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An insight into the derivatives trading of firms in the euro area[1]

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[1] This paper was prepared for the meeting. The views expressed are those of the authors and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.

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Abstract

Financial institutions are not the only traders of derivative contracts. Non-financial corporations (NFCs) also use derivatives to mitigate their risks. But which are the characteristics of these firms and what are the implicit entry barriers to derivatives trading for non-financial corporations? In this paper we first analyse how demographic and financial characteristics of firms determine their recourse to derivative markets in Europe. Subsequently we use a multinomial logit model to identify patterns in the trading preferences, using transaction-level data on derivatives contracts collected under the European Market Infrastructure Regulation (EMIR).

Keywords: OTC derivatives, firm data, risk mitigation

JEL classification: D22, D25, D53, G32

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1. Introduction: the usage of financial derivatives by NFCs

The immediate impact of the 2007–2008 crisis on the non-financial sector has been relatively limited. According to Bartram et al. (2015), the main reason for this is that firms' stock volatility is mostly influenced by economic factors, such as competition and price fluctuations, and less so by market-based financial risks which are often accounted for in the firm's risk management policies which may include, among others, mitigating external risks using financial derivatives.

The use of financial derivatives by non-financial firms has increased notably in the last 3 decades (Nguyen 2011). As a result, we notice the substantial development of a specific empirical literature which studies the nature of this phenomenon and investigates the main reasons driving a firm's decision to invest in this type of financial instruments.

Typically, the firm's decision to use financial derivatives is related to the need of hedging against a specific risk. The established financial risk management literature identifies the most common determinants of the use of financial derivatives by firms around the need to mitigate cash flow volatility. In particular, the main case studies can be summarised as follows:

- Costs of financial distress:
  Cash flow volatility can have a negative impact on the firm's available liquidity and limit its capacity to meet regular payment obligations on time, such as salaries and interest payments. Financial risk management can reduce the likelihood of incurring such liquidity constraints and thus lower the expected costs associated with periods of financial distress (Mayers and Smith, 1982; Myers, 1984; Stulz, 1984; Smith and Stulz, 1985; Shapiro and Titman, 1998, among others).

- Taxes:
  When firms are subject to progressive taxation on income, then financial derivatives can be used to reduce the volatility of taxable income and thus the expected value of tax liabilities (Smith and Stulz, 1985; Nance et al., 1993; Graham and Smith, 1999; Graham and Rogers, 2002).

- Underinvestment:
  Cash flow volatility increases the likelihood that the firm may be faced with costly external financing for planned investment projects due to cash shortages. Empirical evidence based on this rationale shows that firms with substantial investment plans that are facing high costs of access to financing are more willing to hedge against liquidity risks that would hamper their investment capacity (Bessembinder, 1991, Froot et al., 1993).

The theories of hedging mentioned above show how firms can increase their "debt capacity" in a context of imperfect capital markets. However, the empirical literature shows only mixed evidence about the positive relation between hedging with financial derivatives and increasing firm value.

Further streams of the literature indicate that hedging strategies are used by managers to reap the benefits of informational asymmetries which exist between themselves and the shareholders of the company, since managers typically have better information about the risks of the firm (Smith and Stulz, 1985; Duffie and DeMarzo, 1991). Similarly, some narratives on financial risk management focus on the risk aversion of managers and the nature of their compensation contracts (Smith and Stulz, 1985; Tufano, 1996; Berkman and Bradbury, 1996).

Industry and size effects are broadly consistent across different studies which find positive correlation between firm scale and financial derivative usage. Indeed, due to the high set-up and implementation costs related to corporate risk-management policies, it is often the case that for smaller firms these costs may exceed the benefits of a hedging program. There are, however, some valid arguments pointing to the existence of a negative relation between firm size and hedging activity: for example, some studies suggest that small firms may have a greater incentive to hedge as they face higher bankruptcy costs (i.e. the increased costs of financing with debt that result from higher probability of bankruptcy) compared to larger firms (Smith and Stulz, 1985). Small firms are also faced with greater information asymmetries and costs of external financing and thus they are more likely to incur financial distress and, as a result, they might be more inclined to hedging activities.

Due to the limited coverage of available data, many studies limit the scope of the analysis to specific categories of derivatives, or to selected industries and geographic areas, while the sample of the analysis is often limited to publicly listed firms. The vast majority is focused on the US market while very few empirical studies have examined the determinants of derivatives usage in a European context, using mainly survey data (e.g. Bodnar and Gebhardt, 1999; De Ceuster et al, 2000; Bodnar et al, 2013 and Jankensgård, 2015).

With respect to the empirical models employed, most of the studies can be split into two main groups: those that focus on firms' usage of derivatives as qualitative information (mostly based on probability models) and those that aim at capturing the extent of firms' derivatives usage through measures of notional amounts (mostly using truncated probability models or two-part models where the decision to use derivatives is analysed separately from the decision on the extent of usage).

Due to the considerations that will follow in the next section, in this study we use multivariate logit to draw some insights into the financial profile of firms using financial derivatives.

The main distinctive feature of this study is the exploratory analysis of transaction-level data on derivative contracts collected under the European Market Infrastructure Regulation (EMIR) as well as the investigation of the analytical potential of this dataset with reference to the non-financial sector. The EMIR dataset covers all counterparties established in the euro-area and all contracts where one of the two counterparties is located in the euro area or where the reference obligation is sovereign debt of a euro area member. As a result, the analysis benefits from the following distinctive characteristics:

- All NFCs in the euro area which make use of derivatives in the period of analysis are included in the sample (i.e. not only larger and/or listed firms).
- All types of derivatives and asset classes are included in the sample, regardless of whether they are traded over the counter (OTC derivatives) or on a regulated exchange (ETD derivatives).

- We identify the characteristics of firms trading on derivative markets compared to those non-trading when controlling for size, sector, and country they belong to.
- We identify which types of firms are more likely to trade a specific type of contract based on the underlying asset class.

2. The EMIR dataset: a brief overview

2.1. The EMIR reporting framework

In the aftermath of the financial crisis in 2008, new regulatory initiatives have been developing worldwide, following the decisions taken by G20 leaders in the Pittsburgh Summit of 2009, to start a process of reforms aiming at improving functioning and transparency within the OTC derivatives markets.

In the EU, the European Market Infrastructure Regulation (EMIR)[1] established the obligation to report, since February 2014, data on all OTC and exchange-traded derivatives transactions conducted by counterparties resident in the EU. Information is currently collected by six authorised trade repositories (TRs) that validate and store the data received by the reporting agents and share them with more than 60 competent authorities in the EU.

The EMIR legal framework was developed by the European Securities and Market Authority (ESMA), which received the mandate to define the reporting requirements as well as to authorise and supervise TRs.

2.2. Dataset structure

Through EMIR, the European Central Bank (ECB) has access to transaction-level derivatives data for all counterparties established in the euro-area and all contracts where the reference entity is located within the euro area or where the reference obligation is sovereign debt of a euro area member.

The data cover five instrument classes (equity derivatives, credit derivatives, interest rate derivatives, commodity derivatives, foreign exchange derivatives), both exchange-traded (ETD) and over-the-counter (OTC) contracts, including trades cleared via Central Clearing Counterparties (CCPs). The data are collected transaction-by-transaction and include more than 120 reported fields[2].

The information to be reported in compliance with EMIR is comprehensive and includes so-called "counterparty data", pertaining to each counterparty individually considered, and "common data", i.e. information about the contract that are expected to be the same for both counterparties. When both counterparties are subject to the reporting obligation, EMIR establishes a "double-reporting" regime,

1 Regulation (EU) 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

2 As of November 2017.

by which both of them are bound to individually report the same transaction after agreeing on the content of common fields (Ascolese et al. 2017).

The high volume and granularity of the EMIR data provides an unprecedented analytical perspective on the European derivatives markets which is particularly valuable for macro-prudential policy and financial stability purposes. In fact, the wide data coverage would allow for the calculation of aggregate level data, however several caveats must be considered due to important data quality limitations in particular with reference to the level of standardisation in the main data fields (i.e. counterparty and product ID, trade ID and valuation information).

In this respect, several EU-level initiatives have been taken to reduce these data quality issues by amending EU regulations and guidelines and by supporting international efforts on the standardisation of OTC derivatives data. The recent adoption of the amended regulations[3] paved the way to significant data quality improvements as of 1 November 2017, in particular with reference to a more widespread adoption of global identification standards (such as LEI or ISIN codes[4])[5].

The current paper makes use of the EMIR granular data as collected from TRs as of November 2017 (i.e. in compliance with the latest regulatory standards).

3. Matching EMIR and balance sheet data of NFCs

3.1. EMIR and Orbis: the scope of the analysis

In this study we aim at the identification of patterns and correlations within euro area NFCs which participate in the derivatives market as opposed to those which do not make use of these financial instruments. In particular, we focus on demographic characteristics such as the size, age and sector of the firm as well as financial information coming from the firms' balance sheet and profit and loss accounts.

3.1.1. The Orbis database

Demographic and financial firm-level information comes from Orbis Europe, a cross-country database on NFCs financials provided by Bureau van Dijk (BvD). Orbis Europe is a commercial database, containing firm-level balance sheet and other company information (e.g., among others, various identification codes, ownership data and directors) for around 86 million European firms. The data is collected by BvD's information providers at each national official body in charge of collecting annual accounts in the respective country. The coverage of the database by legal form varies across countries.

3.1.2. Timing considerations

Orbis data come at an annual frequency (following the disclosure of the annual financial reports) and as of today the latest available information is dated end-

[3] Regulation (EU) 104/2017 and Regulation (EU) 105/2017.

[4] Legal entity identifier (LEI), International Securities Identification Number (ISIN).

[5] See Ascolese et al. (2017) for more details on EMIR reporting standards and data quality considerations.

2016[6]. On the other hand, EMIR daily data on derivatives transactions covers the period between November 2017 and May 2018. Therefore, we face a mismatch between the timeliness of the two datasets.

In order to circumnavigate this issue and obtain a useful preliminary analysis of the behaviour of non-financial corporations on the derivative markets, we opted for averaging the balance-sheet information utilised over the period 2014-2016.

Using this approximation, although the Orbis data for 2017-2018 is not available yet (as annual financial data for these reference periods has not been compiled entirely by the reporting entities), we expect to be able to obtain the most significant set of parameters available to conduct our analysis.

3.2. The matching process

The data matching process follows the steps listed below:

1. On the EMIR side, we identify those entities which have entered a new derivative transaction of any kind during the available time period (Nov17-May18).
2. On the Orbis side, we aggregate (by averaging values through the considered period) all firms with the following characteristics:
    a. They have an LEI code.
    b. They belong to the non-financial sector[7].
    c. They report unconsolidated financial statements in 2014, 2015 or 2016.
    d. They are resident in the euro area at the time of reference.
3. We match the two datasets coming from 1. and 2. through the LEI code. Due to the structure of the EMIR tables, the matching is done in two steps:
    a. The EMIR "reporting counterparty IDs" are matched with the Orbis LEI codes to enrich the dataset with information from EMIR (e.g. contract type, asset type, etc.)
    b. The EMIR "other counterparty IDs" are matched with the Orbis LEI codes to enrich the dataset with information from EMIR (e.g. contract type, asset type, etc.)
4. As the same entities can appear as reporting counterparties and other counterparties, and given that in our analysis we do not look at amounts traded, we keep every unique transaction by LEI code and contract characteristics (type of contract and asset class).
5. A dummy variable is finally created in the dataset to indicate whether a firm is involved in a derivative transaction or not (i.e. whether it appears both in the EMIR and in the ORBIS datasets or only in the ORBIS dataset).

[6] Data for 2017 are still provisional and have much lower coverage.

[7] See Section 4 for the list of NACE rev2 1-digit sectors included in the dataset.

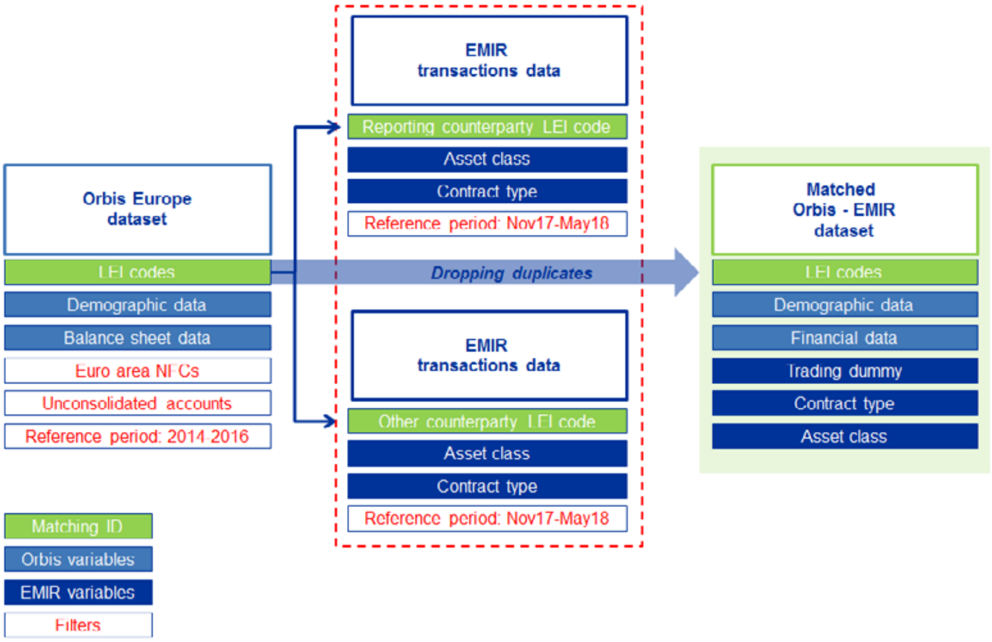
Therefore, the final matched dataset includes:

a. financial information for all firms with a LEI code (as available in Orbis).

b. a dummy variable indicating whether a firm traded derivatives in the period of analysis.

c. for those firms which traded derivatives, information on the type of contract and underlying asset class.

Figure 1. Orbis-EMIR matching process



Sources: EMIR and Orbis Europe.

As anticipated, due to the structure of the EMIR dataset which currently does not allow a fully unique trade and product identification, we simplify the data extraction by focusing on the identification of the entities and the related categorical information (e.g. contract types, asset classes, ETD vs OTC, etc.) while quantitative information on trading volumes or notional amounts as well as on the number of contracts signed by each entity are excluded from the analysis.

3.3. Main matching results

Given the very high availability of LEI codes throughout the NFCs population in EMIR, the results of the matching procedure with the Orbis data are quite satisfactory. Overall, 56% of euro area entities reported in EMIR as NFCs can be matched with Orbis through the LEI code. Table 1 summarizes these results by country.

Table 1. Matched firms / total firms in EMIR[8]

Country	Orbis coverage of NFCs trading in EMIR
AT	60%
BE	75%
CY	4%
DE	72%
EE	17%
ES	54%
FI	61%
FR	57%
GR	62%
IE	18%
IT	50%
LT	35%
LU	7%
LV	31%
MT	14%
NL	59%
PT	73%
SI	72%
SK	66%

Sources: calculations based on EMIR and Orbis Europe data.

Therefore, considering the comprehensive coverage of the EMIR reporting scheme, we can assume that the matched dataset we have obtained can offer (in particular for bigger countries) a representative picture of the euro area NFCs population participating in the derivatives market during the period of analysis.

However, due to the very limited time coverage of the EMIR transaction data in the database we use, the analysis is not looking at this small group of firms in comparison with the overall NFCs population reported in Orbis. Instead, as described above, we compare the group of firms identified in EMIR with all the firms which are reported in Orbis with an LEI code. This choice will bias our sample towards larger firms but if functions as a good proxy for firms in the Orbis dataset with similar quality of reported information, fundamental for the comparison we carry on in the next steps. Table 2 summarizes the total number of firms included in the two clusters of the dataset.

8 The matching results by countries refer only to the "reporting counterparties" (thus exclude the "other counterparties") in EMIR.

Table 2. The structure of the matched dataset – distribution across countries[9]

Country	NFCs non-trading derivatives (Orbis Europe)		NFCs trading derivatives (EMIR)		NFCs with LEI (Orbis Europe)
	n	*%*	*n*	*%*	*n*
AT	2,953	81%	685	19%	3,638
BE	4,085	72%	1,614	28%	5,699
CY	45	65%	24	35%	69
DE	21,983	75%	7,278	25%	29,261
EE	141	77%	43	23%	184
ES	4,983	65%	2,705	35%	7,688
FI	1,133	71%	458	29%	1,591
FR	7,763	69%	3,527	31%	11,290
GR	301	76%	97	24%	398
IE	1,153	78%	331	22%	1,484
IT	27,805	86%	4,391	14%	32,196
LT	156	73%	59	27%	215
LU	622	77%	182	23%	804
LV	99	77%	30	23%	129
MT	61	78%	17	22%	78
NL	7,371	78%	2,109	22%	9,480
PT	806	68%	379	32%	1,185
SI	297	76%	93	24%	390
SK	964	85%	175	15%	1,139
euro area	82,721	77%	24,197	23%	106,918

Sources: calculations based on EMIR and Orbis Europe data.

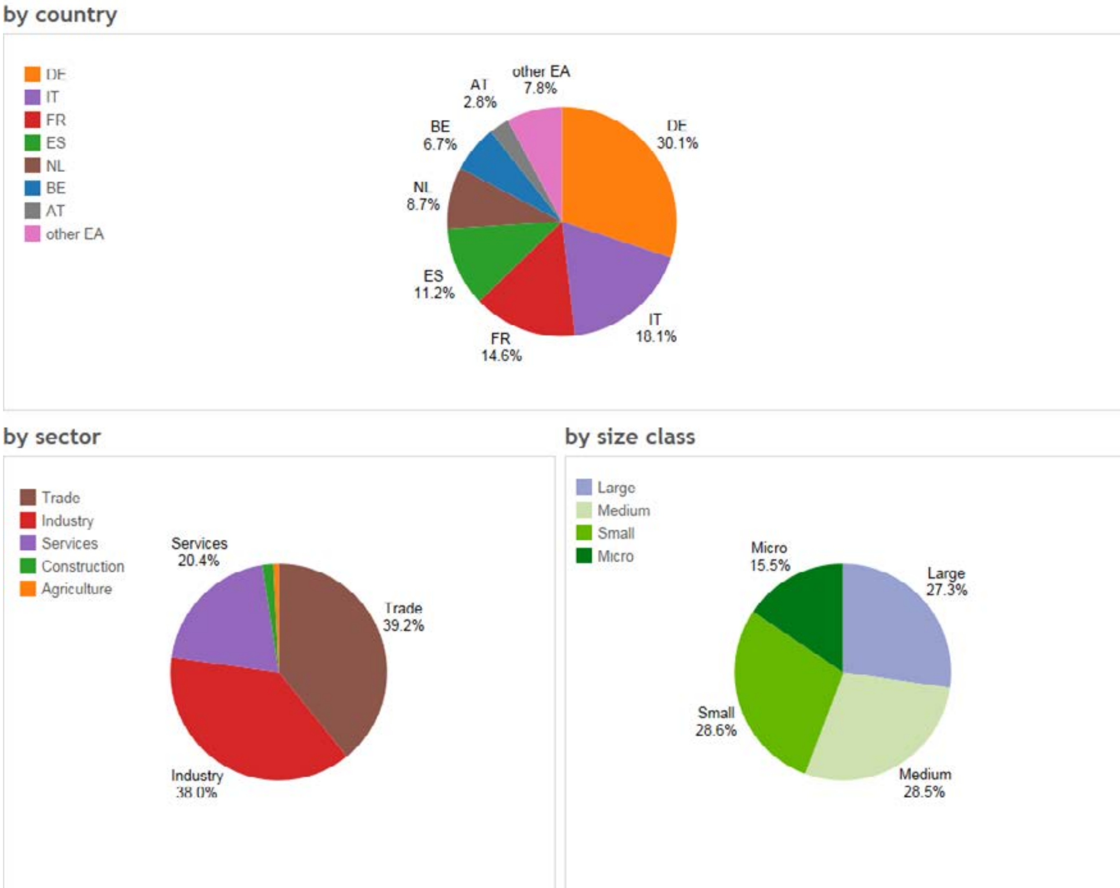
4. An insight into euro area NFCs trading derivatives

4.1. Demographic characteristics

In this section the analysis will focus on the group of firms using derivatives, namely those NFCs which have registered at least one derivative transaction during the period of analysis (from November 2017 to May 2018). Using information from Orbis we can break down this group of firms to identify relevant demographic characteristics. Figure 2 provides the composition by country, size class and sector of activity.

9 Orbis data refer to annual reports from 2014 to 2016. EMIR data refer to the number of NFCs involved at least in one derivative transaction between November 2017 and May 2018.

Figure 2. Firms using derivatives, breakdown by country, size and sector



Sources: calculations based on EMIR and Orbis Europe data.

The country composition is broadly in line with the overall NFC population composition within the euro area. About 80% of the firms trading derivatives in the euro area are resident in Germany, Italy, France, Spain and the Netherlands. However, German firms constitute 30% of the overall sample which is notably a high proportion with respect to official business population statistics[10] and means that there is a higher heterogeneity in the composition of derivatives trading firms in Germany compared to other countries (i.e. when looking at which firms are trading which type of contract with which underlying asset).

The sectors of activity have been clustered into five main groups, namely agriculture, construction, industry, services and trade[11]. Most of the firms trading

[10] According to Eurostat's Structural Business Statistics, German NFCs population is about 15% of the overall NFCs population in the euro area.

[11] The split by sector is based on economic activities at the one-digit level of the European NACE classification (Rev. 2):

- "Agriculture" includes only agriculture, forestry and fishing (A),
- "Industry" includes mining and quarrying (B), manufacturing (C), and electricity, gas, steam and air conditioning supply (D), and water supply, sewerage, waste management and remediation activities (E).
- "Construction" is simply construction (F).
- "Trade" includes wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods (G).

derivatives operate in either industry or trade (about 77%, split almost equally between the two sectors) while 20% are active in services. Very few firms belong to the agriculture and construction sectors however the proportions compared to the total are in line with those in the Orbis dataset.

Regarding the size of firms, the definition applied throughout this paper follows the EU recommendation 2003/361. The two criteria used to determine the size of the firm are (i) the number of employees and (ii) either turnover (operating revenues) or total assets. They are applied as follows:

- Small and Medium-sized enterprises (SMEs):
    - Micro firms: < 10 *employees* and (*turnover* <= EUR 2 mln or *total assets* <= EUR 2 mln)
    - Small firms: < 50 *employees* and (*turnover* <= EUR 10 mln or *total assets* <= EUR 10 mln)
    - Medium firms: < 250 *employees* and (*turnover* <= EUR 50 mln or *total assets* <= EUR 43 mln)
- Large firms:

    > 250 *employees* or (*turnover* > EUR 50 mln and *total assets* > EUR 43 mln)

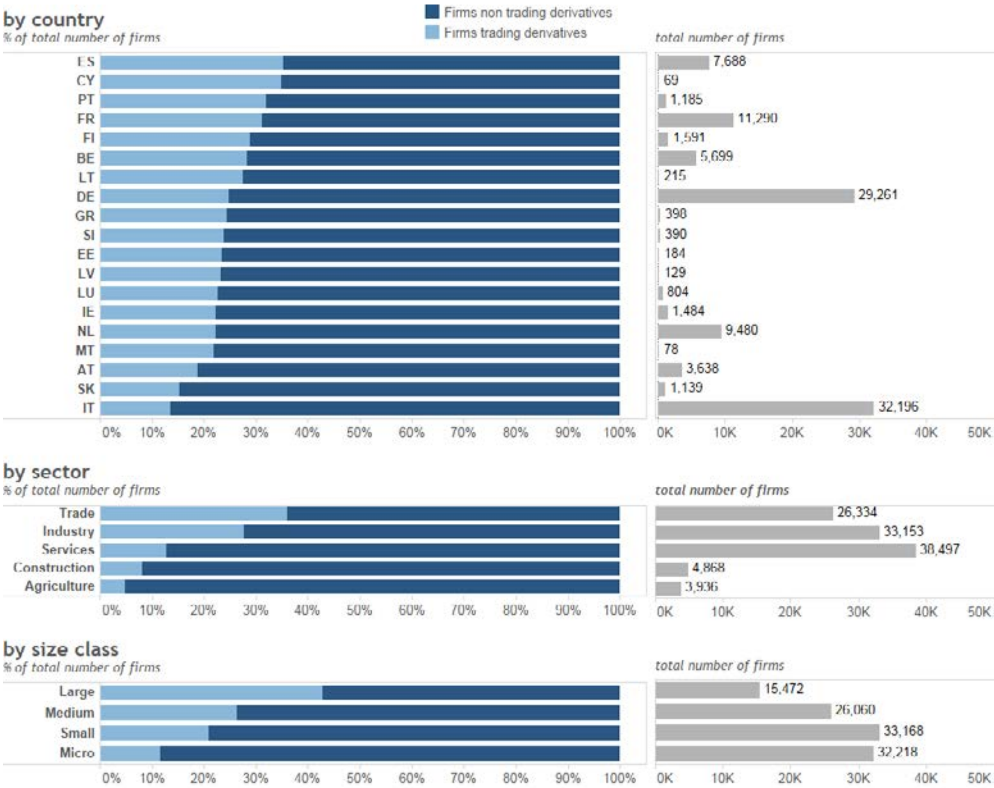
Using the above definitions, large firms constitute 27% of the sample while the rest of the firms using derivatives are SMEs. Considering that in terms of number of firms SMEs constitute about 99% of the European business economy we can already see a bias toward larger firms within the sample of firms using derivatives.

Figure 3 reports, for all countries, sectors and size classes, the percentage of firms using derivatives in the dataset. Across the entire sample of 106,918 firms, 23% used some type of derivatives during the period of analysis. Usage ratios do not vary substantially across countries while they are higher for the trade sector and increase significantly with firm size.

- "Services" includes enterprises in transport and storage (H), accommodation and food service activities (I), information and communication (J), real estate activities (L), professional, scientific and technical activities (M), administrative and support service activities (N), education (P), human health and social work activities (Q) arts, entertainment and recreation (R) and other service activities (S).

The following activities were excluded from the sample: financial and insurance activities (K), public administration and defence, compulsory social security (O), activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (T), activities of extraterritorial organisations and bodies (U).

Figure 3. Percentage of firms using derivatives, breakdown by country, size and sector



Sources: calculations based on EMIR and Orbis Europe data.

4.2. Types of derivatives

From the EMIR side of the matched dataset we retrieve information about the type of derivative contract and the underlying asset class for every firm. In particular, we know whether a firm is investing in one or more types of derivatives.

In general, 98% of the firms are using OTC derivatives and thus only 2% of the reporting entities uses exclusively exchange traded derivatives (ETD). Thus the data confirms the common view that most of the trading activity on derivatives in the euro area occurs "over the counter".

As shown in Figure 4, 60% of the firms trade currency derivatives, 13% interest rates derivatives and almost 6% commodity derivatives. This finding is broadly in line with the literature on derivatives usage by NFCs (e.g. Bartram et al, 2009). Unfortunately, for 40% of the records in the sample we do not have information about the asset class in EMIR.

In terms of contract type, 70% of the identified cases firms use forwards, 29% swaps and 20% options.

Figure 4. Firms trading derivatives, breakdown by contract type and asset class[12]

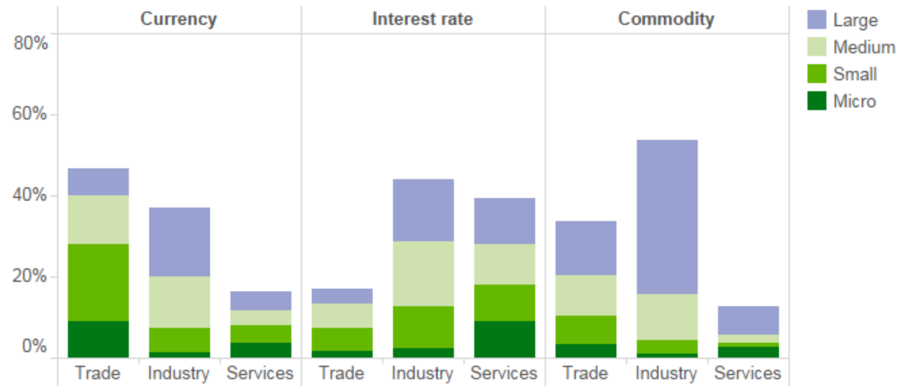
Asset Class	Contract Type: Forwards	Swap	Option	Other	Futures	Financial contracts for difference	Swaption	Forward rate agreements	Unspecified	Grand Total
Currency	52.77%	9.11%	0.04%	9.03%	0.08%	0.25%		0.02%	0.05%	60.05%
Unspecified	28.56%	14.45%	9.72%	2.36%	0.41%	0.46%	0.02%	0.02%		42.27%
Interest rate	0.05%	8.11%	3.19%	3.63%	0.10%	0.01%	0.12%	0.02%	0.00%	13.17%
Commodity	1.54%	2.57%	0.93%	0.31%	1.87%	0.12%	0.01%	0.01%	0.02%	5.75%
Equity	0.11%	0.11%	1.01%	0.41%	0.29%	0.19%			0.01%	1.81%
Credit		0.08%		0.01%			0.01%			0.09%
Grand Total	70.49%	29.23%	20.18%	14.63%	2.45%	0.84%	0.14%	0.08%	0.07%	100.00%

Sources: calculations based on EMIR and Orbis Europe data.

The high frequency in the use of forwards is a reasonable finding as these types of derivatives are very specific for the OTC market. In particular, currency forwards are used by the highest proportion of firms inside the sample (53%).

Figure 5 shows that most of the firms using currency derivatives belong to trade and industry. However, in the case of industry most of these firms are medium and large in size while they are mostly micro and small in the trade sector. Commodity-based derivatives are also mostly used in industry and trade although in this case medium and large firms are the most common investors. Interest rate derivatives are more popular in both industry and services.

Figure 5. Firms using derivatives, breakdown by sector and size class (% by asset class)



Sources: calculations based on EMIR and Orbis Europe data.

12 All percentages (including totals) refer to the number of firms and thus they do not sum up to row and column totals as one firm can fall into more than one category (i.e. use more than one contract type or asset class).

4.3. Firm size and derivatives usage

Most of the current literature on NFCs and derivatives usage[13] shares the idea that larger firms are more likely to use derivatives as they can rely on more sophisticated financial management practices and the economies of scale provide a competitive advantage on information and transaction costs in the derivatives market. On the other hand, other empirical findings[14] suggest that, since smaller firms can be more vulnerable during periods of financial distress and face higher bankruptcy costs, they are more likely to use derivatives to hedge against financial risks.

We can test these hypotheses on our matched dataset using different measures of firm size coming from the balance sheet data and comparing the results across country and sector in order to identify possible patterns in the sample.

We measure firm size using (i) total assets, (ii) turnover (operating revenues) and (iii) number of employees. All measures are expressed as natural logarithm transformations.

In order to highlight patterns in the dataset, we plot the distributions of the two clusters of the sample (i.e. firms using derivatives / firms not using derivatives) along the above mentioned measures of firm size and we compare the results across sectors and country.

Figure 6 compares the distributions of the two clusters of firms on total assets. For all the three main sectors, the distribution of the group of firms using derivatives (light blue shaded area in the chart) is shifted to the right with respect to the one of the firms not using derivatives (dark blue bars), with industry showing the highest difference. Also, the level of dispersion does not vary significantly across the two clusters especially in the case of trade where the difference in variance is minimal.

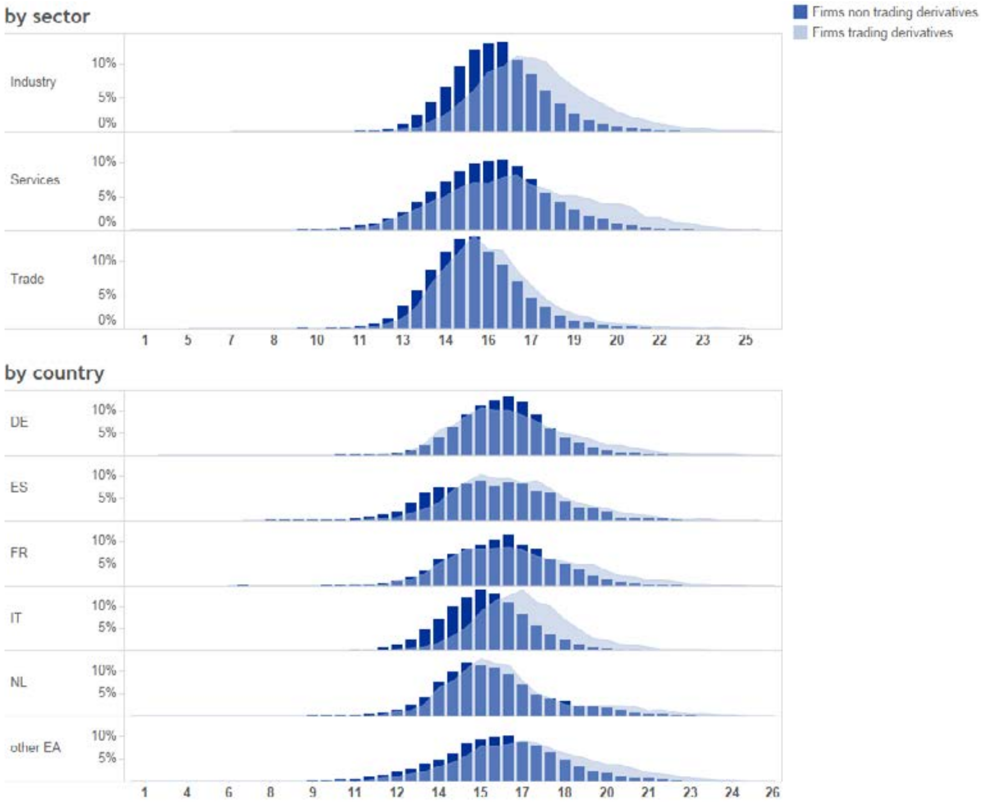
The difference in firm size between the two distributions (firms trading and firms not trading) is statistically significant (according to the kolmogorov-smirnov test[15]) both across sectors and across countries. We reach very similar conclusions when using turnover and number of employees as proxies for the firm size (see Figure 7 and 8). Particularly in the case of turnover, the positive relation between size and derivatives is more pronounced across all sectors and countries.

13 Among others, Berkman and Bradbury (1996), Borokhovich et al. (2004), Carroll et el (2017), Fok et al. (1997), Geczy et al. (1997), Graham and Rogers (2002), Guay (1999), Judge (2006) Lel (2012), Lin and Smith (2007), Mian (1996), Nance et al. (1993), Rogers, (2002).

14 Among others, Ang et al. (1982), Nance et al. (1993), Smith and Stulz (1985), Warner (1977).

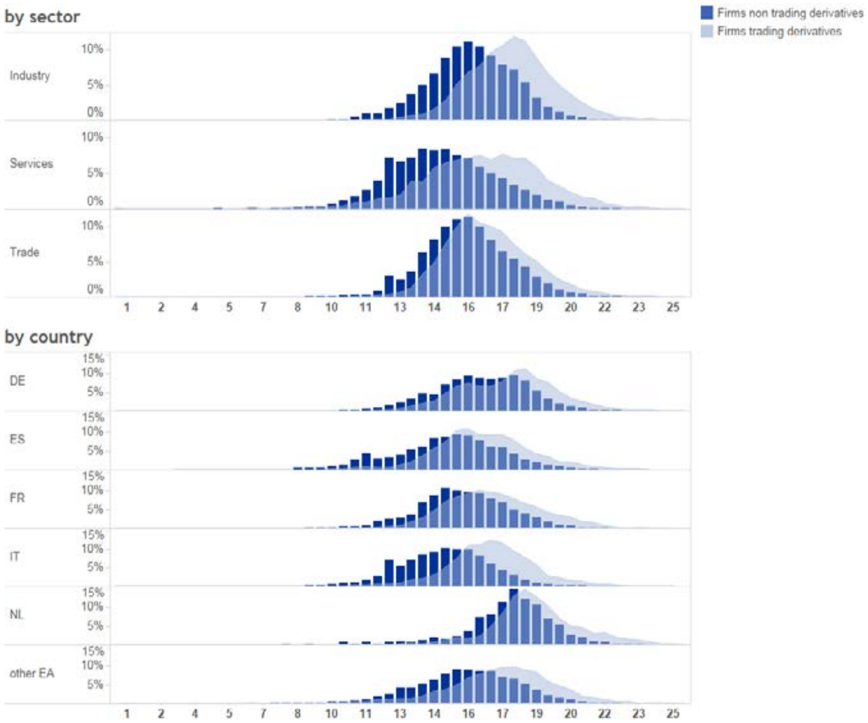
15 The two-sample Kolmogorov–Smirnov test is a common statistical test to determine whether the underlying probability distributions of two functions are statistically different (Massey, Frank J. 1951).

Figure 6. Distribution of firms by total assets (natural log), breakdown by sector and country



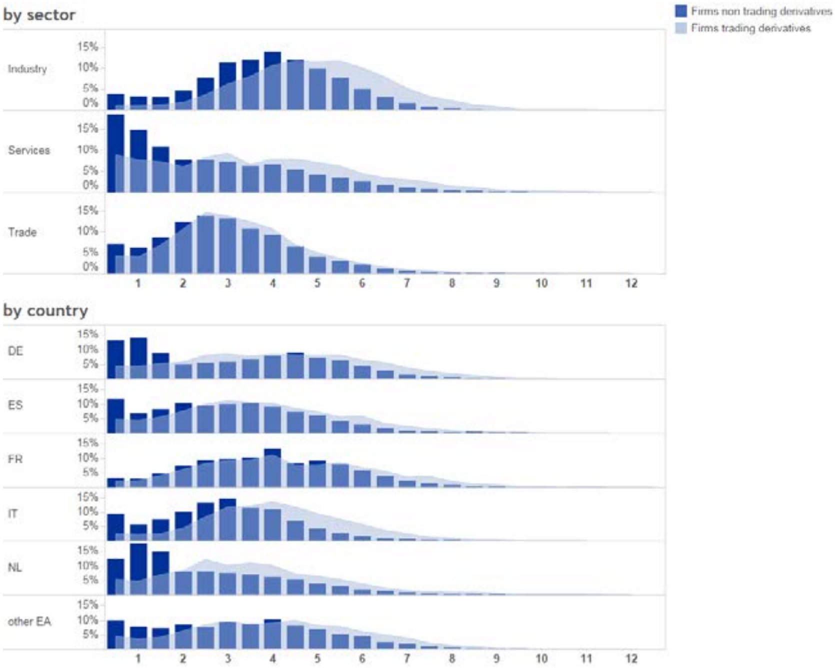
Sources: calculations based on EMIR and Orbis Europe data.

Figure 7. Distribution of firms by turnover (natural log), breakdown by sector and country



Sources: calculations based on EMIR and Orbis Europe data.

Figure 8. Distribution of firms by number of employees (natural log), breakdown by sector and country



Sources: calculations based on EMIR and Orbis Europe data.

Therefore, descriptive statistics suggest that in general the scale of the firm is a relevant factor among those determining the euro area NFCs usage of the derivatives market.

In the following section we will thus clean the analysis from the firm size effect on derivative usage and study the impact of other financial characteristics using a probability regression models. We first use a logit regression (i.e on a dichotomous dependent variable which identifies firms trading derivatives versus non-trading firms) to determine the financial characteristics of NFCs trading derivatives against those not participating in this market. We later use a multinomial logit regression (i.e. a probability model on a categorical variable which identifies the 5 types of assets underlying the reported transactions) to determine the financial characteristics influencing preferences of firms for different types of underlying asset classes.

4.4. One step further in the analysis of the characteristics of firms trading derivatives

As the demographic analysis above demonstrates and as suggested by large part of the literature on this topic, the larger the firm, the more likely it is to trade derivative contracts. To prove this concept further we analyse which is the probability of trading derivatives for firms belonging to each of the size classes described above when compared to micro firms, controlling for the country and the sector they belong to. The estimation in Table 3 proves indeed the size[16] to be significantly important and positively correlated with the probability of a firm trading derivatives contracts.

Table 3. Logit regression results – country, sector and size class

Variables	**Trading odds ratio**
Small	1.604***
	(0.0372)
Medium	2.256***
	(0.0539)
Large	4.831***
	(0.124)
Country dummies	***
Sector dummy	***
Constant	0.0284***
	(0.00254)
Observations	106,908
Pseudo R-squared	0.123

SEs in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Sources: calculations based on EMIR and Orbis Europe data.

The estimated model, however, also highlights how country and sector dummies are still strongly significant and suggests us to further investigate whether the model can be improved by adding other variables in our logit regression.

Based on data availability, we look then at a set of financial indicators suggested by the literature analysed above which could provide us with further explanations. In particular, we focus on leverage and debt maturity, liquidity, solvency, profitability, capital/R&D investments and exports.

[16] The probabilistic models reported below report contributions from variables in the format of odds ratios. An odds ratio higher than 1 determines the positive contribution of an independent variable on the outcome variable. An odds ratio lower than 1 determines the negative contribution of an independent variable on the outcome variable

Table 4. Logit regression results – financial indicators

Variables	Trading odds ratio
Small	1.568***
Medium	2.058***
Large	4.205***
Country dummies	2.083***
Sector dummies	7.987***
Leverage and debt maturity	
debtequityratio	1.000
liabilitiesassetratio	1.000
ltdebteqratio	1.000
ltdebttotalassetsratio	0.439***
Liquidity	
currentratio	1.000
liquidityratio	0.996***
Solvency	
solvencyratio	1.003***
Profitability	
ebitdamargin	0.990***
ebitmargin	1.003***
profitmargin	1.008***
Capital/R&D investments	
capexpendituresturnoverratio	1.000
randdexpensesturnoverratio	0.534
capexpendituressalesratio	1.000
randdexpensessalesratio	1.105
marketbookratio	0.992
ntangbookratio	1.000
Exports	
exportrevenueratio	1.929***
Constant	0.0289***
Observations	106,908
Pseudo R-squared	0.135

*** p<0.01, ** p<0.05, * p<0.1

Sources: calculations based on EMIR and Orbis Europe data.

As shown in Table 4, the probability of trading derivatives is now strongly related not only to the size of the company, its sector or where it is located but also by its main financial indicators. In particular, the solvency ratio, the long-term-debt-to-asset ratio, the export-revenue ratio and the profitability ratios seem to be the most significant drivers.

The results seem to suggest that high-exporting firms and those with shorter debt maturity are the more likely to trade derivatives in the sample analysed. This finding is in line with our demographic analysis which highlighted how firms in this sample are using for a vast majority currency forwards which are common in the trading sectors. Moreover, even though less significant, the impact of the solvency ratio and liquidity ratio is in line with the literature suggesting that firms which are financially stable firms[17] but at the same time also less-liquid firms[18] are the main actors on the derivative markets. With respect to profitability instead, we find significant but diverging results depending on the ratios used: if we consider profits including those coming from financial activities (i.e. profit margin) these show a positive sign as such activities are typically more relevant for larger firms. On the other hand, if we focus solely on operating profits (i.e. the ebitda margin) then we find that less profitable firms are more likely to use derivatives as suggested by the literature on financial distress.

Once defined the characteristics of firms trading derivatives against those non-trading, we decided to investigate whether there are differences among trading firms in the choice of the asset class of the financial contract.

From our demographic analysis in the paragraphs above we could already identify an intense concentration of firms on the trading of forward contracts with currency as the underlying asset. Therefore, in order to obtain results easy to interpret we use currency contracts as benchmark to run a multinomial logistic regression (Table 5).

[17] Among others, Berkman and Bradbury (1996), Borokhovich et al. (2004), Carroll et el (2017), Fok et al. (1997), Geczy et al. (1997), Graham and Rogers (2002), Guay (1999), Judge (2006) Lel (2012), Lin and Smith (2007), Mian (1996), Nance et al. (1993), Rogers, (2002).

[18] Among others, Ang et al. (1982), Nance et al. (1993), Smith and Stulz (1985), Warner (1977).

Table 5. Multinomial logit regression results – asset classes

Variables	COMM odds ratio	CRD odds ratio	CURR odds ratio	EQUI odds ratio	INTR odds ratio
Small	0.805*	1.375		0.243***	0.925
Medium	1.590***	14.35**		0.180***	1.044
Large	3.865***	17.31**		0.433***	0.883
Country dummies	*	*		*	*
Sector dummies	*	*		*	*
solvencyratio	1.000	0.999		0.995***	1.000
ltdebttotalassetsratio	1.615***	0.518		1.628**	7.049***
exportrevenueratio	0.294***	0.359		0.320**	0.237***
ebitdamargin	0.996	0.997		1.002	1.027***
ebitmargin	0.996	1.032**		0.997	0.996
profitmargin	0.994**	0.968**		1.004	0.995**
liquidityratio	1.001	0.991		1.030***	0.988**
Constant	0.203***	0		0.0720**	0.391***
Observations	19,562	19,562	19,562	19,562	19,562
Pseudo R-squared	0.205	0.205	0.205	0.205	0.205

*** p<0.01, ** <0.05, * p<0.1

Sources: calculations based on EMIR and Orbis Europe data.

The results allow us to draw the following "identikit":

- Currency derivatives are strongly exchanged by the most exporting firms, with a lower long term debt and with higher profit margins.
- Commodity derivatives are more likely to be traded by large, relatively less exporting and less profitable firms.
- Credit derivatives are generally traded by the same type of firms trading currency derivatives, with the difference that credit derivative trading firms are generally much bigger.
- Equity derivatives are generally traded by firms which are less solvent but more liquid and significantly smaller than those trading currency derivatives.
- Interest rate derivatives are generally traded by more indebted and less liquid firms.

The effects of country and sector dummies are often significant and further analysis should be done on the differences arising across these categories but in this paper we want to keep them as control variables and focus our analysis on financial ratios.

These results, although statistically significant, might be driven by the limited temporal window of available data we are looking at and might therefore not take into account the seasonality of derivative markets. Moreover, the high percentage of missing values among the reported asset classes and the bias towards currency derivatives in the sample might also hide different data dynamics. However, such first identification of predominant characteristics of trading firms and how these vary by type of traded product can add value to the existing literature which so far did not have such a wide database available.

5. Conclusions

The study we carried on is a first analysis of a novel dataset obtained by merging the EMIR data with Orbis Europe. After analysing the literature on the use of derivatives by non-financial corporations, we describe the first findings obtained by looking at the descriptive statistics on demographic variables such as country, sector and size of the entity. These suggest, in line with the research already carried out in this field, that size matters when trading derivatives. We then take a look more in depth into which are the financial ratios described by the literature as having higher impact on the probability of trading derivatives and we discover that the high export ratios and low long-term-debt ratios strongly characterise firms trading derivatives, in line with the fact that the most traded derivatives in our sample are currency forwards.

Last but not least, we go further trying to identify differences in the characteristics of the firms trading derivatives across different types of asset classes and we introduce a novel identikit of financial ratios which makes more likely for a non-financial corporation to be trading a specific type of derivative contract.

References

Ang, J.S., J.H. Chua, and J.J. McConnell (1982). The Administrative Costs of Bankruptcy: A Note. *Journal of Finance* (March), 219-226.

Ascolese M., Molino A., Skrzypczynski G., Cerniauskas J. and Pérez-Duarte S. (2017). Euro-area derivatives markets: structure, dynamics and challenges. IFC-National

Bank of Belgium Workshop on "Data needs and Statistics compilation for macroprudential analysis". Brussels, Belgium, 18-19 May 2017.

Bartram, S. M., Brown, G. W. and Waller, W. (2015). How important is financial risk? *Journal of Financial and Quantitative Analysis* 50, 801–24.

Bartram, S. M., Brown, G. W., and F. R. Fehle, F. R. (2009). International Evidence on Financial Derivatives Usage. *Financial Management* 38, 185-206.

Berkman, H. and Bradbury, M. E. (1996). Empirical evidence on the corporate use of derivatives. *Financial Management* 25, 5–13.

Bessemembinder, H. (1991). Forward Contracts and Firm Value: Investment Incentive and Contracting Effects. *Journal of Financial and Quantitative Analysis* 26, 519-532.

Bodnar, G. M. and Gebhardt, G. (1999). Derivative usage in risk management by US and German nonfinancial firms: A comparative survey. *Journal of International Financial Management and Accounting* 10, 153–87.

Bodnar, G. M., Consolandi, C., Gabbi, G. and Jaiswal-Dale, A. (2013). Risk management for Italian nonfinancial firms: Currency and interest rate exposure. *European Financial Management* 19, 887–910.

Borokhovich, K. A., Brunarski, K. R., Crutchley, C. E. and Simkins, B. J. (2004). Board composition and corporate use of interest rate derivatives. *Journal of Financial Research* 27, 199–216.

Carroll A., O'Brien F. and Ryan J. (2017). An Examination of European Firms' Derivatives Usage: The Importance of Model Selection. *European Financial Management*, 23(4), 648–690.

De Ceuster, M. J. K., Durinck, E., Laveren, E. and Lodewyckx, J. (2000). A survey into the use of derivatives by large non-financial firms operating in Belgium. *European Financial Management* 6, 301–18.

DeMarzo, Peter and Duffie, Darrell (1991). Corporate financial hedging with proprietary information. *Journal of Economic Theory* 53(2), 261-286.

Fok, R. C. W., Carroll, C. and Chiou, M. C., (1997). Determinants of corporate hedging and derivatives: A Revisit. *Journal of Economics and Business* 49, 569–85.

Froot, K.A., D.S. Scharfstein, and J.C. Stein (1993). RiskManagement: Coordinating Corporate Investment and Financing Policies. *Journal of Finance* 48, 1629-1658.

Geczy, C., B.A. Minton, and C. Schrand (1997). Why Firms Use Currency Derivatives. *Journal of Finance* 52, 1323-1354.

Graham, J.R. and C.W. Smith Jr. (1999). Tax Incentives to Hedge. *Journal of Finance* 54, 2241-2263.

Graham, J.R. and D.A. Rogers (2002). Do Firms Hedge In Response to Tax Incentives? *Journal of Finance* 57, 815-840.

Guay, W. (1999). The impact of derivatives on firm risk: An empirical examination of new derivative users. *Journal of Accounting and Economics* 26, 319–51.

Jankensgård, H. (2015). Does centralisation of FX derivative usage impact firm value? *European Financial Management* 21, 309–32.

Judge, A. (2006). Why and how UK firms hedge. *European Financial Management* 12, 407–41.

Lel, U. (2012). Currency hedging and corporate governance: A cross-country analysis. *Journal of Corporate Finance* 18, 221–37.

Lin, C. M. and Smith, S. D. (2007). Hedging, financing and investment decisions: A simultaneous equations framework. *Financial Review* 42, 191–209.

Mayers, D. and C.W. Smith Jr. (1982). On the Corporate Demand for Insurance. *Journal of Business* 55, 281-296.

Mian, S. L. (1996). Evidence on corporate hedging policy. *Journal of Financial and Quantitative Analysis* 31, 419–39.

Myers, S.C. (1984). The Capital Structure Puzzle. *Journal of Finance* 39, 575-592.

Nance, D. R., Smith, C. W. and Smithson, C. W. (1993). On the determinants of corporate hedging. *The Journal of Finance* 48, 267–84.

Nguyen, H. V. (2011). Why do Non-Financial Firms Select One Type of Derivatives Over Others. *Journal of Applied Business and Economics* 12(3), 91-109.

Rogers, D. A. (2002). Does executive portfolio structure affect risk management? CEO risk-taking incentives and corporate derivatives usage. *Journal of Banking and Finance* 26, 271–95.

Shapiro, A.C. and S. Titman (1986). An Integrated Approach to Corporate Risk Management, in J.M. Stern and D.H. Chew Jr., Eds., *The Revolution in Corporate Finance*, New York, Basil Blackwell, 215-229.

Smith, C.W. and R.M. Stulz (1985). The Determinants of Firms' Hedging Policies. *Journal of Financial and Quantitative Analysis* 20, 391-405.

Stulz, R.M. (1984). Optimal Hedging Policies. *Journal of Financial and Quantitative Analysis* 19, 127-140.

Tufano, P. (1996). Who manages risk? An empirical examination of risk management practices in the gold mining industry. *The Journal of Finance* 51, 1097–137.

Warner, J. (1977). Bankruptcy Costs: Some Evidence. *Journal of Finance* (May), 337-348.

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BANK FOR INTERNATIONAL SETTLEMENTS

Ninth IFC Conference on "Are post-crisis statistical initiatives completed?"

Basel, 30-31 August 2018

An insight into the derivatives trading of firms in the euro area[1]

Nicola Benatti and Francesco Napolitano,
European Central Bank

[1] This presentation was prepared for the meeting. The views expressed are those of the authors and do not necessarily reflect the views of the BIS, the IFC or the central banks and other institutions represented at the meeting.

EUROPEAN CENTRAL BANK

EUROSYSTEM

Nicola Benatti
Francesco Napolitano

DG-Statistics, European Central Bank

An insight into the derivatives trading of firms in the euro area

9th IFC Conference on

Are post-crisis statistical initiatives completed?

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Overview

Why do firms decide to use financial derivatives?

Hedging against cash flow volatility by increasing "debt capacity" in a context of imperfect capital markets

Common cases in the literature:

- Reducing risk of financial distress[1]
- Reducing expected value of tax liabilities[2]
- Financing investment plans[3]

Our contribution:

- ➢ Exploratory analysis of EMIR transaction-level data on derivatives traded by NFCs focusing on euro area countries
- ➢ Research questions: *Does firm size matter? Which types of firms use derivatives? Which firms prefer which types of derivatives?*

[1] Mayers and Smith, 1982; Myers, 1984; Stulz, 1984; Smith and Stulz, 1985; Shapiro and Titman, 1998
[2] Smith and Stulz, 1985; Nance et al., 1993; Graham and Smith, 1999; Graham and Rogers, 2002
[3] Bessembinder, 1991, Froot et al., 1993

Data sources

Orbis Europe balance sheet data

- Firm-level data on annual balance sheets and other financial information
- Commercial data provider (Bureau van Dijk) collecting data from national offices in charge of collecting annual accounts in the respective country.
- About 86 million European firms. Data coverage varies across countries.

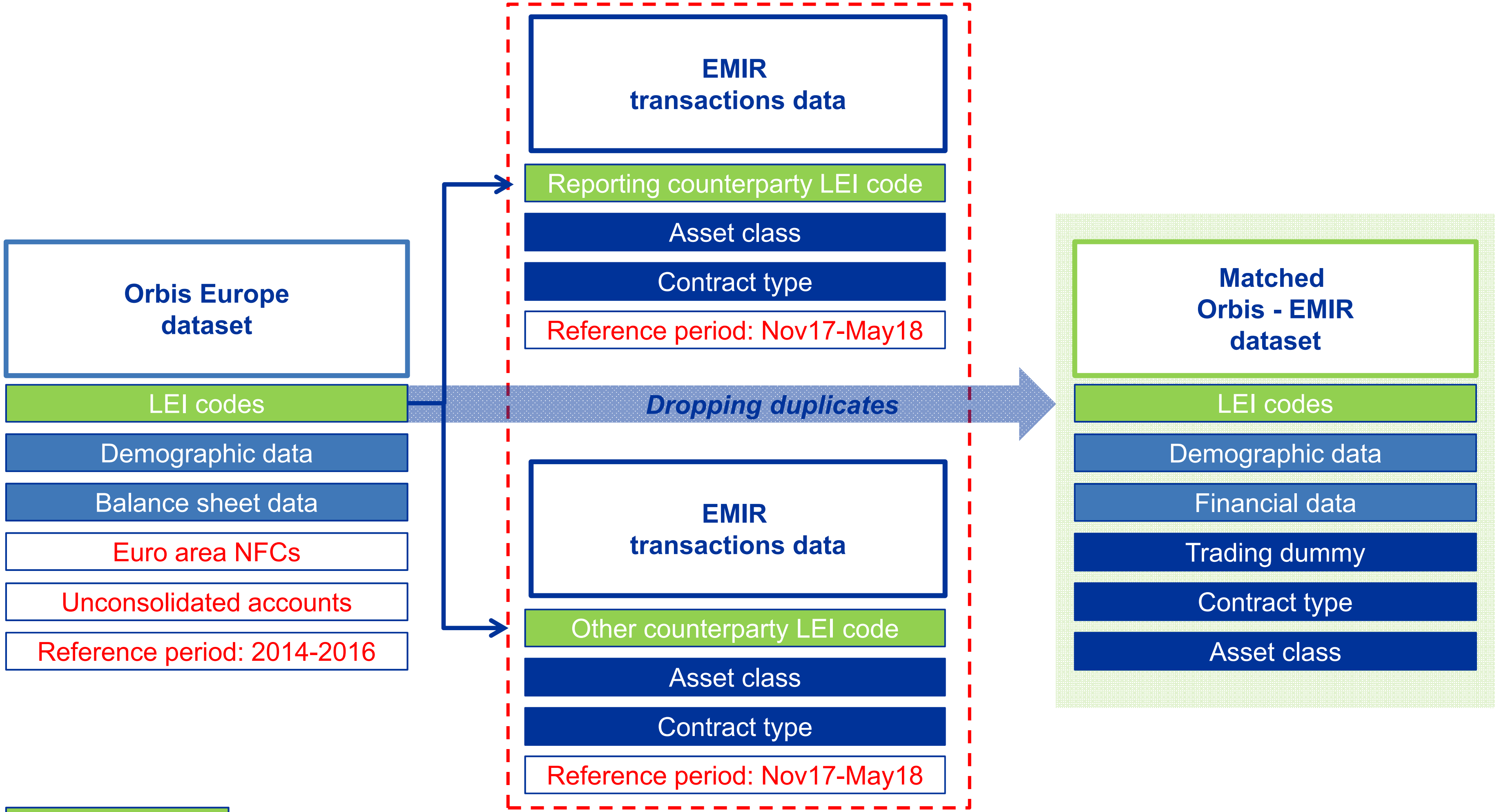
EMIR data

- Transaction-level derivatives data for all counterparties established in the euro area and all contracts where the reference entity is located within the euro area or where the reference obligation is sovereign debt of a euro area member.
- Collected by six Trade Repositories (TRs) under the European Market Infrastructure Regulation (EMIR) since February 2014 and shared with 60 competent authorities (including the ECB).
- All contract types (OTC and ETD) and instrument classes (equity, credit, interest rates, commodities, foreign exchanges).
- More than 120 reporting fields.
- “Double reporting regime” ensuring validation and consistency controls but standardisation problems (i.e. the lack of a global trade ID) generate data reconciliation issues.

Focus of the analysis

- ➢ EMIR data collected as of November 2017 (in compliance with the latest regulatory standards).
- ➢ Orbis data for firms identifiable with an LEI
- ➢ Qualitative information on derivatives usage by NFCs (use/no use, contract type, asset class).
- ➢ Timing considerations: Orbis (2014-2016 reports) – EMIR (Nov17-May18 new transactions)

Matching EMIR and Orbis



Matching ID

Orbis variables

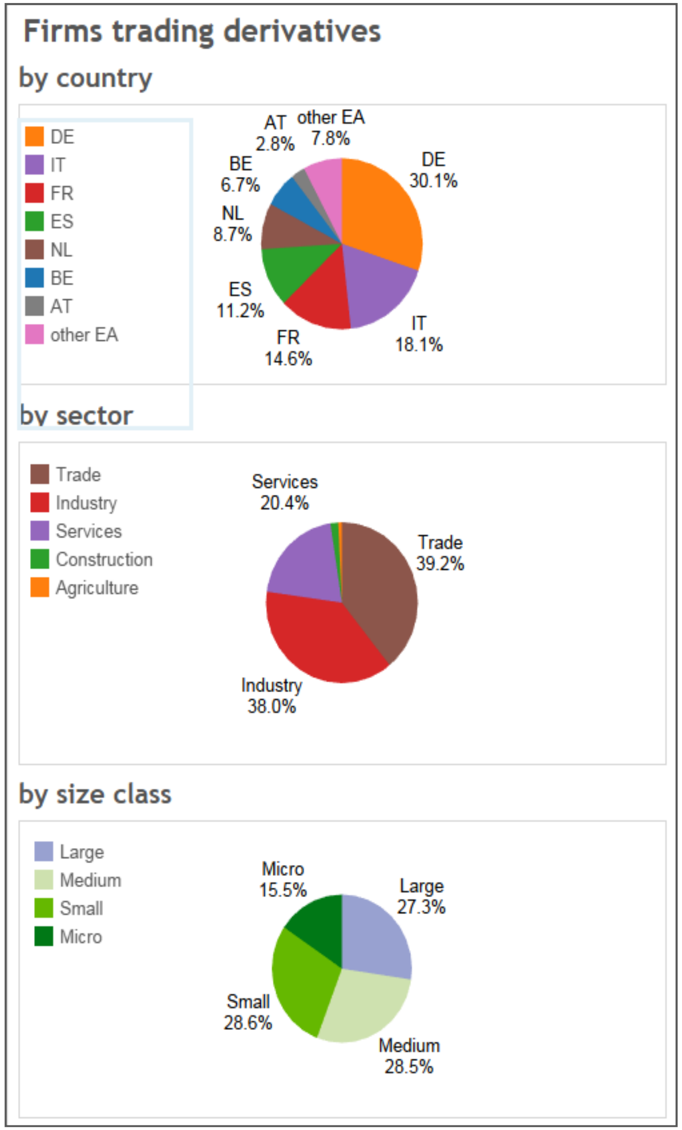
EMIR variables

Filters

56% *of euro area NFCs reported in EMIR can be matched with Orbis through the LEI code!*

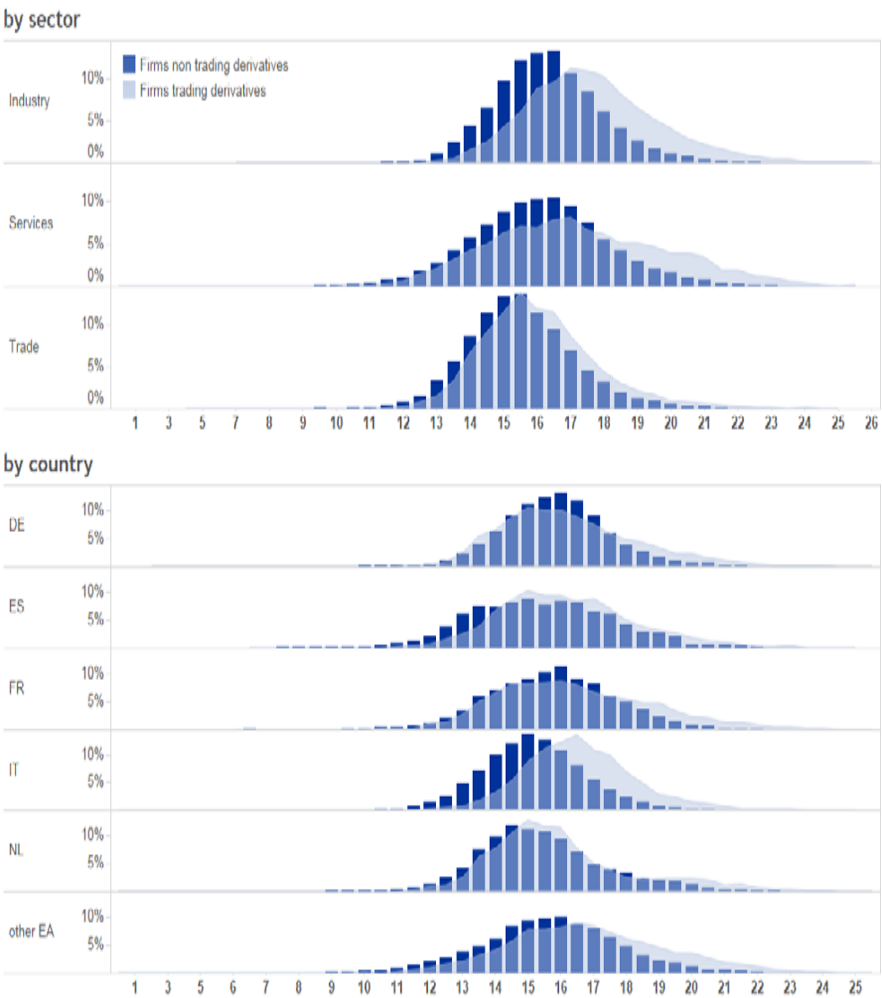
An insight into euro area NFCs trading derivatives

ECB-UNRESTRICTED

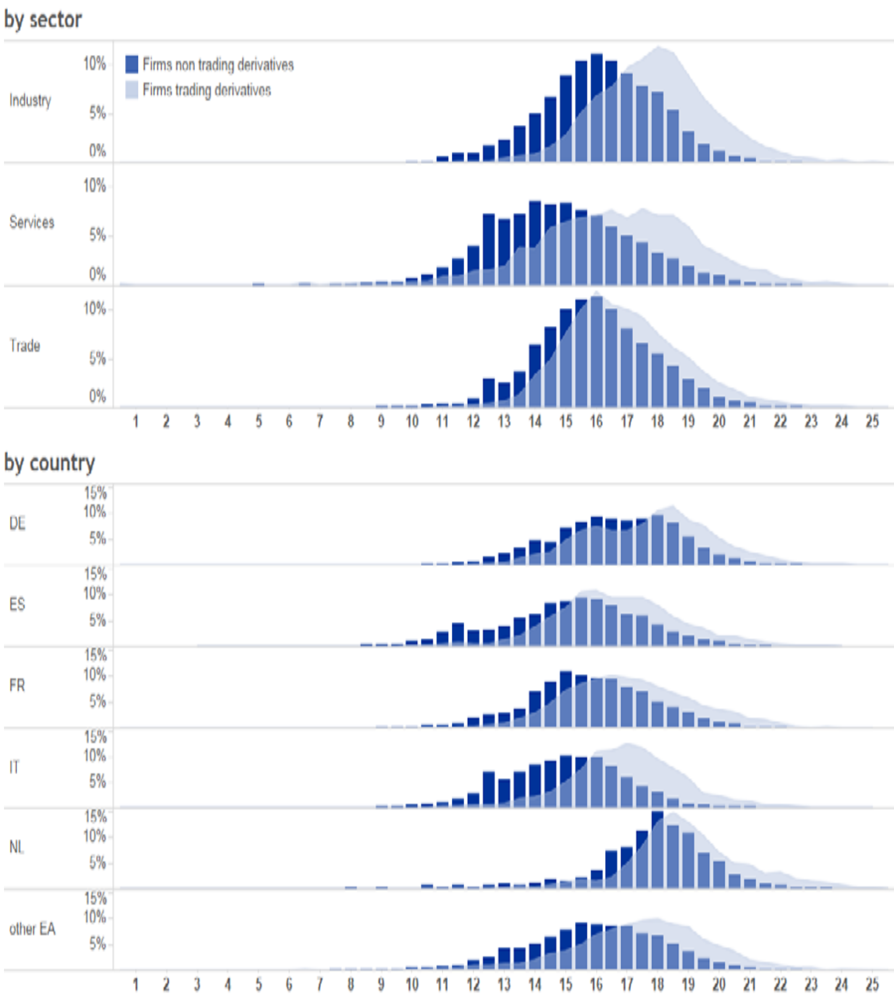


Firm size matters but the impact is different across countries and sectors

Total assets (natural log)



Turnover (natural log)



Variables	Trading odds ratio
Small	1.568***
Medium	2.058***
Large	4.205***
Country dummies	2.083***
Sector dummies	7.987***
Leverage and debt maturity	
debtequityratio	1.000
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Exports	
exportrevenueratio	1.929***
intangbookratio	1.000
Constant	0.0289***
Observations	106,908
Pseudo R-squared	0.135

*** p<0.01, ** p<0.05, * p<0.1

Moving beyond firm size…

- Export-oriented (majority of firms in the sample use currency forwards)
- Short-term debt maturity
- Financially stable but also less liquid firms
- Mixed results on profitability
- Country and sector characteristics play a significant role

Variables	COMM odds ratio	CRD odds ratio	CURR odds ratio	EQUI odds ratio	INTR odds ratio
Small	0.805*	1.375		0.243***	0.925
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ebitdamargin	0.996	0.997		1.002	1.027***
ebitmargin	0.996	1.032**		0.997	0.996
profitmargin	0.994**	0.968**		1.004	0.995**
liquidityratio	1.001	0.991		1.030***	0.988**
Constant	0.203***	0		0.0720**	0.391***
Observations	19,562	19,562	19,562	19,562	19,562
Pseudo R-squared	0.205	0.205	0.205	0.205	0.205

*** p<0.01, ** p<0.05, * p<0.1

…and looking at asset classes, we get the following profiles:

- Currency derivatives are strongly exchanged by the most exporting firms, with a lower long term debt and with higher profit margins.
- Commodity derivatives are more likely to be traded by large, relatively less exporting and less profitable firms.
- Credit derivatives are generally traded by the same type of firms trading currency derivatives, with the difference that credit derivative trading firms are generally much bigger.
- Equity derivatives are generally traded by firms which are less solvent but more liquid and significantly smaller than those trading currency derivatives.
- Interest rate derivatives are generally traded by more indebted and less liquid firms.

Conclusions

- First exploratory analysis of EMIR transaction-level data on derivatives traded by NFCs
- Demographic analysis suggests that firm size matters but differences exist across countries and sectors.
- Logit regression results confirm the role of firms size and suggest that high exports and lower long-term debt ratios are common characteristics of firms trading derivatives in our sample. Financially stable but less liquid firms also decide to use derivatives.
- We go further in trying to identify specific profiles of firms in relation to different types of derivatives.

Challenges and way forward:

- Enlarge the time coverage of the dataset.
- Go deeper in the analysis of NFCs' derivatives trading using quantitative information on number of contracts and notional amounts.
- Country and sector analysis.