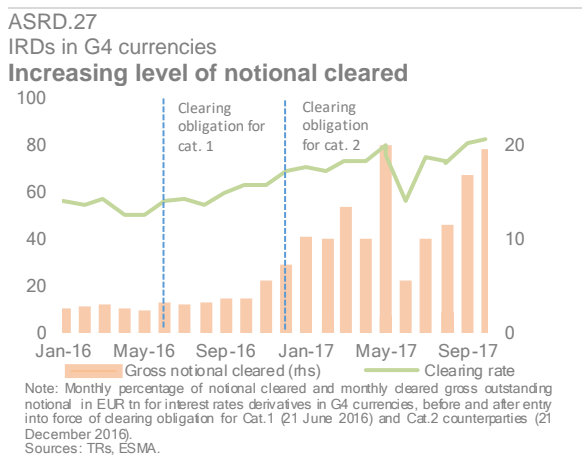
Using EMIR TR data, we are able to gather evidence on the impact of the clearing obligation for the classes of instruments currently subject to the obligation.

Our analysis is focused on IRD in G4 currencies (EUR, USD, GBP and JPY), interest rate derivatives in Norwegian Kroner, Swedish Kronor and Polish Zlotys (NOK, SEK and PLN) and CDS on indices. Not all CDS on indices are currently subject to the clearing obligation. However, the information available under the EMIR reporting standards in force before November 2017 does not allow for the identification of the underlying

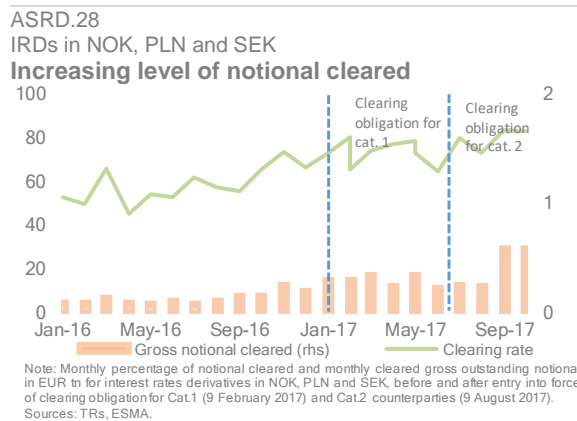
⁵³ See for instance ISDA (2014).

index. The information is available from November 2017 under the revised EMIR RTS.⁵⁴

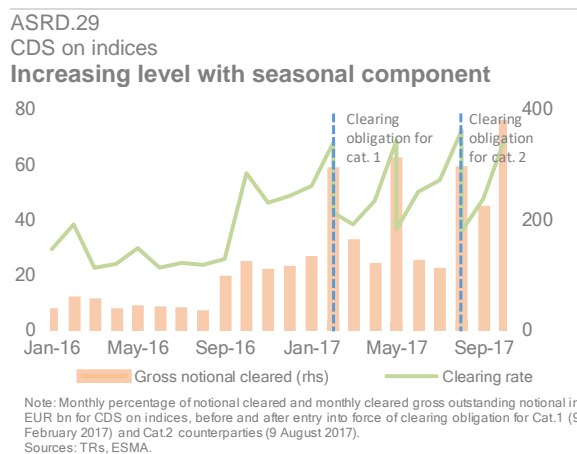
For our analysis, we produced a time series of the estimated cleared outstanding volume and the clearing rate for each month, based on the execution timestamp for each class of instrument. For our first reference date (February 2017), we have considered only the outstanding contracts at that date executed after January 2016. This introduces a survival bias, as the contracts executed and matured in that timeframe are not included in our calculations. For the subsequent dates, we have taken into consideration the contracts concluded after the previous reference date, in order to avoid double counting. Thus we are able to report clearing rates from January 2016 to October 2017.



For IRDs in G4 currencies, the share of gross notional amount that was centrally cleared steadily increased, reaching a level of 82% in October 2017 (ASRD.27). Before the entry into force of the clearing obligation for counterparties in category 1 (see ASRD.21), on 21 June 2016, around 55% of gross notional amount was centrally cleared. At the moment of entry into force of the clearing obligation for counterparties in category 2 (21 December 2016), around 68% of gross notional amount was cleared by a CCP.



A similar pattern is observed for IRD in NOK, PLN and SEK currencies, for which around 83% of the notional is centrally cleared in October 2017 (ASRD.28). When the clearing obligation for category 1 counterparties started to apply, CCPs were clearing around 80% of total outstanding volume, which increased to 84% when the clearing obligation started for counterparties in category 2, on 9 August 2017.



The trend of clearing rates for CDS on indices is different from that of the instruments considered above: before the entry into force of the clearing obligation, very low levels of notional amount were centrally cleared by CCPs. Since the clearing obligation entered into force for counterparties in category 1 on 9 February 2017, the evolution of the clearing rate appears to have developed seasonality (ASRD.29), reaching 70% in October 2017. This seasonality may be related to the compression cycle of the outstanding notional amount. The compression exercise, carried out periodically by CCPs on clearing contracts, reduces the amount of notional cleared. This process drives down the numerator of equation (1), thus reducing the resulting

⁵⁴ Commission Delegated Regulation (EU) 2017/104 ([https://eur-lex.europa.eu/legal-](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017R0104&from=E)

clearing rate. This issue will be further investigated.

References

BIS (2018), "Statistical release: OTC derivatives statistics at end-December 2017".

Cecchetti S., Gyntelberg J. and Hollanders M. (2009), "Central counterparties for over-the-counter derivatives", BIS Quarterly Review, September 2009.

Cont, R. and Kokholm, T. (2014), "Central clearing of OTC derivatives: Bilateral vs multilateral netting". *Statistics and Risk Modeling*, Vol 31, No. 1, pp. 3-22.

Duffie, D., Scheicher, M. and Vuillemeys, G. (2014), "Central clearing and collateral demand", ECB Working Paper Series No. 1638.

Duffie, D. and Zhu, H. (2011), "Does a Central Clearing Counterparty Reduce Counterparty Risk?" *The Review of Asset Pricing Studies*, Vol.1, No 1, pp.74-95.

ECB (2017), "Collateral, central clearing counterparties and regulation", Research Bulletin No. 41.

ESMA (2018), "EU-wide CCP Stress Test 2017".

FSB (2017), "OTC Derivatives Market Reforms: Twelfth Progress Report on Implementation", FSB Progress Reports. <http://www.fsb.org/2017/06/otc-derivatives->

[market-reforms-twelfth-progress-report-on-implementation/](http://www.fsb.org/2017/06/otc-derivatives-)

FSB (2018), "Incentives to centrally clear over-the-counter (OTC) derivatives", FSB Progress Reports. <http://www.fsb.org/2018/08/incentives-to-centrally-clear-over-the-counter-otc-derivatives/>

ISDA (2014), "Central clearing in the equity derivatives market" – An ISDA Study.

ISDA (2015), "The impact of compression on the interest rate derivatives market", Research notes.

ISDA (2016), "Derivatives market analysis: interest rate derivatives", Research Notes.

Wooldridge P. (2017), "Central clearing makes further inroads", BIS Quarterly Review, June.

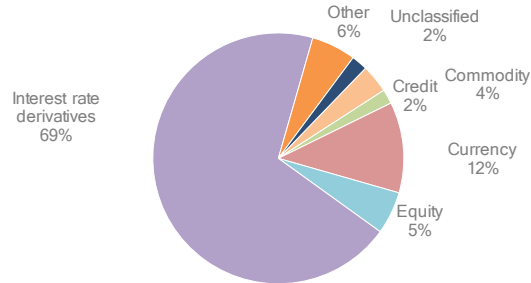
Derivatives markets statistics

Market structure

EU derivatives market

ASRD-S.1

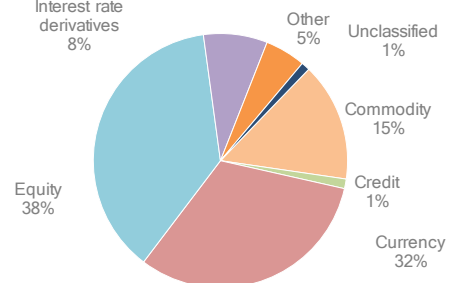
Gross notional amount by asset class



Note: Gross notional amount outstanding, by asset class, in % of overall gross notional amount outstanding.
Sources: TRs, ESMA.

ASRD-S.2

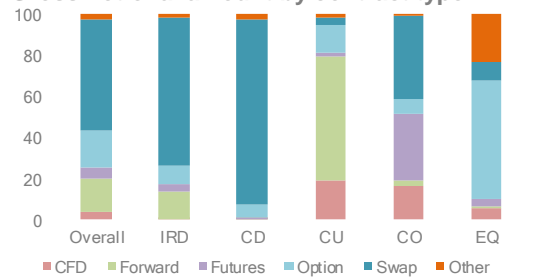
Number of derivative contracts by asset class



Note: Number of outstanding derivatives contracts by asset class. In % of overall number of outstanding derivatives contracts.
Sources: TRs, ESMA.

ASRD-S.3

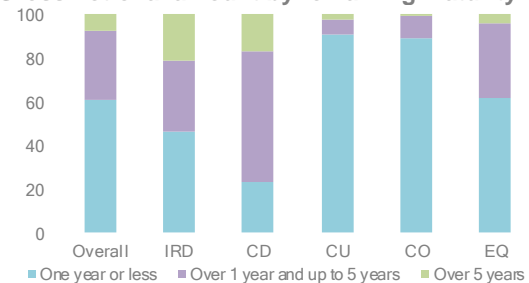
Gross notional amount by contract type



Note: Gross notional amount outstanding by contract type, in % of gross notional amount outstanding by asset class.
Sources: TRs, ESMA.

ASRD-S.4

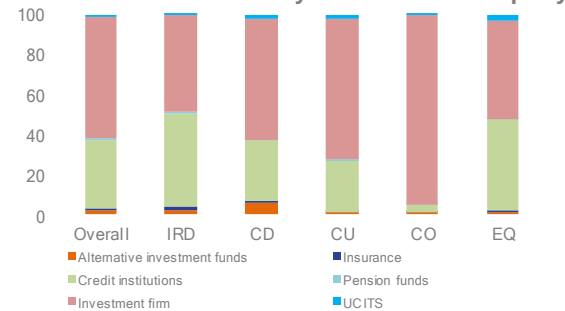
Gross notional amount by remaining maturity



Note: Gross notional amount outstanding by remaining maturity of the contract, in % of gross notional amount outstanding by asset class.
Sources: TRs, ESMA.

ASRD-S.5

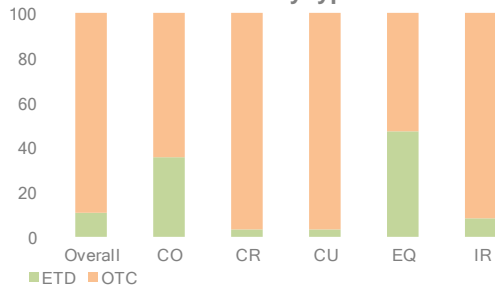
Gross notional amount by sector of counterparty



Note: Gross notional amount outstanding (not reconciled) by counterparty, in % of gross notional amount outstanding, by asset class.
Sources: TRs, ESMA.

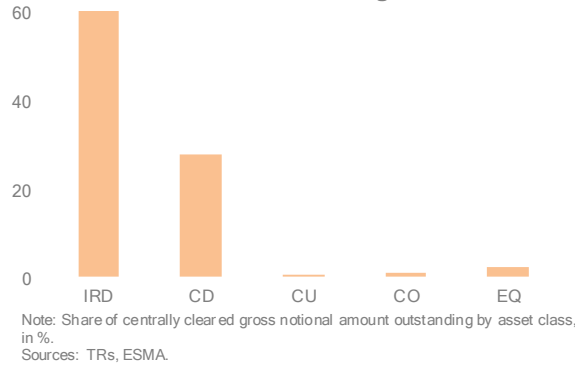
ASRD-S.6

Gross notional amount by type of execution

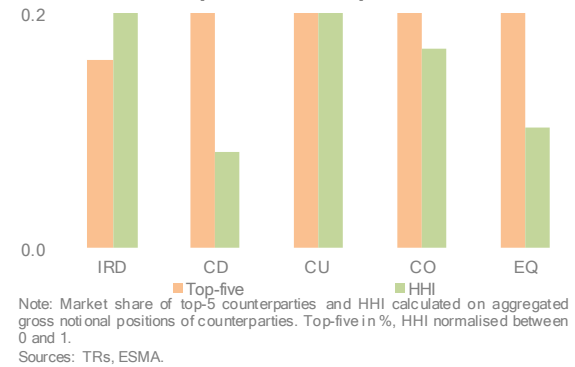


Note: Share of gross notional amount outstanding, by asset class, in %.
Sources: TRs, ESMA.

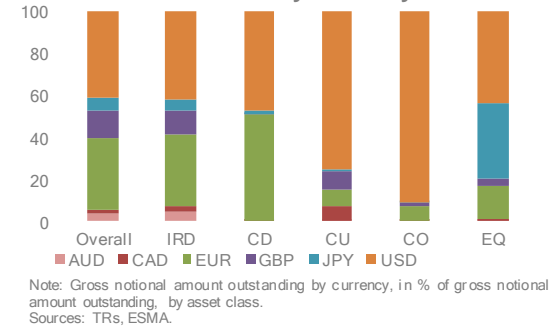
ASRD-S.7
Gross notional amount – clearing rates



ASRD-S.8
HHI index and top-five counterparties



ASRD-S.9
Gross notional amount by currency

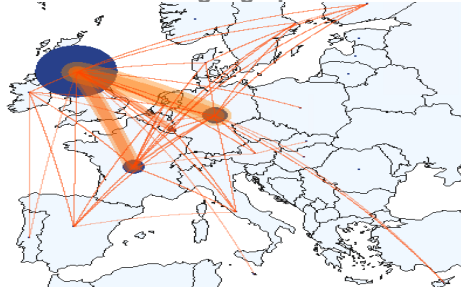


ASRD-S.10
Interest rate derivatives: geographical network



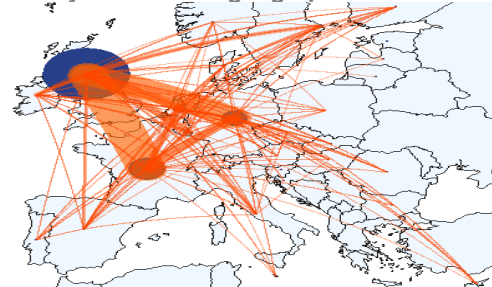
Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.
 Sources: TRs, ESMA.

ASRD-S.11
Credit derivatives: geographical network



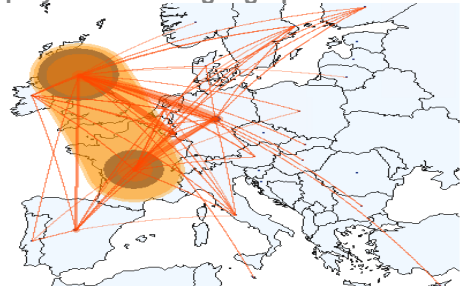
Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.
 Sources: TRs, ESMA.

ASRD-S.12
Currency derivatives: geographical network



Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.
 Sources: TRs, ESMA.

ASRD-S.13
Equity derivatives: geographical network



Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.
 Sources: TRs, ESMA.

ASRD-S.14
Commodity derivatives: geographical network



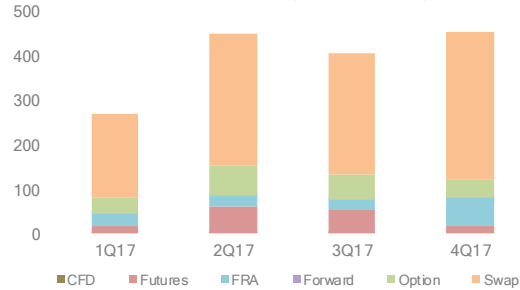
Note: Undirected network of gross notional amount outstanding. The size of the bubbles is proportional to the gross notional amount outstanding for counterparties domiciled in the Member State. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two Member States.
 Sources: TRs, ESMA.

Market trends

Interest rate derivatives market

ASRD-S.15

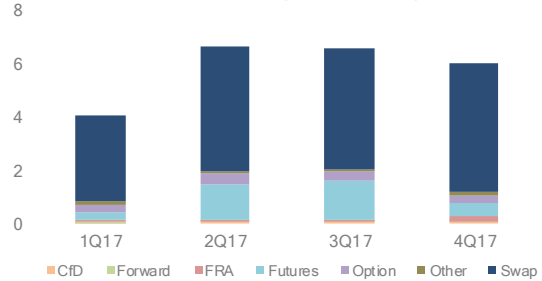
Gross notional amount by contract type



Note: Gross notional amount outstanding, by contract type, in EUR tn.
Sources: TRs, ESMA.

ASRD-S.16

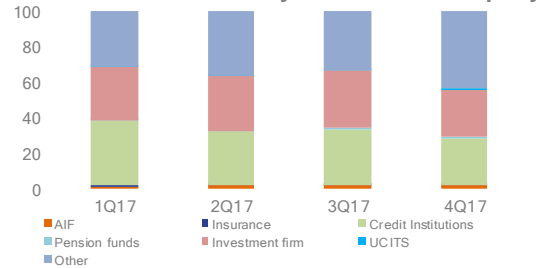
Number of derivatives by contract type



Note: Number of derivatives, by contract type, in million.
Sources: TRs, ESMA.

ASRD-S.17

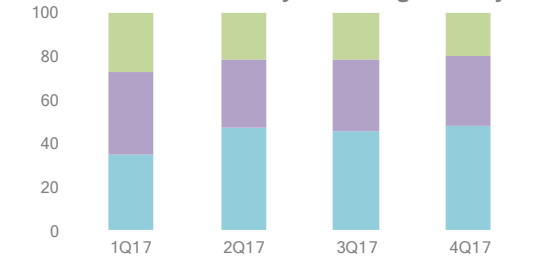
Gross notional amount by sector of counterparty



Note: Gross notional amount outstanding (not reconciled) by counterparty, in % of gross notional amount outstanding, by asset class.
Sources: TRs, ESMA.

ASRD-S.18

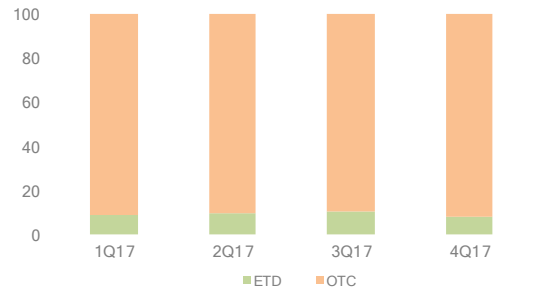
Gross notional amount by remaining maturity



Note: Gross notional amount outstanding by remaining maturity of the contract, in % of total gross notional amount outstanding.
Sources: TRs, ESMA.

ASRD-S.19

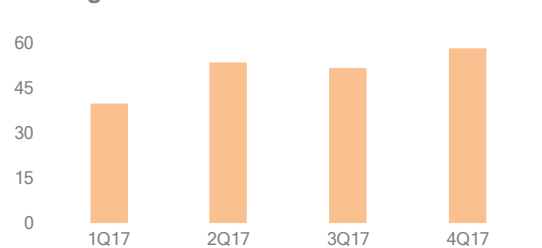
ETD vs OTC



Note: Share of gross notional amount outstanding, in %.
Sources: TRs, ESMA.

ASRD-S.20

Clearing rates



Note: Central clearing rates for all interest rate derivatives outstanding. Based on outstanding gross notional amounts, in %.
Sources: TRs, ESMA.

ASRD-S.21

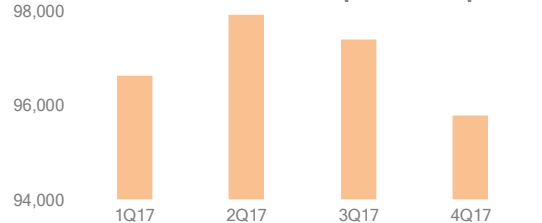
Concentration: HHI and top-five counterparties



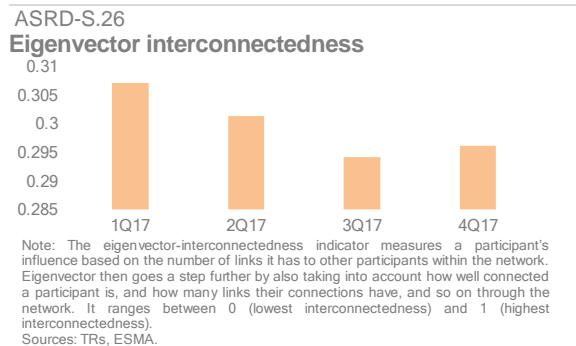
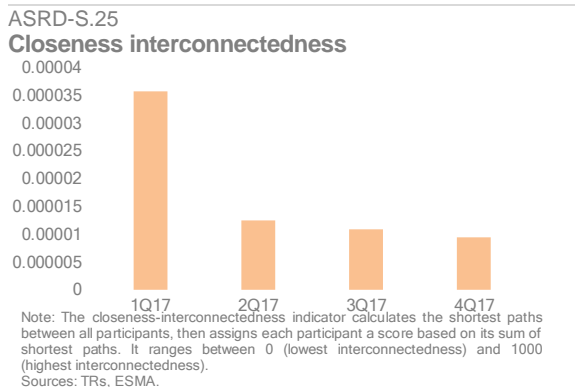
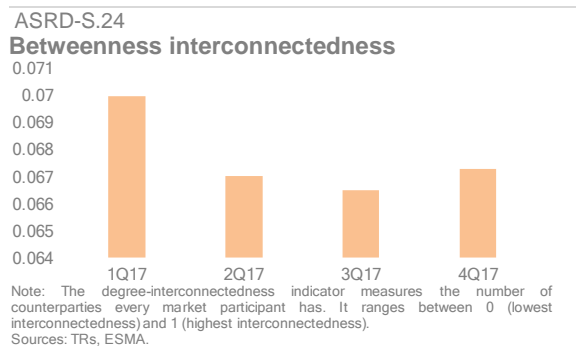
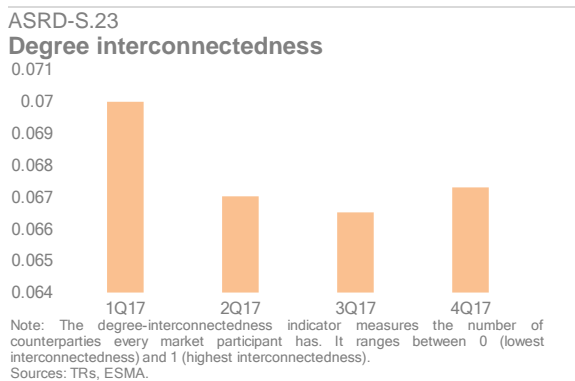
Note: HHI and gross exposure of top-five counterparties calculated on aggregated gross notional positions of counterparties. Market share in %. HHI normalised between 0 and 1.
Sources: TRs, ESMA.

ASRD-S.22

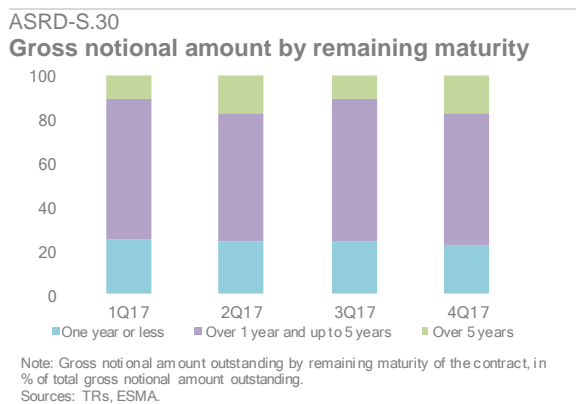
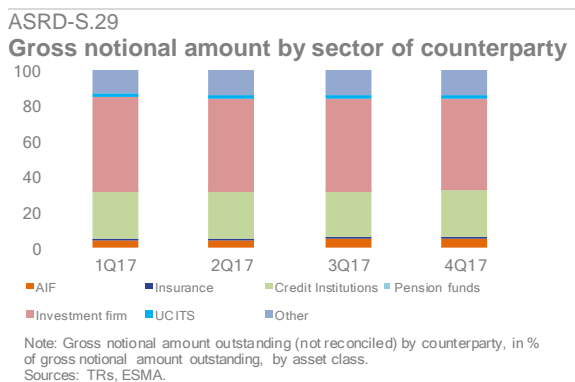
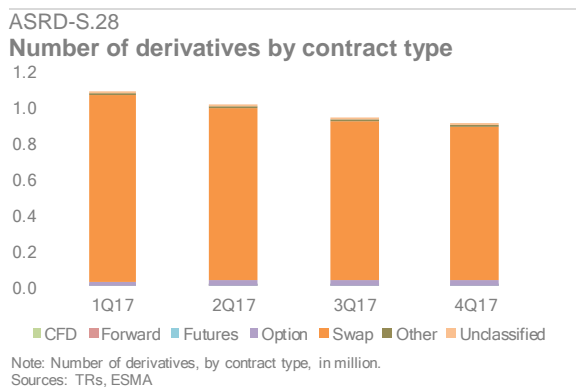
Concentration: Number of unique counterparties



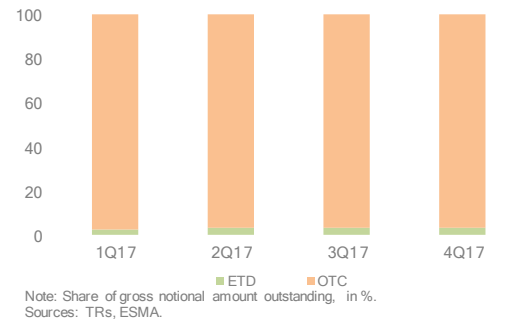
Note: Number of unique counterparties.
Sources: TRs, ESMA.



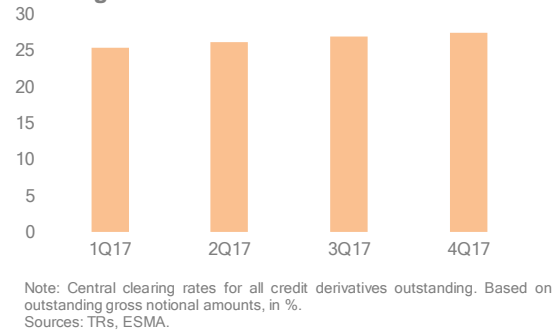
Credit derivatives market



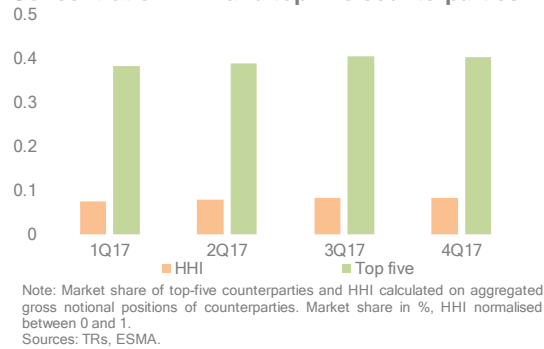
ASRD-S.31
ETD vs OTC



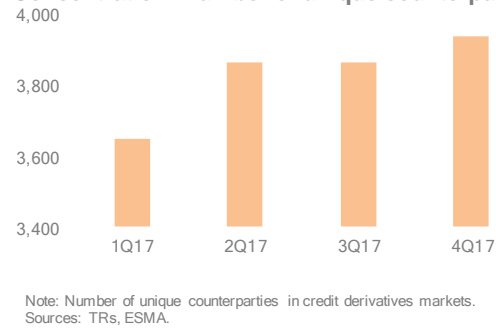
ASRD-S.32
Clearing rates



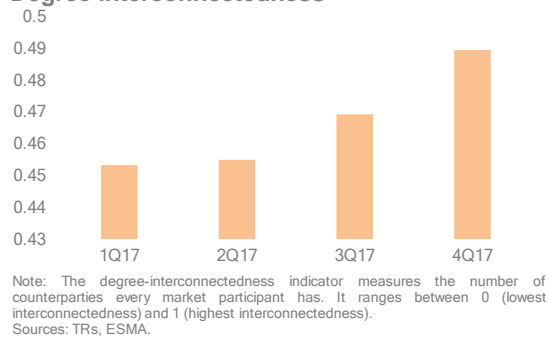
ASRD-S.33
Concentration: HHI and top-five counterparties



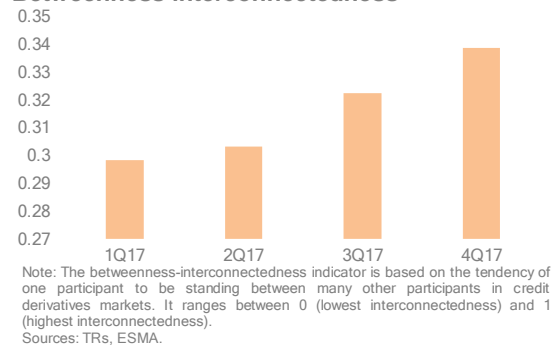
ASRD-S.34
Concentration: Number of unique counterparties



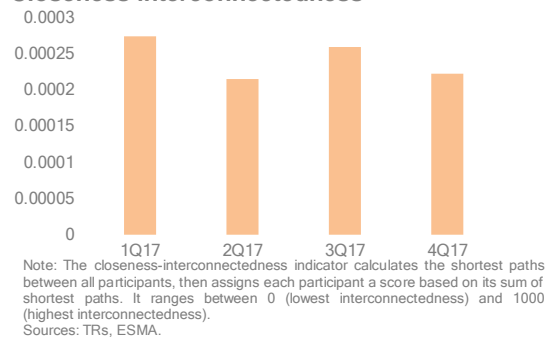
ASRD-S.35
Degree interconnectedness



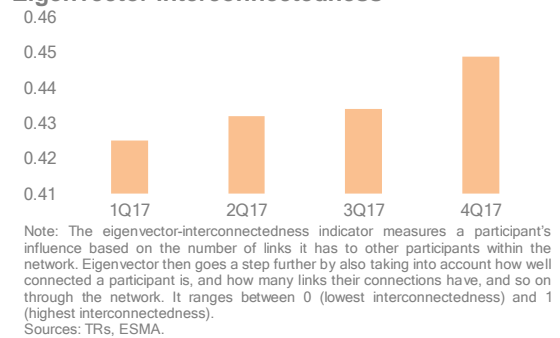
ASRD-S.36
Betweenness interconnectedness



ASRD-S.37
Closeness interconnectedness



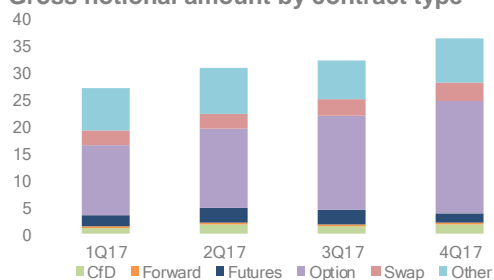
ASRD-S.38
Eigenvector interconnectedness



Equity derivatives market

ASRD-S.39

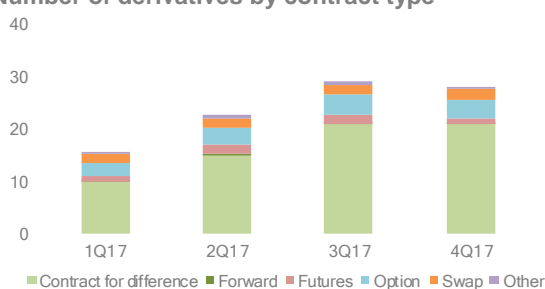
Gross notional amount by contract type



Note: Gross notional amount outstanding in EUR tn.
Sources: TRs, ESMA.

ASRD-S.40

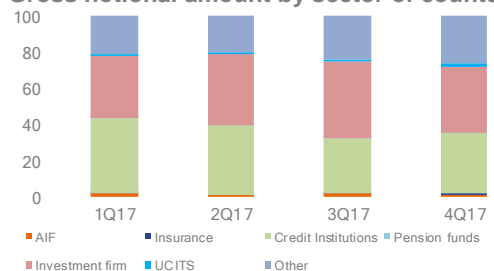
Number of derivatives by contract type



Note: Number of derivatives, by contract type, in million..
Sources: TRs, ESMA.

ASRD-S.41

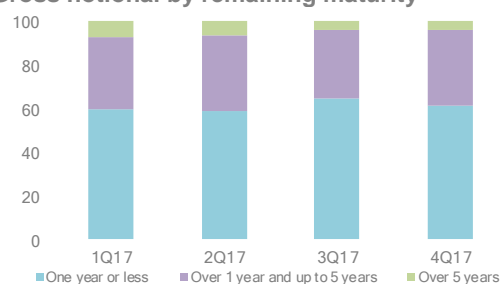
Gross notional amount by sector of counterparty



Note: Gross notional amount outstanding (not reconciled) by counterparty, in % of gross notional amount outstanding, by asset class.
Sources: TRs, ESMA.

ASRD-S.42

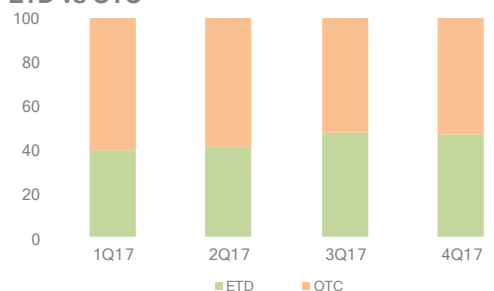
Gross notional amount by remaining maturity



Note: Gross notional amount outstanding by remaining maturity of the contract, in % of total gross notional amount outstanding.
Sources: TRs, ESMA.

ASRD-S.43

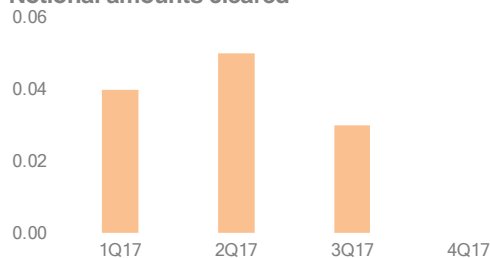
ETD vs OTC



Note: Share of gross notional amount outstanding, in %.
Sources: TRs, ESMA.

ASRD-S.44

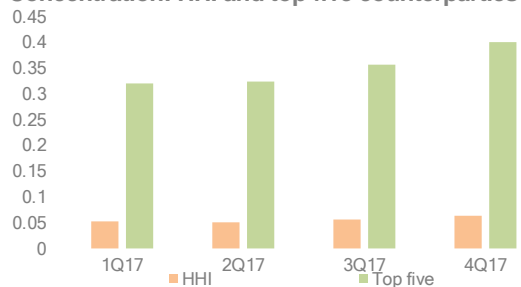
Notional amounts cleared



Note: Gross notional amounts cleared, in EUR mln.
Sources: TRs, ESMA.

ASRD-S.45

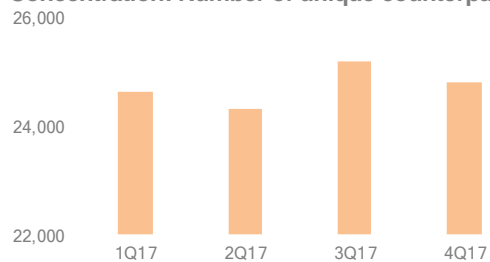
Concentration: HHI and top-five counterparties



Note: HHI and gross exposure of top-five counterparties calculated on aggregated gross notional positions of counterparties. Market share in %. HHI normalised between 0 and 1.
Sources: TRs, ESMA.

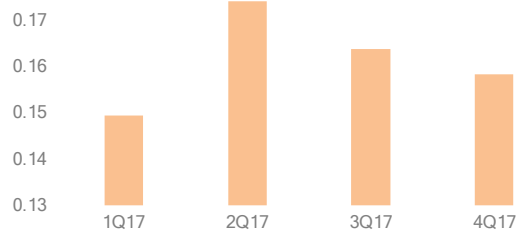
ASRD-S.46

Concentration: Number of unique counterparties



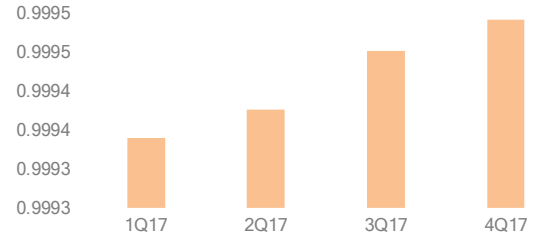
Note: Number of unique counterparties.
Sources: TRs, ESMA.

ASRD-S.47
Degree interconnectedness
0.18



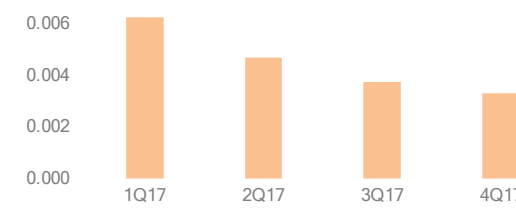
Note: The degree-interconnectedness indicator measures the number of counterparties every market participant has. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: ESMA, TRs.

ASRD-S.48
Betweenness interconnectedness
0.9996



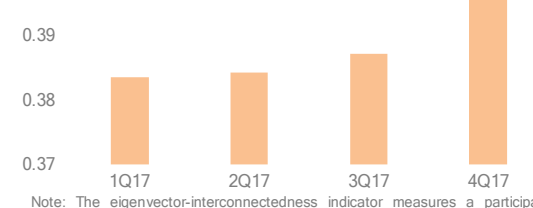
Note: The betweenness-interconnectedness indicator is based on the tendency of one participant to be standing between many other participants. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

ASRD-S.49
Closeness interconnectedness
0.008



Note: The closeness-interconnectedness indicator calculates the shortest paths between all participants, then assigns each participant a score based on its sum of shortest paths. It ranges between 0 (lowest interconnectedness) and 1000 (highest interconnectedness).
Sources: TRs, ESMA.

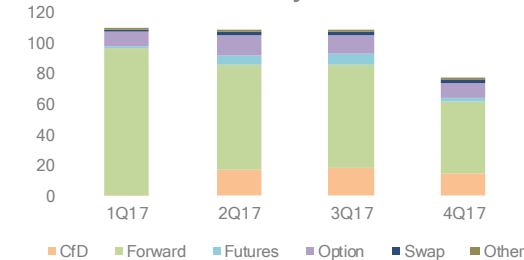
ASRD-S.50
Eigenvector interconnectedness
0.4



Note: The eigenvector-interconnectedness indicator measures a participant's influence based on the number of links it has to other participants within the network. Eigenvector then goes a step further by also taking into account how well connected a participant is, and how many links their connections have, and so on through the network. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

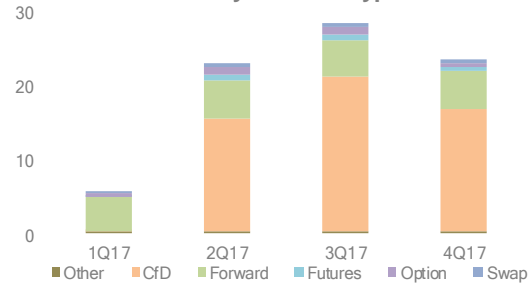
Currency derivatives market

ASRD-S.51
Gross notional amount by instrument



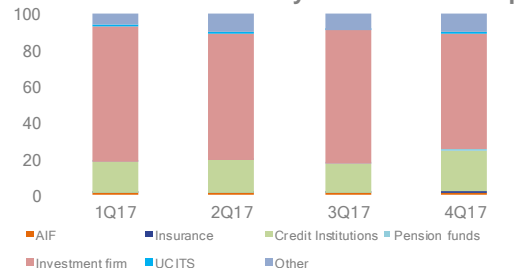
Note: Gross notional amount outstanding, in EUR tn.
Sources: TRs, ESMA.

ASRD-S.52
Number of trades by contract type



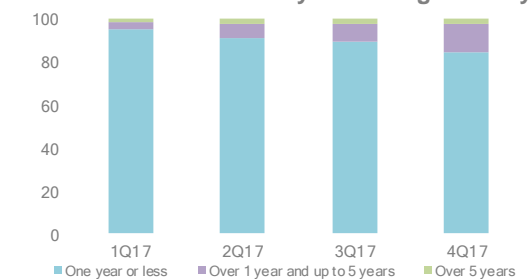
Note: Number of derivatives, by contract type, in million.
Sources: TRs, ESMA.

ASRD-S.53
Gross notional amount by sector of counterparty



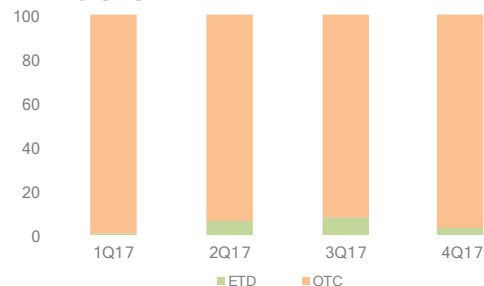
Note: Gross notional amount outstanding (not reconciled) by counterparty, in % of gross notional amount outstanding, by asset class.
Sources: TRs, ESMA.

ASRD-S.54
Gross notional amount by remaining maturity



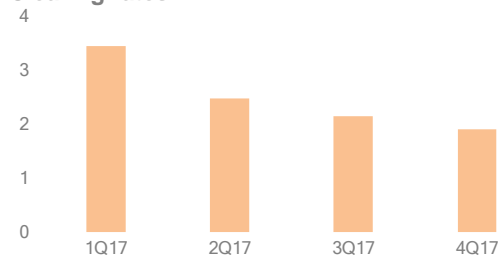
Note: Gross notional amount outstanding by remaining maturity of the contract, in % of total gross notional amount outstanding.
Sources: TRs, ESMA.

ASRD-S.55
ETD vs OTC



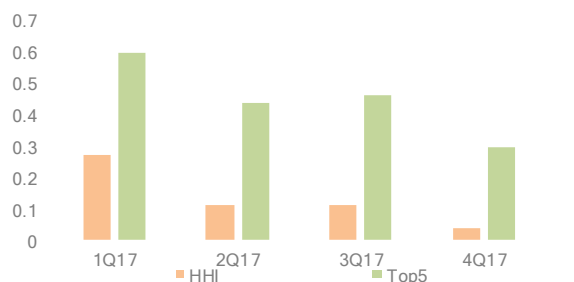
Note: Share of gross notional amount outstanding, in %.
Sources: TRs, ESMA.

ASRD-S.56
Clearing rates



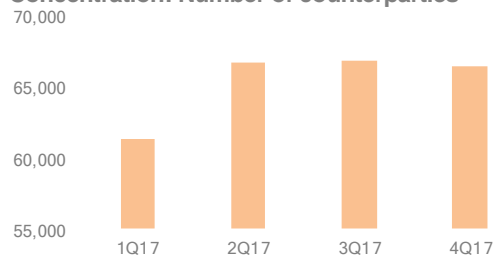
Note: Central clearing rates for all currency derivatives outstanding. Based on outstanding gross notional amounts, in %.
Sources: TRs, ESMA.

ASRD-S.57
Concentration: HHI and top-five counterparties



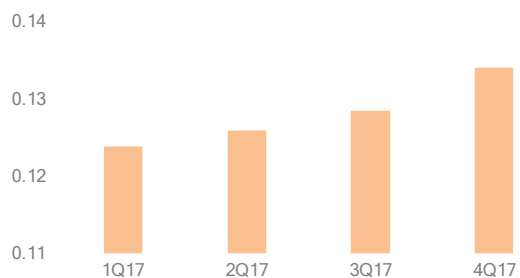
Note: Market share of top 5 counterparties and Herfindahl index calculated on aggregated gross notional positions of counterparties. Top 5 in %, Herfindahl index normalised between 0 and 1.
Sources: TRs, ESMA.

ASRD-S.58
Concentration: Number of counterparties



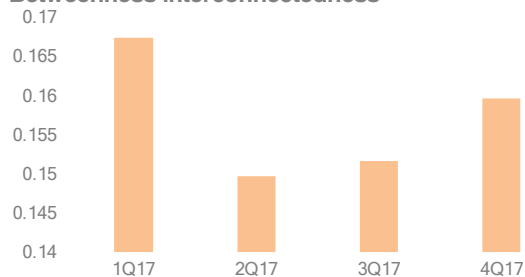
Note: Number of unique counterparties.
Sources: TRs, ESMA.

ASRD-S.59
Degree interconnectedness



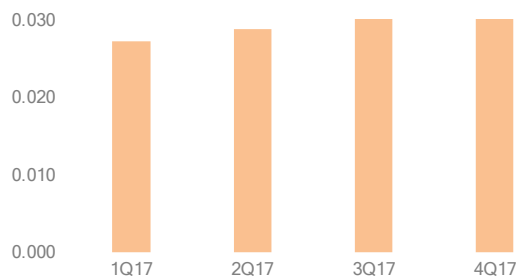
Note: The degree-interconnectedness indicator measures the number of counterparties every market participant has. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

ASRD-S.60
Betweenness interconnectedness



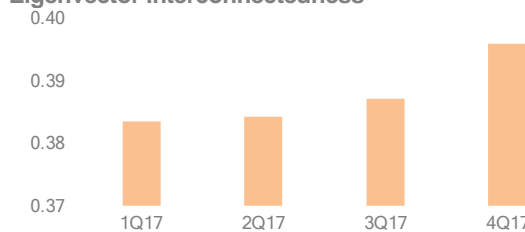
Note: The betweenness-interconnectedness indicator is based on the tendency of one participant to be standing between many other participants. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

ASRD-S.61
Closeness interconnectedness



Note: The closeness-interconnectedness indicator calculates the shortest paths between all participants, then assigns each participant a score based on its sum of shortest paths. It ranges between 0 (lowest interconnectedness) and 1000 (highest interconnectedness).
Sources: TRs, ESMA.

ASRD-S.62
Eigenvector interconnectedness

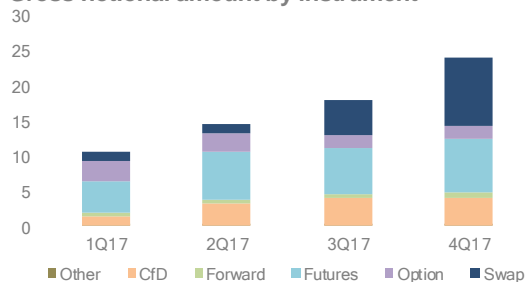


Note: The eigenvector-interconnectedness indicator measures a participant's influence based on the number of links it has to other participants within the network. Eigenvector then goes a step further by also taking into account how well connected a participant is, and how many links their connections have, and so on through the network. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
Sources: TRs, ESMA.

Commodity derivatives market

ASRD-S.63

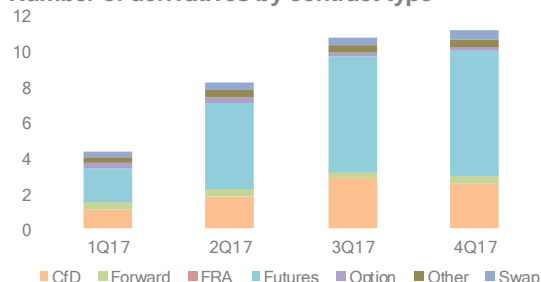
Gross notional amount by instrument



Note: Gross notional amount outstanding, in EUR tn.
Sources: TRs, ESMA.

ASRD-S.64

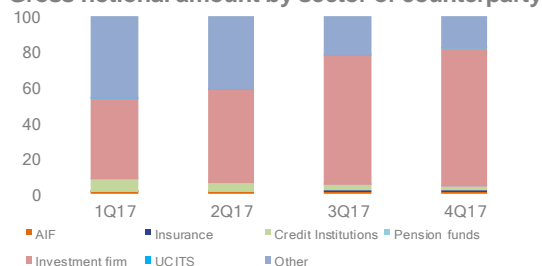
Number of derivatives by contract type



Note: Number of derivatives, by contract type, in million.
Sources: TRs, ESMA.

ASRD-S.65

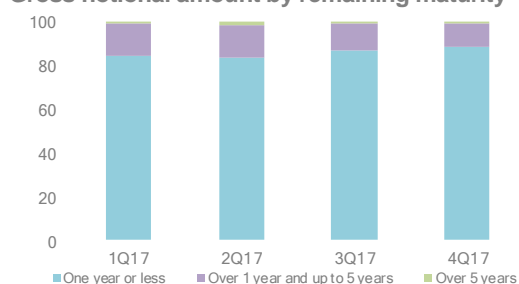
Gross notional amount by sector of counterparty



Note: Gross notional amount outstanding (not reconciled) by counterparty, in % of gross notional amount outstanding, by asset class.
Sources: TRs, ESMA.

ASRD-S.66

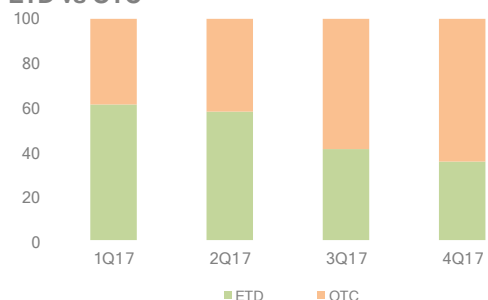
Gross notional amount by remaining maturity



Note: Gross notional amount outstanding by remaining maturity of the contract, in % of total gross notional amount outstanding.
Sources: TRs, ESMA.

ASRD-S.67

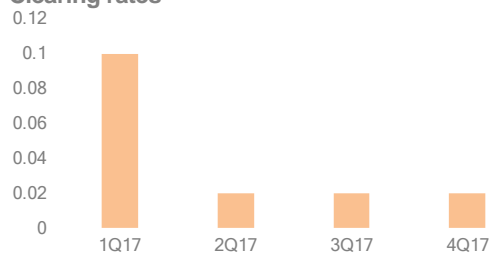
ETD vs OTC



Note: Share of gross notional amount outstanding, in %.
Sources: TRs, ESMA.

ASRD-S.68

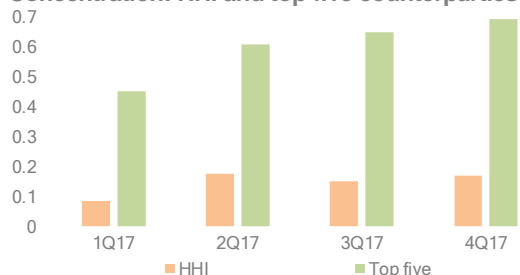
Clearing rates



Note: Central clearing rates for all commodity derivatives outstanding. Based on notional amounts, in %.
Sources: TRs, ESMA.

ASRD-S.69

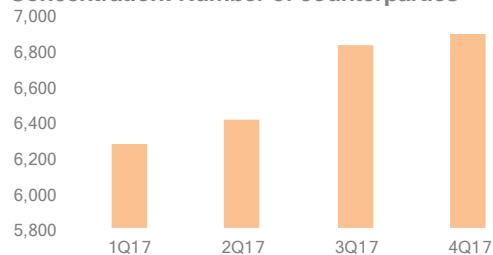
Concentration: HHI and top-five counterparties



Note: Market share of top-five counterparties and HHI calculated on aggregated gross notional positions of counterparties. Market share in %, HHI normalised between 0 and 1.
Sources: TRs, ESMA.

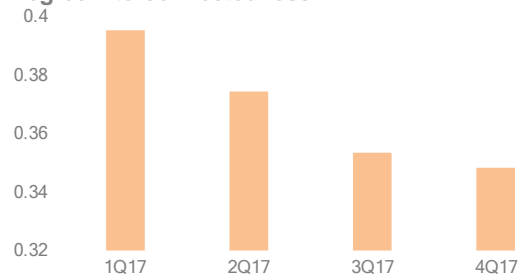
ASRD-S.70

Concentration: Number of counterparties



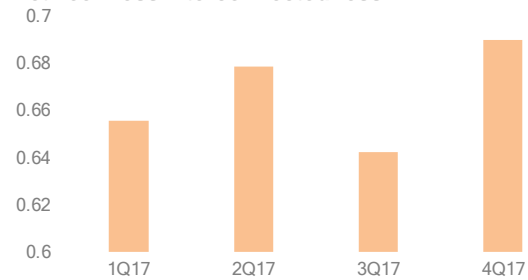
Note: Number of unique counterparties.
Sources: TRs, ESMA.

ASRD-S.71
Degree interconnectedness



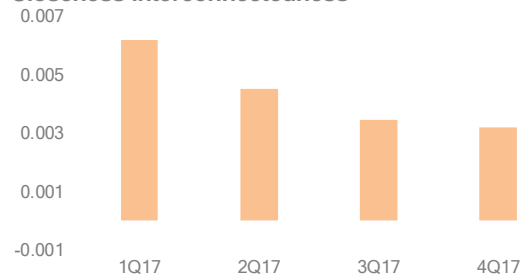
Note: The degree-interconnectedness indicator measures the number of counterparties every market participant has. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
 Sources: TRs, ESMA.

ASRD-S.72
Betweenness interconnectedness



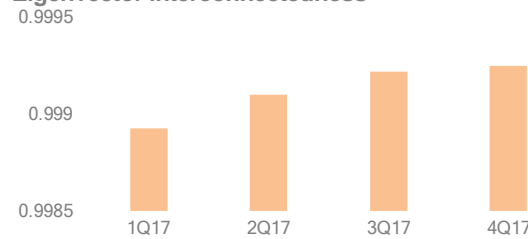
Note: The betweenness-interconnectedness indicator is based on the tendency of one participant to be standing between many other participants. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
 Sources: TRs, ESMA.

ASRD-S.73
Closeness interconnectedness



Note: The closeness-interconnectedness indicator calculates the shortest paths between all participants, then assigns each participant a score based on its sum of shortest paths. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
 Sources: TRs, ESMA.

ASRD-S.74
Eigenvector interconnectedness



Note: The eigenvector-interconnectedness indicator measures a participant's influence based on the number of links it has to other participants within the network. Eigenvector then goes a step further by also taking into account how well connected a participant is, and how many links their connections have, and so on through the network. It ranges between 0 (lowest interconnectedness) and 1 (highest interconnectedness).
 Sources: TRs, ESMA.

Annex

Statistical annotations

ASRD-S.10-ASRD-S.14 Geographical network of derivatives: This graph of the geography of risks shows the undirected network of gross notional amounts outstanding between country domiciles of counterparties. The size of the bubbles is proportional to the total gross notional amount outstanding for counterparties domiciled in the country. The thickness of the line is proportional to the gross notional amount outstanding between counterparties from the two countries.

ADR-S8, ASRD-S.21, ASRD-S.33, ASRD-S.45, ASRD.S-57, ASRD.S-69 Concentration - Top 5 Exposure: This graph shows the relative notional exposure of the top 5 counterparties (excluding the central counterparties) compared to the overall market.

ADR-S8, ASRD-S.21, ASRD-S.33, ASRD-S.45, ASRD.S-57, ASRD.S-69 Concentration - HHI: This graph shows the development of concentration of open contracts by all counterparties (including central counterparties) using the Herfindahl-Hirschman index (HHI) which is widely used measure to determine the concentration of a market. Thereby, a higher HHI is associated with higher concentration, i.e., less competition in a market. Vice versa a smaller HHI is associated with a more competitive, i.e., less concentrated, market. The calculation is as follow:

$$HHI = \sum_{i=1}^N (\text{MarketShare}^2)$$

ADR-S7, ADR-S20, ADR-S32, ADR-S44, ADR-S50, ADR-S68 Clearing rates: We define clearing rate as the share of cleared outstanding notional over the total outstanding notional, for contracts with at least one counterparty located in EEA. The formula to compute clearing rates is:

$$\text{Cleared notional (\%)} = \frac{\frac{CN_{EEA}}{2} + CN_{Non-EEA}}{UN + \left(\frac{CN_{EEA}}{2} + CN_{Non-EEA} \right)}$$

where:

- CN_{EEA} is the notional amount of contracts with one EEA CCP as counterparty.
- $CN_{non-EEA}$ is the notional amount cleared by a non EEA CCP.
- UN is the notional amount uncleared.

For a detailed explanation of the formula and its application, see the section “Methodology for clearing rate calculation”, pp.25-31.

ASRD-S.23-26, ASRD-S.35-38, ASRD-S.47-50, ASRD-S.59-62, ASRD.S-71-74 Network interconnectedness measures: Degree-interconnectedness: it measures the number of counterparties every participant has; Betweenness-interconnectedness is based on the tendency of one participant to be standing between many other participants. Eigenvector-interconnectedness is a recursive measure which gives the tendency of participants to be exposed to other central participants; Closeness-interconnectedness is based on the average distance between all the market participants (for example, two counterparties that are not trading with each other but are both trading with the same third counterparty would have a distance of two).

Glossary

Central counterparty (CCP): An entity that interposes itself between the two sides of a transaction, becoming the buyer to every seller and the seller to every buyer.

Clearing: The process of establishing positions, including the calculation of net obligations, and ensuring that financial instruments, cash, or both, are available to secure the exposures arising from those positions.

Clearing member: An undertaking that participates in a CCP and that is responsible for discharging the financial obligations arising from that participation.

Client: Client means an undertaking with a contractual relationship with a clearing member of a CCP that enables that undertaking to clear its transactions with that CCP.

Commodity forward: Contract between two parties to purchase or sell a commodity or commodity index at an agreed price on a future date.

Commodity option: Contract that gives the buyer the right (but not the obligation) to purchase or sell a commodity or commodity index at an agreed price at or by a specified date.

Commodity swap: Contract between two parties to exchange sequences of payments during a specified period, where at least one sequence of payments is tied to a commodity price or commodity index.

Counterparty: An entity that takes the opposite side of a financial contract - for example, the borrower in a loan contract, or the buyer in a sales transaction.

Credit Default Swap (CDS): A contract whereby the seller commits to repay an obligation (eg bond) underlying the contract at par in the event of a default. To produce this guarantee, a regular premium is paid by the buyer during a specified period.

Credit derivative: Derivative whose redemption value is linked to specified credit-related events, such as bankruptcy, credit downgrade, non-payment or default of a borrower. For example, a lender might use a credit derivative to hedge the risk that a borrower might default. Common credit derivatives include credit default swaps (CDS), total return swaps and credit spread options.

Currency option: A contract that gives the buyer the right (but not the obligation) to purchase or sell a currency at an agreed exchange rate at or by a specified date.

Currency swap: A contract between two parties to exchange sequences of payments during a specified period, where each sequence is tied to a different currency. At the end of the swap, principal amounts in the different currencies are usually exchanged.

Derivative: A financial instrument whose value depends on some underlying financial asset, commodity or predefined variable. Derivative or derivative contract means a financial instrument as set out in points (4) to (10) of Section C of Annex I to Directive 2004/39/EC as implemented by Article 38 and 39 of Regulation (EC) No 1287/2006.

Equity forward: A contract between two parties to purchase or sell an equity or equity basket at a set price at a future date.

Equity option: A contract that gives the buyer the right (but not the obligation) to purchase or sell an equity security or basket of equities at an agreed price at or by a specified date.

Equity swap: A contract between two parties to exchange sequences of payments during a specified period, where at least one sequence is tied to an equity price or an equity index.

Exchange rate: The price of one country's currency in relation to another.

Exchange Traded Derivative (ETD): A derivative that is traded on a regulated market or on a third-country market considered to be equivalent to a regulated market in accordance with Article 28 of this Regulation (MiFIR), and as such does not fall within the definition of an OTC derivative as defined in Article 2(7) of Regulation (EU) No 648/2012, according to Article 2 under MiFIR (Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments and amending Regulation (EU) No 648/2012).

Financial counterparty: An investment firm authorised in accordance with Directive 2004/39/EC, a credit institution authorised in accordance with Directive 2006/48/EC, an insurance undertaking authorised in accordance with Directive 73/239/EEC, an assurance undertaking authorised in accordance with Directive 2002/83/EC, a reinsurance undertaking authorised in accordance with

Directive 2005/68/EC, a UCITS and, where relevant, its management company, authorised in accordance with Directive 2009/65/EC, an institution for occupational retirement provision within the meaning of Article 6(a) of Directive 2003/41/EC and an alternative investment fund managed by AIFMs authorised or registered in accordance with Directive 2011/61/EU.

First counterparty basis: Methodology whereby positions are allocated to the primary party to a contract.

Insurance: For this report, insurance is the aggregation of an insurance undertaking authorised in accordance with Directive 73/239/EEC, an assurance undertaking authorised in accordance with Directive 2002/83/EC, and a reinsurance undertaking authorised in accordance with Directive 2005/68/EC.

Interconnectedness: Interconnectedness is a market-level centralisation measure based on the network-centrality scores of each counterparty in the market, while the market is defined as all derivatives outstanding within an asset class. This is done using the R package *igraph*⁵⁵. The underlying formula is:

$$\text{Interconnectedness}(\text{market}) = \frac{\sum(\max(c(w), w) - c(v), v)}{\sum(\max(c(w), w) - c(v), v)}$$

where $c(v)$ is the centrality of counterparty v . The market-level centrality score is then normalized dividing by the maximum theoretical score for a theoretical market with the same number of counterparties. It ranges between zero and one, zero being the minimum level of interconnectedness and one the maximum. For degree, closeness and betweenness the most centralized structure is some version of the star graph, where all counterparties are linked to one central counterparty and not between each other. For eigenvector interconnectedness the most centralized structure is the graph with a single edge (and potentially many isolates).

Interest rate option: A contract that gives the buyer the right (but not the obligation) to pay or receive an agreed interest rate on a predetermined principal at or by a specified date.

Interest rate swap: A contract to exchange periodic payments related to interest rates on a single currency; can be fixed for floating, or floating for floating based on different indices. This group includes those swaps whose notional principal is amortised according to a fixed schedule independent of interest rates.

Notional amount outstanding: Gross nominal or notional value of all derivatives contracts concluded and not yet settled on the reporting date.

Over the Counter (OTC): an 'OTC derivative' or 'OTC derivative contract' means a derivative contract the execution of which does not take place on a regulated market as within the meaning of Article 4(1)(14) of Directive 2004/39/EC or on a third-country market considered as equivalent to a regulated market in accordance with Article 19(6) of Directive 2004/39/EC.

Pension funds: For this report a pension fund is an institution for occupational retirement provision within the meaning of Article 6(a) of Directive 2003/41/EC.

Portfolio compression: Portfolio compression is defined in MIFIR as a risk reduction service in which two or more counterparties wholly or partially terminate some or all of the derivatives submitted by those counterparties for inclusion in the portfolio compression and replace the terminated derivatives with another derivative whose combined notional value is less than the combined notional value of the terminated derivatives.

Remaining maturity: The period from the reference date until the final contractually scheduled payment.

Swap: Financial derivative in which two parties agree to exchange payment streams based on a specified notional amount for a specified period.

Trade repository: a A legal person that centrally collects and maintains the records of derivatives.

⁵⁵ Csardi G, Nepusz T: The *igraph* software package for complex network research, *InterJournal, Complex Systems* 1695. 2006. <http://igraph.org>

List of abbreviations

BIS	Bank for International Settlements
CCP	Central Counterparty
CD	Credit Derivatives
CDS	Credit Default Swap
CFD	Contract for Difference
CM	Clearing Member
CO	Commodity Derivatives
CTPY	Counterparty
CU	Currency Derivatives
EEA	European Economic Area
EMIR	European Markets Infrastructure Regulation
EQ	Equity Derivatives
ETD	Exchange Traded Derivatives
FC	Financial Counterparty
FSB	Financial Stability Board
HHI	Herfindahl-Hirschman Index
IRD	Interest Rate Derivatives
IRS	Interest Rate Swaps
ISDA	International Swaps and Derivatives Association
LEI	Legal Entity Identifier
MIC	Market Identifier Code
MiFIR	Markets in financial instruments Regulation
NCA	National Competent Authority
NFC	Non-Financial Counterparty
OTC	Over the Counter
RTS	Regulatory Technical Standard
TR	Trade Repository
UCITS	Undertakings for Collective Investment in Transferable Securities

Countries abbreviated according to ISO standards

Currencies abbreviated according to ISO standards



European Securities and
Markets Authority

