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EMIR data to compile external statistics[1]

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[1] This contribution was prepared for the conference. The views expressed are those of the authors and do not necessarily reflect the views of the European Central Bank, the Bank of Spain, the BIS, the IFC or the other central banks and institutions represented at the event.

EMIR Data for external statistics

An analysis of the Austrian financial derivatives market using experimental data derived from EMIR

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Abstract

After the economic and financial crisis in 2008, it was identified that good and granular data on financial derivatives (especially OTC-derivatives) was needed for a better understanding of economic linkages and contagion risks. In the aftermath of the crisis the European Market Infrastructure Regulation (EMIR) was established and very granular data for financial derivatives are now available. Primarily, these data are collected for financial stability issues, but the experimental data derived from it could be used for other purposes e.g. statistical purposes in concrete external statistics. Especially for Austria a small and open economy, most derivatives contracts are concluded with foreign countries, therefore data of financial derivatives are of high interest for Balance of Payment compiler. In 2022, as the war in Ukraine began and energy prices rose, financial derivatives gained renewed importance, and data from all sectors of the economy, not only banks but also non-financial companies, were urgently needed.

The big advantage of EMIR data is, that it is granular data and therefore contains a lot of information that is lost in aggregated data reports. It is almost a complete survey without any thresholds and if the aggregation for the compilation of macroeconomic statistics is successful, a direct macro-micro linkage is available. The disadvantage of EMIR data is, that they are not collected for statistical purposes, the data are relatively unstructured, and the quality controls are different from those of a direct national collection for statistical purpose.

In this paper, we will first briefly describe the EMIR data source and then highlight its potential usefulness for the compilation of the financial account. We will provide a first analysis of the experimental data set of financial derivatives stocks for Austria derived from EMIR.

Keywords: financial account, financial derivatives, EMIR Data

JEL classification: C55, F40, G15

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Content

1. Introduction

The role of financial derivatives in the 2008 financial and economic crisis is undisputed; they were the key factor in the rapid contagion effects within the financial sector. One of the most important lessons from the crisis was that the risk of the system might be much higher as the sum of individual agent's risk: As the case in 2007 the contagion risk through derivatives was underestimated for the financial sector as a whole. Furthermore, the financial derivative market was unregulated, and few information was available for OTC traded derivatives.

Therefore, in the aftermath of the crisis increased attention was paid in regulation and data availability of financial derivatives. It became apparent that derivatives are important in many contexts: for the analysis of economic and financial markets, for monetary policy, for financial stability analysis as well as for prudential and macroprudential supervision and regulation. In order to cover all these issues reliable and complete data of financial derivatives are crucial.

Already in 2009 at the G20 summit in Pittsburgh it was decided that standardized OTC derivatives shall be centrally cleared, and OTC derivatives reported to the trade repositories.

In 2012 this G20 decision was implemented in the EU with the adoption of the European market infrastructure regulation (EMIR) which refers to the regulation on OTC derivatives, central counterparties and trade repositories. The aim of this regulation is to improve the stability and transparency of the financial system in the European Union. EMIR was introduced to reduce the risks associated with over the counter (OTC) derivatives and to increase transparency in the financial markets. One of the main requirements of EMIR is the reporting of derivatives transactions to a trade repository. This register collects and stores information on derivatives transactions to provide regulators with a better overview of the derivatives market. The report includes information such as the type and nature of the derivative, the value and notional, the maturity date, margin, and the counterparties involved.

The collected data provide the supervisory authorities with a comprehensive overview of the derivatives market in order to identify, monitor and control risks. By reporting derivatives transactions, the supervisory authorities may identify potential risks at an early stage and take appropriate measures to ensure the stability of the financial system. EMIR also aims at promoting the use of central counterparties (CCPs) to reduce the risk of derivatives transactions. CCPs act as intermediaries between trading parties and assume the risk of a transaction if one party becomes insolvent. The introduction of EMIR and the associated reporting obligations have increased transparency in the derivatives markets, leading to a better understanding of the risks and improved monitoring.

A new step in regulation was that, in addition to financial counterparties, non-financial counterparties are also affected by the reporting obligation under EMIR. Even though the introduction of EMIR Reporting primarily serves the purpose of monitoring derivative transactions it represents much more than a mere regulatory requirement. The data collected through EMIR on micro data base might be used also to compile macroeconomic statistics.

In Balance of Payments and Financial Accounts all financial transaction and non-transactions- related changes have to be compiled with splits regarding country, counterpart sector and type of transaction. A good coverage of derivative data is necessary for the complete presentation within the macroeconomic statistics.

The EMIR data source on micro-data level may significantly contribute to the improvement of the representation of financial derivatives in macroeconomic statistics. A direct macro to micro link can be established.

A restriction is that the data is not collected for statistical purpose and therefore it is a challenge to derive the required data, especially for transactions, which we are still working on. In addition, EMIR data can be classified as big data, which means that structuring and cleansing the data requires a relatively large amount of effort. The main critical issue is the data quality; the data do not pass through the standard data checks as implemented for reported data for external statistic purpose and especially queries to the reporting companies are not integrated in the quality process.

Thus, EMIR reporting appears not only as a regulatory obligation but as a comprehensive instrument that promotes transparency, improves the quality of data on financial derivatives, and could make a significant contribution to the compilation of macroeconomic statistics such as balance of payments.

In this paper we introduce the EMIR data source, we show how experimental data for balance of payment and financial account might be derived, we present and describe the data for Austria, and give an outlook for further potential use especially in evaluating the risk of the exposure.

2. Financial derivatives in macroeconomic statistics

Financial derivatives play an important role in all macroeconomic statistics such as in the quarterly financial accounts (QFA), the balance of payment (BoP), the international investment position (IIP) and the Banking Balance Sheet Item (BSI) and other monetary statistics. For a complete presentation stocks, transactions, price effects, currency effects and other changes of financial derivatives are needed. Furthermore, information about counterpart country and counterpart sector is required. The statistic definition of financial derivatives within external statistics is set in the IMF's Balance of Payment and International Investment Position Manual 6 (BPM6) in paragraph 5.8:

“A financial *derivative contract is a financial instrument that is linked to another specific financial instrument or indicator or commodity and through which specific financial risks (such as interest rate risk, foreign exchange risk, equity and commodity price risks, credit risk, and so on) can be traded in their own right in financial markets. Transactions and positions in financial derivatives are treated separately from the values of any underlying items to which they are linked*." The definition in the European System of Accounts 2010 (ESA 2010) paragraph 5.199 is consistent with the definition in the BPM6.

Thus, under financial derivatives very different form of contracts such as option, forwards, futures, swaps with different properties and different contractual arrangements are summarized.

3. Literature

In the following section we situate this article in the context of the recent literature. In ESMA 2023 provides a comprehensive overview of the European derivatives market. While they present a very detailed statistical overview of the development of the derivatives sector in the European Union, this article focuses on the identification of Austrian derivatives exposure with its counterparties as well as the measurement of the riskiness of these exposures. The contribution of this article is the application of a unique data set in terms of size and importance to the descriptive statistics of a financial network as well as identification of leverage risks associated with certain exposures. %, which could undermine the stability of the financial system.

Moreover, since this data is not utilized yet due to its recent introduction and limited access to the financial world, we show the potential by highlighting some important use cases. Pelkmans and Simoncini (2014) stressed already the importance of the ESMA data since it has the potential to end a remaining fragmentation of the single European financial market and to ensure a proper functioning of this market. Also, Tridimas (2012) analyzed the introduction of the ESMA framework. He focused on the powers and the accountability mechanisms of ESMA and examined its quasi-regulatory, decision-making and administrative powers and assesses and its likely impact on financial supervision in the EU.

In more recent studies, such as by Vuarlot-Dignac and Siracusa (2019), it is discussed how the introduction of the EMIR fills the gap of divergences in data collection for establishing a common supervisory culture across Europe. Payne (2017) and Berg (2015) stress the necessity of common institutional design of the EU economic and monetary union and the need of financial supervision and financial stability as a response to the financial crisis and the sovereign debt crisis.

In our study we show concrete applications of the unified data collection standard and the potential of data extraction for measuring derivatives exposure risk to bolster financial stability and to improve financial supervision on a cross-country level.

Flotynski (2015) provides a case study analysis by analyzing the impact of EMIR on the financial stability by looking at the derivative market crises in Poland and Brazil. He stresses the potential of regulations such as EMIR in preventing firms from huge losses on options settlement or alerting them from signing contracts for toxic derivatives. Pennesi (2021) discusses potential EU regulatory mechanisms to manage cross-border trade in financial services with third countries, as he argues that safeguards are ineffective in protecting the internal market from external risk. We show that by proper utilization of the EMIR data base, internal market structure can be reinforced to a degree to withstand greater external risk.

Hsiao (2018) puts EMIR into the context of tackling the shadow banking system through an enhanced market transparency and regulation of over-the-counter (OTC) derivatives. His analysis focuses on the reporting obligation to the trade repository and the clearance obligation of designated OTC derivatives through the central counterparty. He argues that while these two obligations can functionally transform shadow banking into a resilient market-based finance, the regulatory framework also creates an exchange platform that transforms the OTC derivative contracts into fungible securities. Balmer (2018) analyzes the post-crisis derivatives regulation reform by comparing the EU regulation in EMIR with that of Dodd-Frank in the United States and discusses the lack of an existing recovery and resolution framework. Another comparative analysis is done by Grossule (2020) who weighs risks and benefits of the increasing role of ESMA.

While most existing literature discusses mainly the framework and impact of EMIR, this article deals with the actual utilization and application of the data in derivative risk exposure identification.

In the field of application EMIR data to macroeconomic statistics the following two articles should be mentioned Boneva et alii (2019) and Keith Lai (2019). In Boneva et alii (2019) the authors give use cases for the data in the field of central banking and analysed in detail how to identify counterparty sector within EMIR. In Keith Lai (2019). a paper of the UK office for National Statistics the author did a comprehensive study of comparing the different UK data reports of financial derivatives with EMIR data and achieves similar results in the sense that EMIR data should be used additional to other data sources.

Our research aims at exploring the potential use of EMIR data as a source of a wide range of macroeconomic statistics, including balance of payments, financial accounts, and monetary statistics. In order to achieve this objective, we conduct an analysis to determine which EMIR reports are most suitable for this purpose. Subsequently, we extract the stocks and notionals of the financial derivatives from the EMIR data, including other important statistical information's. Additionally, we incorporate exchange rate adjustments and confidentiality checks to ensure the accuracy and reliability of the derived statistics.

This newly generated data set serves as a basis to perform descriptive statistics about country, sector, contract type, and asset class, as well as to perform corresponding risk assessment through calculation of derivative leverage risk.

4. EMIR reporting and data extraction

The EMIR data set contains the complete description of a derivative security which is necessary for identification. The conversion of EMIR Data into macroeconomic statistical data can be done through selection of the corresponding sections and extraction of the subset of interest. The Oesterreichische Nationalbank is currently working on achieving experimental data for financial derivatives in BoP and QFA based on EMIR data.

This study delves into the December 2022 reporting period, focusing on the macroeconomic statistics landscape. The analysis leverages data derived from all valid and non-terminated contracts reported within the EMIR framework with relevance to Austria (involving at least one Austrian counterparty), spanning the timeframe from January 1, 2021, to December 31, 2022. The comprehensive examination of this dataset forms the basis for our insights and conclusions.

4.1 Trade Activity Reports vs Trade State Reports

The EMIR data includes two types of reports, namely the Trade Activity Reports (TAR) and the Trade State Reports (TSR). The Activity reports contain detailed information on various contracts in the derivatives market and provide comprehensive information on specific trades, individual transactions, and other valuable information. They provide information about the counterparties, contracts, and trade specifications. In contrast, the State reports produced by trade repositories (TRs) summarize the daily intraday reports in a final version. They only contain the last action type, if reported on that day, and do not include all open contracts. The Activity reports contain the complete data of all derivative transactions, while the State reports reflect only the latest status of derivative contracts.

To determine which of the two reports is more suitable for statistical purposes, we calculate the stock of financial derivatives from the perspective of macroeconomic statistics (see chapter 4.3), such as balance of payments, financial accounts, and monetary statistics, from these two reports and compare it with the MFI financial derivatives data collected by the Oesterreichische Nationalbank (OeNB) as part of the balance of payments and monetary statistics. Contracts of the same type, asset class, and underlying can be compressed by market participants and central clearing counterparties at any time, significantly altering the ratio between assets and liabilities, hence we use the net stock of financial derivatives (assets - liabilities) for this comparison. For this purpose, we calculate the Root Mean Squared Error (RMSE) for all reported MFIs and all Austrian counterpart countries as follows:

$$RMSE_{Activity,State} = \frac{1}{n}\sqrt{\sum_{m \in MFI}\sum_{c \in Country}\left(S_{m,c}(BoP) - S_{m,c}\left(EMIR_{Activity,State}\right)\right)^2}$$

where n is the number of countries multiplied by the number of MFIs, and $S_{m,c}$ is the net stock of financial derivatives (balance of payments or calculated from EMIR data) for the corresponding MFI, m and country, c.

Our results indicate that the *RMSE* for the trade activity data is EUR 16.7 mln., which is significantly lower than the *RMSE* for the trade state data (EUR 52.3 mln). Therefore, we utilize in this study the data from the trade activity reports.

4.2 Time interval of the used historical data

Depending on the reporting type (EMIR action type), the Emir reports are sometimes missing information which is required for the collection of various macroeconomic statistics. This missing information can comprise data on the counterparties such as LEI, country, sector, as well as on traded contracts such as contract value, notional, strike price, multiplier, quantity, contract type, asset class, currencies, and position (long or short). To improve the accuracy of the results we rely on a more comprehensive historical time series of EMIR data. Given the large volume of EMIR data, we aim to establish a historical timeframe that allows for efficient data processing and significant results.

Our statistical analyses show that a historical time frame of 6 months, comprising the contract value and notional amount, is sufficient to obtain significant results. For all other relevant information, we use a time series of EMIR data over a period of 2 years. This extended time perspective ensures that the chosen data time frame for our macroeconomic analyses is sufficient and reliable.

4.3 Calculation of stocks and notional value from EMIR Data

To determine the stocks of financial derivatives from the EMIR data, we take the last reported contract value for all valid and unexpired contracts. If both counterparties report on the same day, the Austrian reporters have priority.

If no reported contract value is available for a contract within this 6-month period, we calculate the price of this contract using Monte Carlo simulations based on the fair value principle and the assumption of risk neutrality. This calculation assumes that all required data, such as underlying asset time series, risk-free interest rate, strike price, and maturity, are accessible. We proceed as follows:

First, we simulate the price of the underlying asset at a point in time *t* for interest rate contracts using a Cox-Ingersoll-Ross model (CIR).

$$S_t = E_t^* \left[exp\left(-\int_t^{t+T} r_u du \right) \right]$$

with interest rate *r*

$$dr_t = \alpha(\mu - r_t)dt + \sigma\sqrt{r_t}\, dW_t, \alpha, \mu, \sigma > 0, r \geq 0$$

where W_t is a standard Brownian motion at time *t*, α is the speed of adjustment, μ is the long-term average rate (the mean-reverting level) and $\sigma\sqrt{r_t}$ is the implied volatility at time *t*, *T* is the maturity of the contract and E_t^* denotes expectation under the risk-neutral probability measure at time *t*.

Next, we simulate the price of the underlying at time *t* for other contracts with other asset classes, such as indices or commodities, using a Geometric Brownian Motion.

$$\frac{dS_t}{S_t} = \mu dt + \sqrt{\sigma} dW_t$$

Where σ is the volatility of the underlying and μ is the average inflation rate of the seller's country over the last 5 years for commodity contracts and the risk-free interest rate of the currency in which the contract is quoted for other contracts.

Avdiu and Unger (2014) showed that the long-term risk-neutral measure of commodities, especially fuels can be replaced by the inflation rate since option valuation reflects more accurate expected price developments than when using interest rates.

Finally, we obtain the share price at time *t* with maturity T from the discounted expected value of the payoff:

$$Unconditional\ contracts: Stock(t) = E[S_T - K] * e^{-r_t*(T-t)}$$

$$Call\ options: Stock(t) = E[max(S_T - K)] * e^{-r_t*(T-t)}$$

$$Put\ options: Stock(t) = E[max(K - S_T)] * e^{-r_t*(T-t)}$$

where E is the risk-neutral expected value, K denotes the strike price of the contract, and S_T the price of the underlying at maturity T.

To avoid negative stocks, we categorize all contracts with a positive contract value from the perspective of the Austrian counterparties as assets, while all contracts with a negative contract value are classified as liabilities. This classification method clearly distinguishes the breakdown of financial derivatives from other functional categories of the balance of payments.

To derive the notional values from the EMIR data we take the last reported notional value for all valid and unexpired contracts, where Austrian reporters are prioritized. For unspecified notional values we multiply the strike price, the multiplier and the quantity of the contract.

4.4 Incorporation of additional data relevant for macroeconomic statistics

All additional relevant contract information such as counterparty, country, sector, buyer, seller, contract type, asset class, underlying, currencies, price, strike, multiplier, quantity, etc. is retrieved systematically from the OeNB's comprehensive EMIR and master database and stored separately. This data is then combined with contract values and nominal values for each contract and subjected to the necessary adjustments.

4.5 Exchange rate adjustment

All contract and notional values which are not denominated in EUR are converted with the exchange rates as of December 31, 2022, taken from the OENB's database. We observed that interest rate contracts in different currencies and currency contracts were partially incorrectly reported. This caused obvious outliers which we detected with an ARIMA outlier test.

4.6 Confidentiality

EMIR and other statistical regulations explicitly require strict confidentiality for EMIR data. To comply with these regulations, we conduct a thorough review of all data based on two main criteria: Firstly, evaluating the dominance of each specific aggregate and secondly, evaluating the number of counterparties involved in the aggregate's composition. We define a counterparty as dominant if the total value of the aggregate stock composition, reported by this counterparty, exceeds 85\%. The number of counterparties to be evaluated has to be at least three. If these two criteria are satisfied, we classify the aggregate as free, otherwise as confidential.

4.7 Summary statistics

In this study, we utilized around 190 million reports from EMIR data. As of December 31, 2022, a total of 2.469 Austrian counterparties were involved in financial derivative transactions with 3,658 foreign counterparts across 54 countries. Together, they held 13,809 open financial derivatives contracts, spanning 63 different currencies.

Out of the 13,809 open contracts, roughly 5% of the contract value were determined through the application of a financial mathematical model, while around 2% of the notional value were calculated using multiplication. For approximately 8% of the contracts, we couldn't ascertain the contract value, and for about 4% of the contracts we couldn't obtain a notional value.

The assets on financial derivatives held by Austrian market participants in relation to other countries, as determined from the EMIR data, reached at the end of 2022 a total of EUR 41.7 bln, while their corresponding liabilities amounted to EUR 42.5 bln. By the end of 2022, Austrian market participants themselves had a cumulative total of EUR 8.5 bln in outstanding assets and liabilities in financial derivatives.

Austrian market participants were most significantly engaged in financial derivatives contracts with Germany, holding 1,864 contracts, followed by France and the UK, with 1,015 and 594 open contracts, respectively. Within their domestic network, Austrian market participants collectively held 8,162 contracts. Overall, 209 contracts could not be allocated to a specific country, which accounts for around 0.9% of total volume of assets and 0.5% of total volume of liabilities.

At the end of 2022, Austrian market participants were most actively trading swaps, totaling 3,675 contracts, followed by forwards at 3,483, and options at 2,065. The primary asset classes in their trades with financial derivatives were currencies, accounting for 5,637 open contracts, and interest rates with 4,574 contracts. We couldn't determine the specific contract type for 3,067 contracts, which constitutes approximately 17% of the total volume of the portfolio. Similarly, 2,298 contracts within various asset classes could not be identified, representing around 9% of the total volume of the portfolio.

5. Methodology

We extract relevant data to provide a descriptive statistic about the financial derivatives exposure from the Austrian perspective. This includes the name and information of the counterparts involved in the transaction, ID number, contract type, asset class, value of the contract, notional, and settlement type and date of every derivative security as of December 31, 2022.

To provide a descriptive statistic of Austrian sector exposures with other countries, we compare Austria's Monetary Financial Institutions (MFIs), Non-MFIs, Non-financial corporations, Households and Government derivative exposure with the countries which exhibit the biggest Austrian derivative exposure. We identify seven countries: Germany, France, Netherlands, Great Britain, Ireland, Hungary, and Czech Republic.

In a second step we analyze the riskiness associated with the different derivatives exposures. We utilize the stock and notional data to measure the riskiness of the exposure, caused by volatility in the generated profit and loss data to measure the riskiness of the exposure, caused by volatility in the generated profit and loss.

6. Results

First, we provide an overview of the distribution of each sector's assets and liabilities between Austria and the corresponding country. We start by providing the results for the descriptive statistics on the sectoral derivatives exposure towards each country.

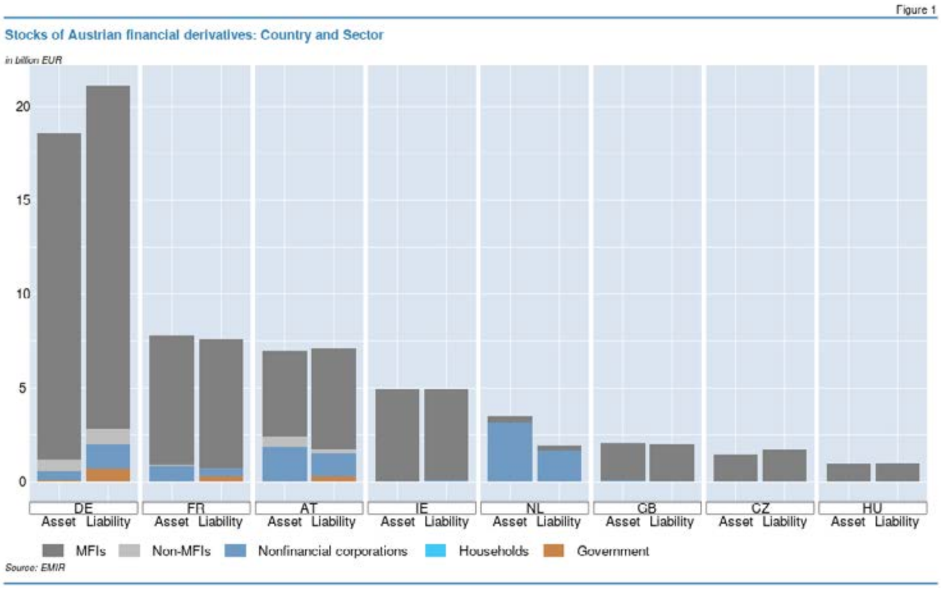
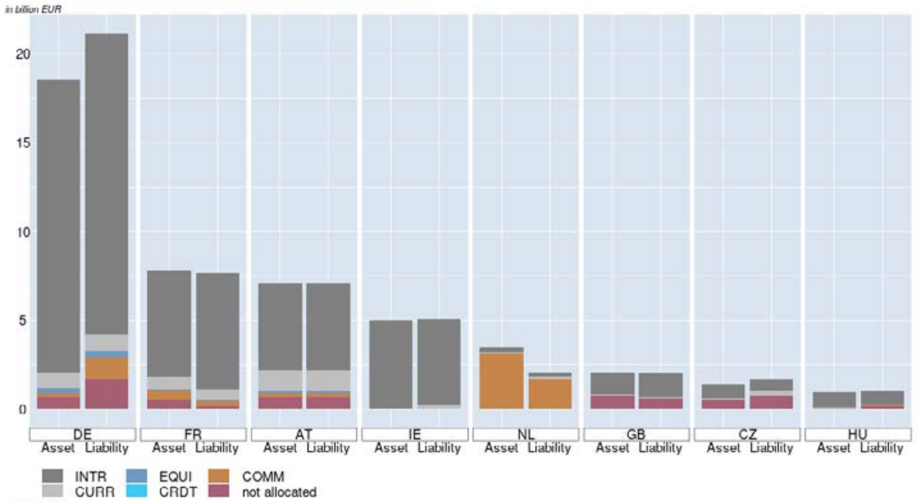


Figure 1 shows that Austria's main derivative exposure is towards Germany, followed by France and Ireland. The balance of stocks between assets and liabilities displays the profit or loss generated across all derivative instruments as of Dec 31, 2022. In case of the Austria's exposure towards Germany we can see that the liabilities exceed the assets while the net stocks with the other counterparts are more balanced. Further, we can see that the main contributor towards the assets and liabilities are for most countries Monetary Financial Institutions (MFI), except the Netherlands where we can see that the predominant exposure is held by non-financial corporations. Thus, banks and other financial institutions exhibit the highest exposure while the exposure of the Government and the Household sector is neglectable.

Figure 2

Stocks of Austrian financial derivatives: Country und Asset Class

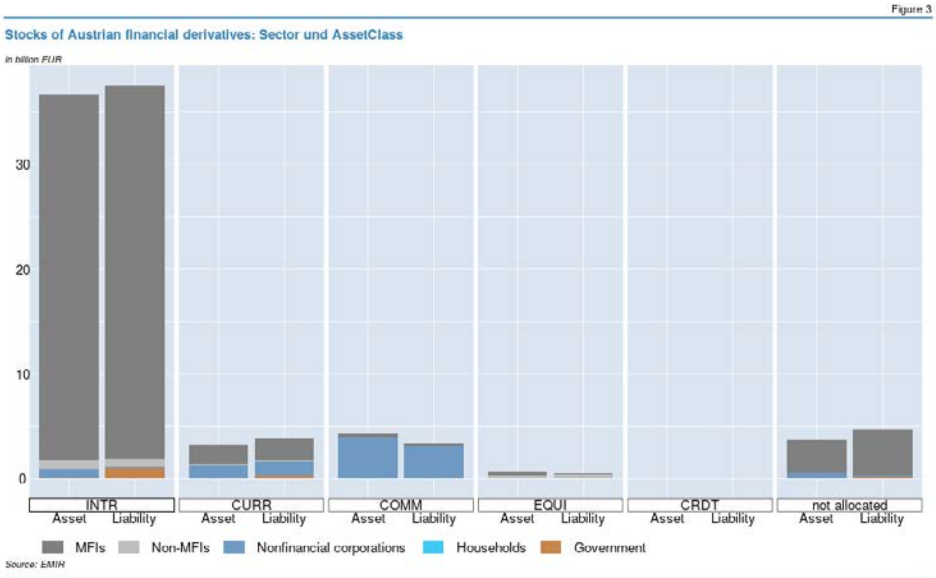


Source: EMIR

The distribution of financial derivative types across the eight countries is shown in figure 2. We can see that the main types of financial derivatives with an open balance are interest rate derivatives (INTR), followed by currency derivatives (CURR). The main exposure in interest rate derivatives is towards Germany, where the liabilities in size of EUR 22 billion exceed the assets of EUR 18 billion. Thus, it can be concluded that the total MFI liability against Germany stems from the negative balance in interest rate derivatives. The second interesting observation is that the main asset class which is being traded between Austria and Netherlands is commodity (COMM). In general commodity involves derivatives such as electricity, oil, natural gas, precious and non-precious metals, carbon emissions, no reason exotic derivatives, inter energy, grains and oil seeds and soft agricultural products.

In relation to the other countries, commodity derivative assets of size EUR 4 billion exceed the liabilities of EUR 3 billion by most, while all other derivative exposures per asset class are rather balanced.

Taking into account the insights gained from figure 1 we can see in combination with figure 2 that the main exposure of MFIs and Non-MFIs is mostly held in interest rate and currency derivatives, while non-financials hold their exposure mostly in commodity derivatives. Equity derivatives (EQUI) and credit derivatives (CRDT) are of minor importance.



We can see in figure 3 how Austria's global sector exposure is distributed across all the different asset classes. On a global level we can further see that the financial derivatives exposure is still dominated by interest rate derivatives, where the liabilities of EUR 37 billion exceed the assets of EUR 36 billion. These interest rate derivatives positions are mostly held by MFIs. The other notable finding is that the commodity exposure is mostly held by non-financial corporations, such as commodity exploration and trading firms. The exposure of the commodities is of the same size as the currency exposure, where MFIs and Non-financial corporations have slightly higher liabilities than assets.

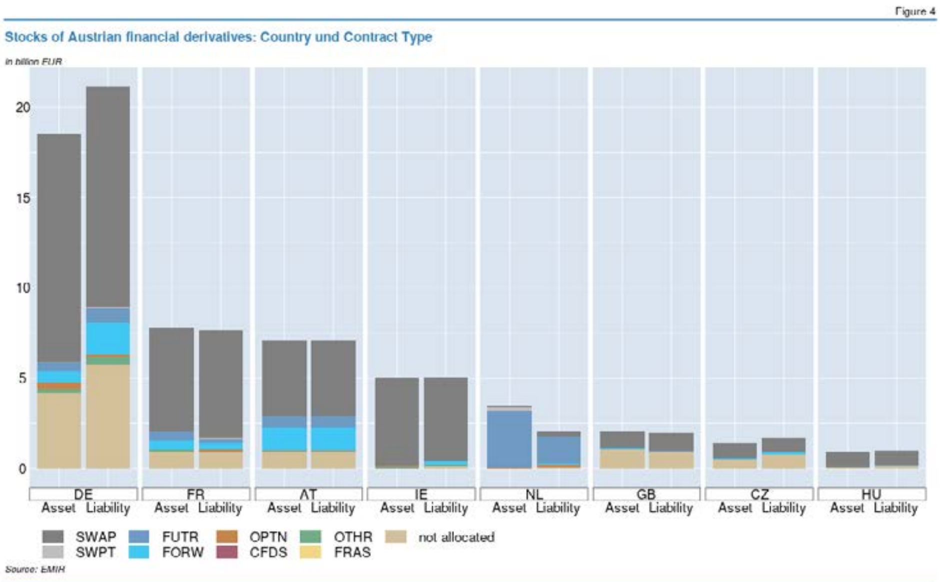
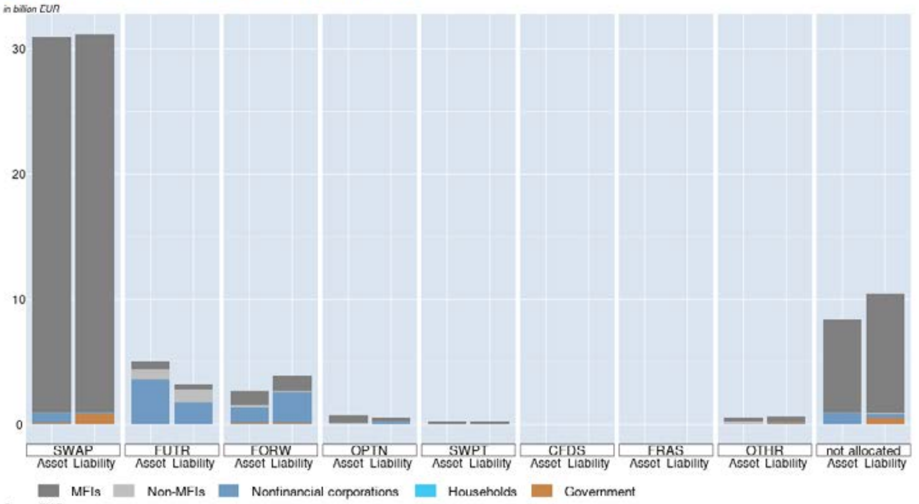


Figure 4 reports the regional breakdown of contract types. Given Germany as the main trading partner, the most traded contract type are swaps (SWAP) (EUR 12 billion EUR in assets vs. EUR 13 billion in liabilities), followed by options (OPTN) (EUR 4 billion in assets vs. EUR 5 billion in liabilities) and forwards (FORW) (EUR 1 billion in assets vs. EUR 3 billion in liabilities). The total assets across all derivative contract types are EUR 17 billion vs. EUR 22 billion in liabilities. Swaps are also the main derivative contract types traded with France, Ireland, and Hungary. However, the main derivative contract types traded with the Netherlands are Futures. The difference can be explained by the fact that most trading in swaps relates to interest rate derivatives, and trading in commodities is mostly done through futures (FUTR). The remaining contract types as swaptions (SWPT), forward rate agreements (FRAS) and contracts for difference (CFDS) do not substantially contribute to the Austrian exposure.

In combination with figure 1 and 2 we can see that in countries where MFIs and Non-MFIs dominate the market, interest rate and currency swaps are the most traded contract types, while in countries where non-financials dominate the market, commodity futures exhibit the highest derivative exposure.

Figure 5

Stocks of Austrian financial derivatives: Sector und Contract Type



Source: EMIR

Figure 5 depicts the distribution of which contract types are traded with which sector. We can see that an overwhelming majority of more than EUR 31 billion in assets are held in swaps by Austrian MFIs vs. EUR 32 billion in liabilities. The second largest contract types are futures, which are mainly held by Non-financial corporations (EUR 4 billion in assets vs EUR 2 billion in liabilities), followed by forwards, which are also mainly held by Non-financial corporations (EUR 2 billion in assets vs EUR 3 billion in liabilities). Government don't hold any considerable contract sizes of any derivative type.

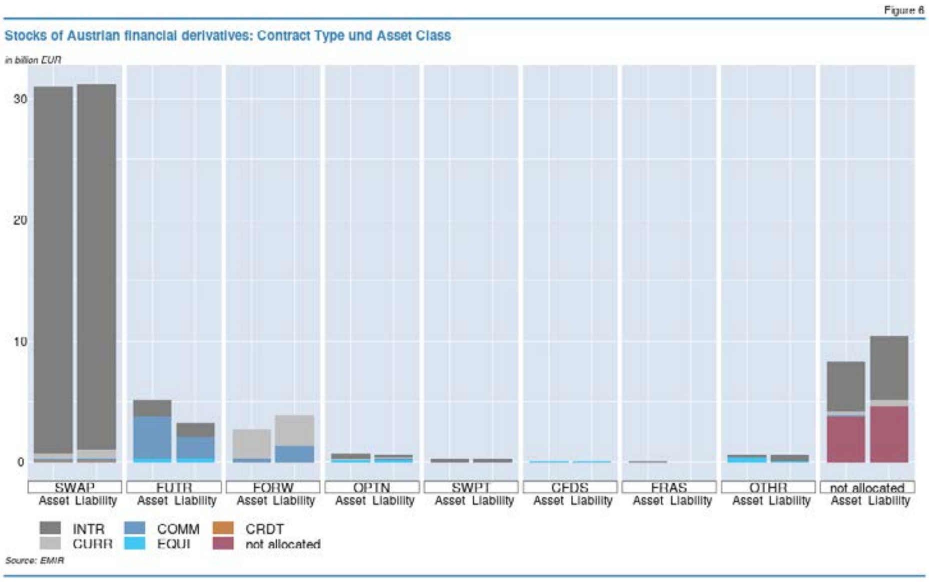


Figure 6 shows the breakdown of asset class according to its contract type. Again, one can see that an overwhelming majority of the derivative exposure is held in interest rate swaps. The assets amount up to EUR 31 billion vs. EUR billion in liabilities. The second most traded assets classes are commodity futures (EUR 3 billion in assets vs EUR 2 billion in liabilities), followed by currency forwards (EUR 2 billion in assets vs EUR 3 billion in liabilities).

7. Risk assessment of derivatives exposure

The previous chapter presented an overview of the major derivatives exposures according to their country, sector, contract type, and asset class. The contract values showed a stand-alone risk in certain areas. Therefore, this section deals with the quantification of this associated risk. For this purpose, we introduce a risk measure which quantifies the derivative exposure as a measure of leverage, measured through the ratio between contract value, CV, and notional, N. Thus, the leverage ratio, LR, of country i, sector j, and asset class k, can be written as

$$LR_{i,j,k} = \frac{CV_{i,j,k}}{N_{i,j,k}}$$

where

$$CV_{i,j,k} = \frac{Asset_{i,j,k} + Liability_{i,j,k}}{2}$$

measures the average profit or loss, and

$$N_{i,j,k} = \frac{Long_{i,j,k} + Short_{i,j,k}}{2}$$

measures the average notional from long and short positions. Thus, the leverage ratio measures the leverage of the average contract value vs. the underlying average notional. The larger this ratio, the riskier the exposure.

We provide next the results of the leverage ratios for each derivatives exposure analysis.

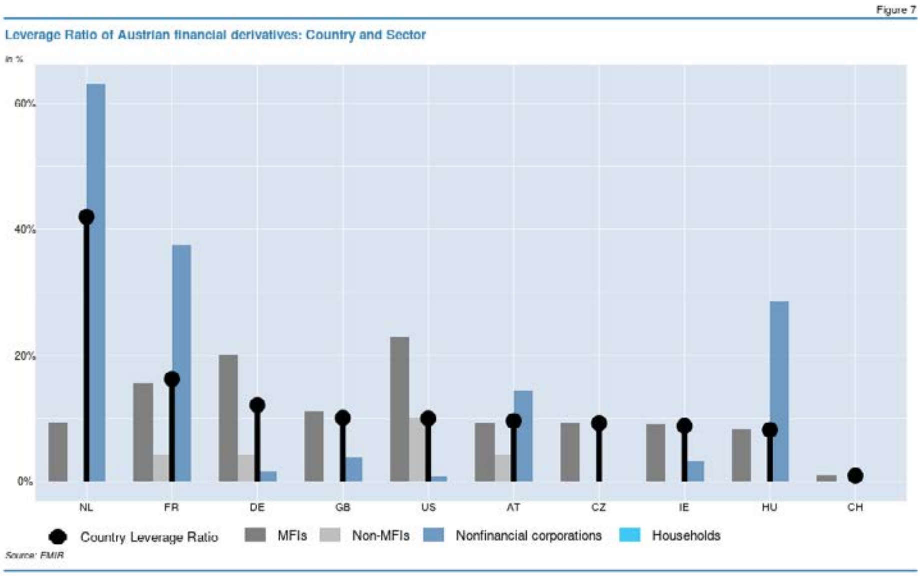


Figure 7 exhibits the leverage ratio of each Austrian sector to each country on an aggregate global basis, including the breakdown into each sector's derivative exposure to each country. We can see the riskiest exposure of non-financial corporations towards the Netherlands, followed by France and Hungary. Austrian MFIs have a moderate risk exposure towards the US, Germany, and France. Government don't exhibit any considerable risk exposure concerning the leverage.

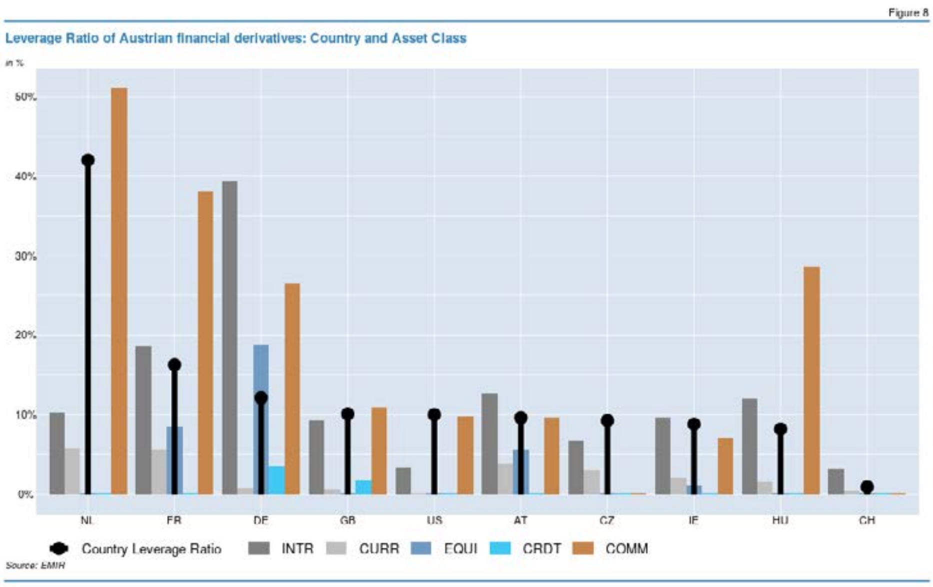
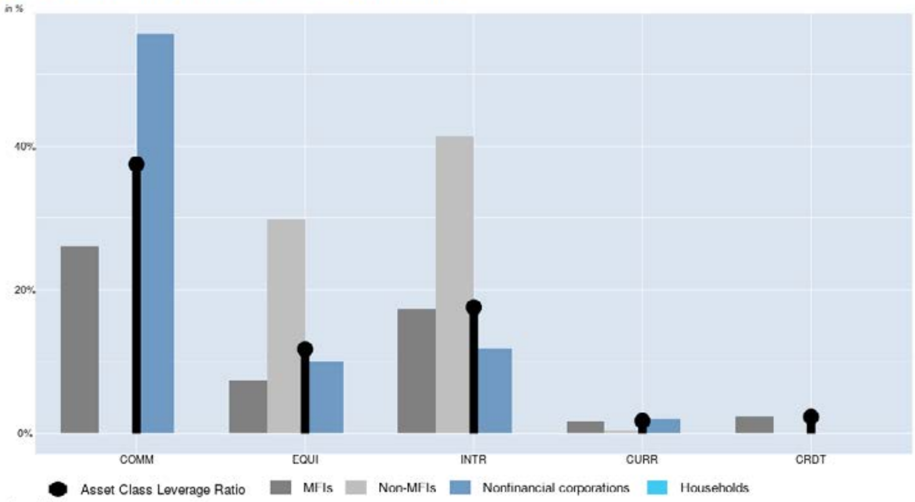


Figure 8 shows the leverage ratio for each country with respect to their asset class. We can see again that the riskiest derivatives exposure is towards the Netherlands with 51%, reflected in commodities, followed by France with 38%, and Hungary with 28%. However, the second riskiest asset class exposure is the interest rate derivative exposure towards Germany with 38%, France with 18% and Hungary with 12%. In general, one can see that commodities bear the highest leverage risk for Austria.

Figure 9

Leverage Ratio of Austrian financial derivatives: Sector and Asset Class



Source: EMIR

Figure 9 depicts the leverage ratio of all asset classes for all sectors. The highest risk is born by non-financial corporations through commodity exposure with 55%, while the second largest risk is born by non-MFIs which are also very exposed to interest rate exposure. The third largest risk can be found to be borne by non-MFIs in equity derivatives with 30%, followed by MFIs in commodity exposure with 25%.

The riskiness of the leverage ratio in commodities can be explained by an increased volatility due to macroeconomic events such as the war in Ukraine. This caused market risk premiums to skyrocket and hedging costs to increase. The resulting incorporated riskiness was reflected in the deterioration of the leverage ratio in commodities.

The riskiness of interest rate swap exposures can mainly be attributed to the heterogeneous timing of interest rate increases by the Central Banks with Austrian interest rate derivative exposure. Interest rate derivatives suffered higher volatility during this phase, causing the leverage ratio to increase.

7. Conclusion

This article demonstrates that achieving experimental macroeconomic statistical data of financial derivatives from EMIR data is very promising and the resulting macro-micro link enables a variety of analysis.

This article shows the power of the EMIR database and the capabilities for conducting a descriptive statistical analysis of a country-wide, sectoral, and asset type derivative risk analysis. By analyzing the assets and liabilities of each country, MFI, Non-MFI, Non-Financial corporation, Household, and Government it is possible to reveal cluster risk, stand-alone risk, and leverage risk for each type of derivative or asset type. We also calculate the leverage ratio to measure the leverage of each country and sector towards each asset class.

For this purpose, we derive the stocks and nominal values of the financial derivatives from the EMIR data and adjust the exchange rates during this process. We also check the confidentiality of the data to ensure that this data is adequately protected. In addition, we expand the data set by integrating further relevant information such as country, sector, contract type and asset class. We hereby create a comprehensive data set for our analysis which provides a broad perspective on the relevant financial information.

The main findings are an overwhelming interest rate swap exposure of MFIs towards Germany and a significant commodity future exposure of Non-financial corporations towards the Netherlands. Some heightened MFI interest rate exposure can also be measured towards France and Ireland.

Regarding the associated leverage risk, we find a significant Non-financial corporate leverage risk towards the Netherlands, followed by France and Hungary. The risk is born mainly through commodity and interest rate derivatives.

The results show the importance of financial derivatives database analysis since it enables Central Banks to identify sources of derivatives risk and thus, to intervene and preemptively contain potential spillover effects towards other sectors of the economy.

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EMIR Data and External Statistics

External Statistics Conference
Madrid, 13th February 2024

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Why using EMIR Data?

How to use EMIR Data?

Which first results can be derived?

Why using EMIR Data?

Pros

+

Granular Data

Almost complete

Data are available

Cons

–

Unstructured big data

Not collected for statistical purpose

Quality issues

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How to use EMIR Data?

EMIR reporting and data extraction

EMIR Reporting for macroeconomic statistics

Emir is a comprehensive database

- Contains detailed information that is relevant for macroeconomic purposes:
  - Contract and notional value, counterparty information, derivative type
  - and many other important details

Conversion to macroeconomic statistics

- By selecting relevant indicators, EMIR data can be converted into macroeconomic statistics
- An in-depth analysis of the data set provides the basis for our findings

Research of the Oesterreichische Nationalbank

- Development of experimental data for financial derivatives in BoP and QFA based on EMIR data
- Focus: Reporting period December 2022
- Analysis includes all valid reported EMIR contracts with Austrian context (at least one Austrian counterparty) from January 2021 to December 2022.

Trade Activity vs Trade State Reports

Trade Activity Reports (TAR)

- Detailed information on derivative contracts
- Comprehensive data on specific trades and individual transactions

Trade State Reports (TSR)

- Summarizes daily intraday reports from TAR in a final version
- Only includes the last action type reported on that day

Objective

- Deriving the financial derivatives stocks from TAR and TSR
- Comparison with the OeNB's MFI financial derivatives data in BoP and BSI

Comparison Outcome via Root Mean Squared Error (RMSE)

- RMSE for Trade Activity Data: EUR 16.7 million vs. RMSE for Trade State Data: EUR 52.3 million
- Decision to use Trade Activity Reports for the study based on superior accuracy

Data Extraction

Time Interval for Historical Data

- Challenges in missing information in EMIR reports
- Establishment of historical timeframe for efficient data processing
- 6 months for contract value and notional amount, 2 years for other relevant information

Calculation of Stocks and Notional Value

- Methodology for determining stocks of financial derivatives
  - Mainly derived from the reports of the counterparties
  - Preference to more up-to-date reports and Austrian counterparties
  - Use of Monte Carlo simulations for missing contract values
- Derivation of notional values from EMIR data
- Categorization of contracts into assets and liabilities or long and short

Data Extraction

Incorporation of Additional Data for Macroeconomic Statistics

- Derivation of other relevant contract information from EMIR and the OeNB master database
  - Contract type, asset class, strike price, currency, maturity, country, sector, etc.
  - Merging with contract values and notional values
- Necessary adjustments for a comprehensive analysis

Exchange Rate Adjustment and outlier test

- Conversion of non-EUR denominated values using December 31, 2022, exchange rates
- Detection and correction of outliers with ARIMA outlier test

Confidentiality

- Strict confidentiality measures for EMIR data
- Review criteria based on dominance and number of counterparties

Summary statistics

Overview of EMIR Data

- Total Reports Utilized: 190 million
- Participants: 2,469 Austrian counterparties, 3,658 foreign counterparts (54 countries)
- Open Contracts: 13,809 spanning 63 currencies

Contract Value and Notional Value

- Derived mostly directly from the EMIR reports
- 5% of open contracts valued using financial mathematical models
- 2% of notional value calculated using multiplication
- For 8% of the contracts no contract value could be derived
- For around 4% of the contracts, no notional value could be determined

Summary statistics

Assets vs. liabilities from the Austrian perspective

- Assets: EUR 41.7 billion
- Liabilities: EUR 42.5 billion
- Austrian market: EUR 8.5 billion in outstanding assets and liabilities

Geographic Engagement

- Top Engagements: Germany (1,864 contracts), France (1,015 contracts), UK (594 contracts)
- Domestic Network: 8,162 contracts
- Unallocated Contracts: 209 (0.9% of total assets, 0.5% of total liabilities)

Summary statistics

Contract Type and Asset Class Distribution

- Most Traded Contracts: Swaps (3,675), Forwards (3,483), Options (2,065)
- Primary Asset Classes: Currencies (5,637 contracts), Interest Rates (4,574 contracts)
- Unidentified Contract Types: 3,067 contracts (17% of total portfolio)
- Unidentified Asset Classes: 2,298 contracts (9% of total portfolio)

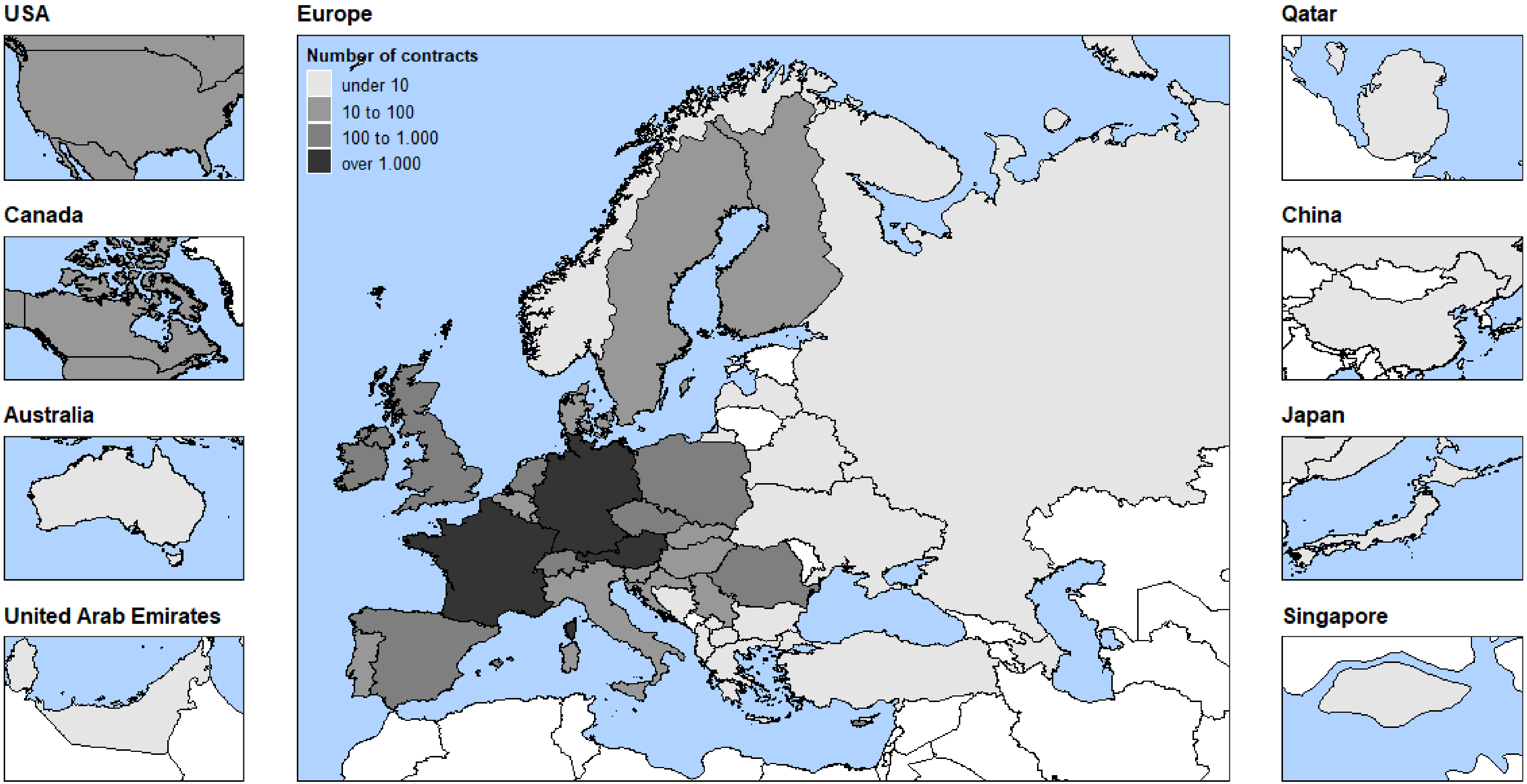
Summary and Key Takeaways

- EMIR data are distinguished by their exceptional level of detail and richness in information
- Despite their complexity and potential errors, EMIR data remain a valuable resource
- The EMIR database serves as a meaningful source for deriving experimental macroeconomic statistics
- The depth of information provided by EMIR improves the ability to provide comprehensive insights into economic trends

Which first results can be derived?

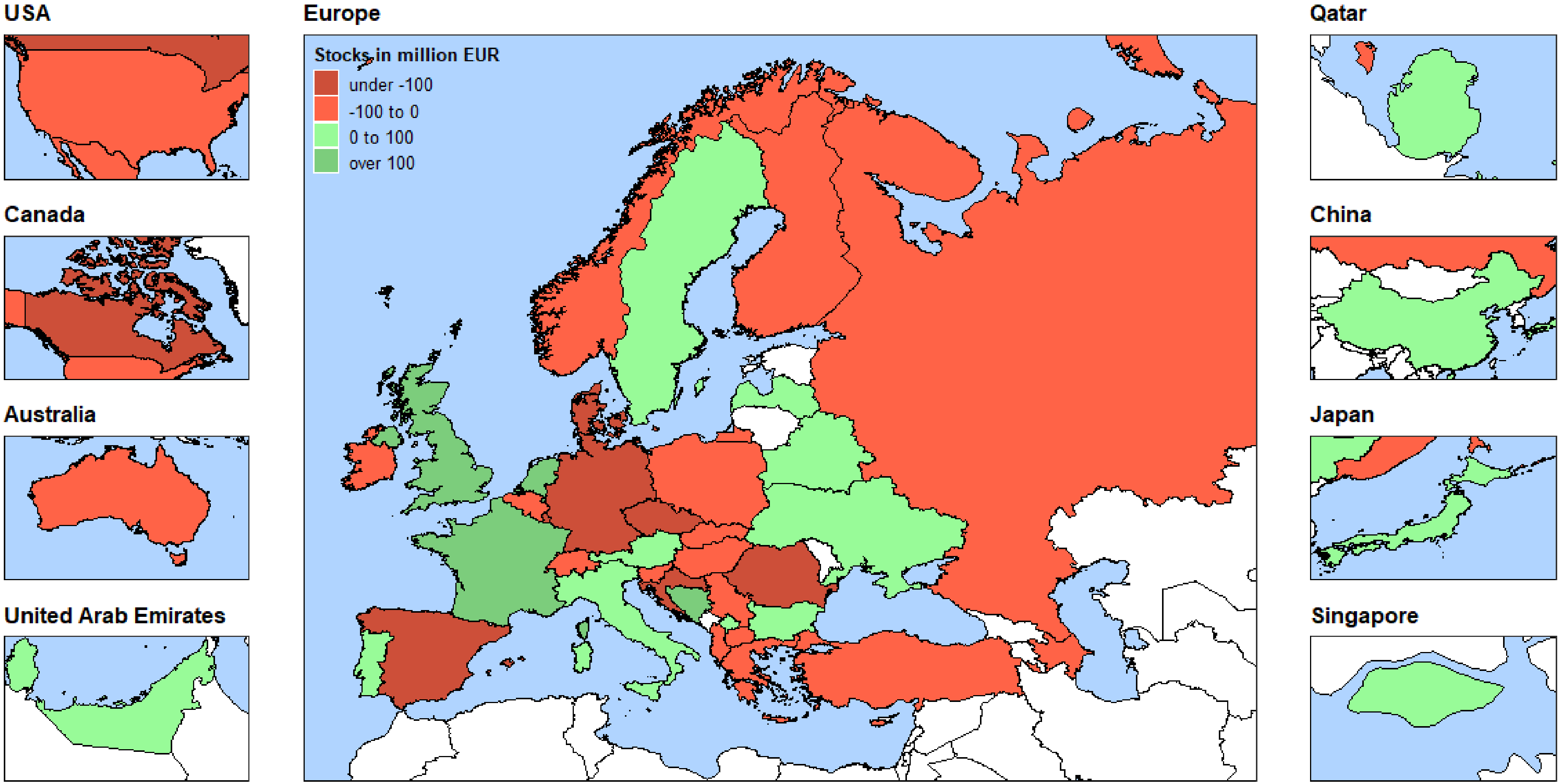
Results & Conclusion

Contracts of Austrian financial derivatives



Source: EMIR

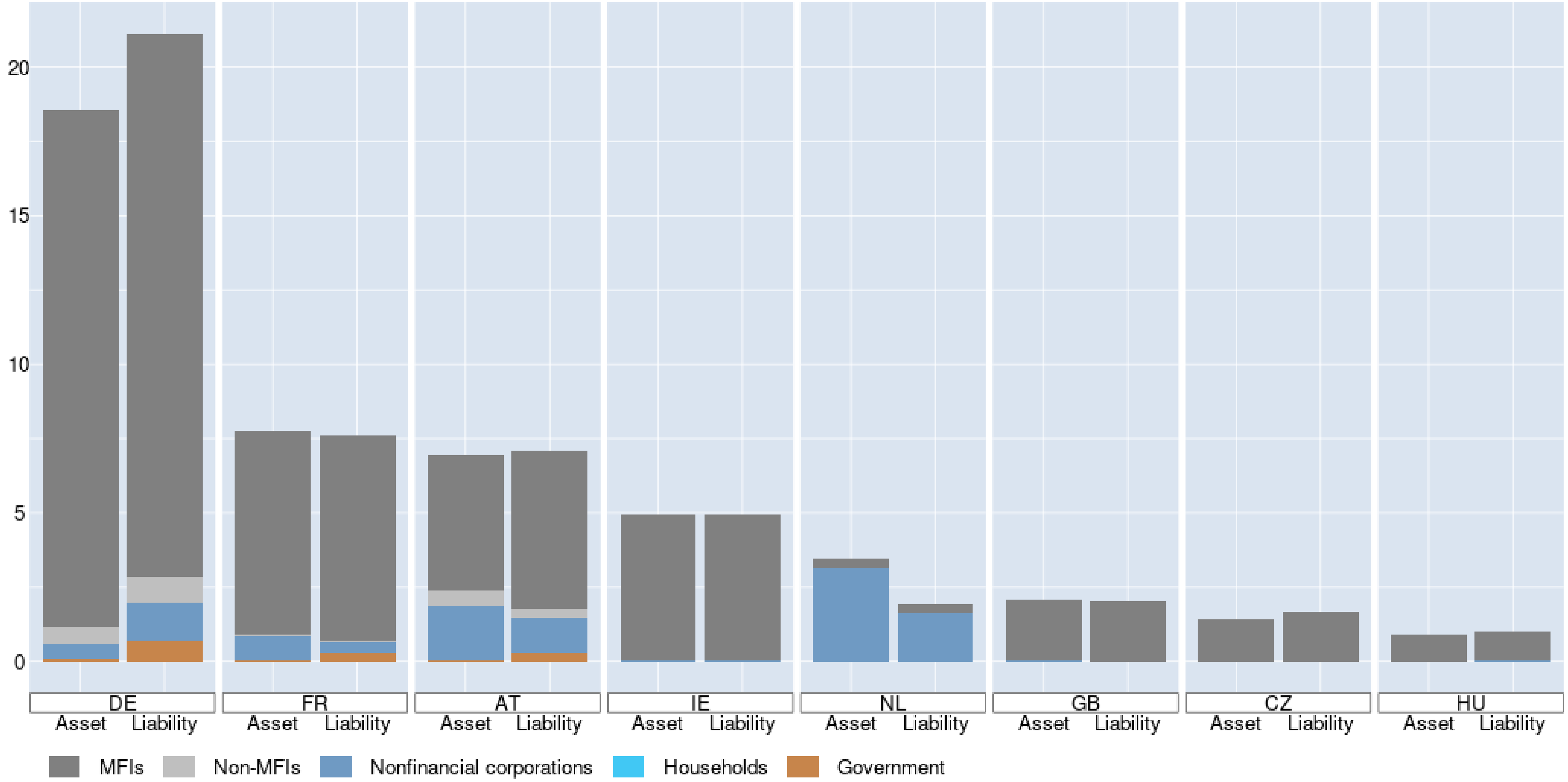
Net stocks of Austrian financial derivatives



Source: EMIR

Stocks of Austrian financial derivatives: Country and Sector

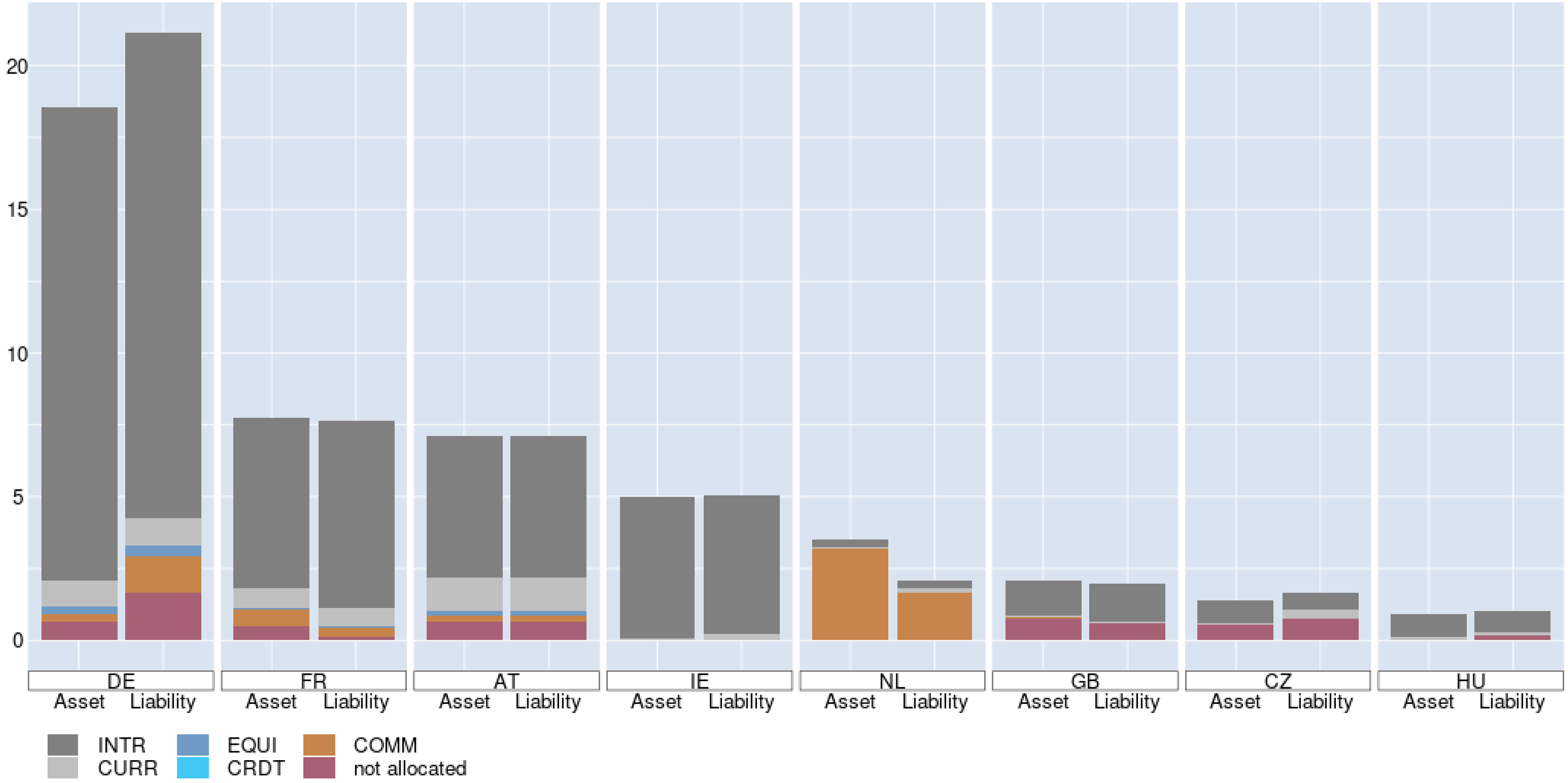
in billion EUR



Source: EMIR

Stocks of Austrian financial derivatives: Country und Asset Class

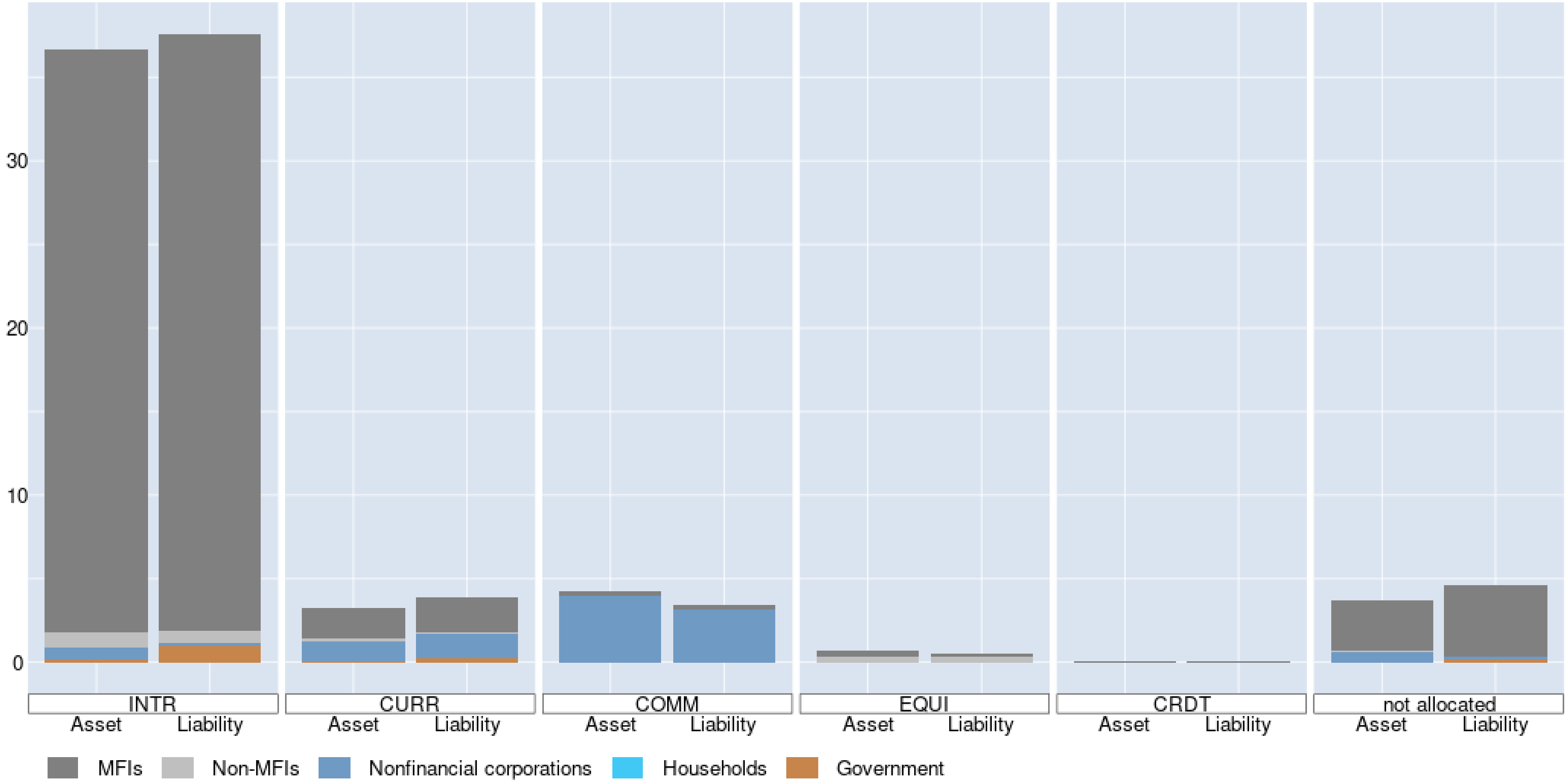
in billion EUR



Source: EMIR

Stocks of Austrian financial derivatives: Sector und AssetClass

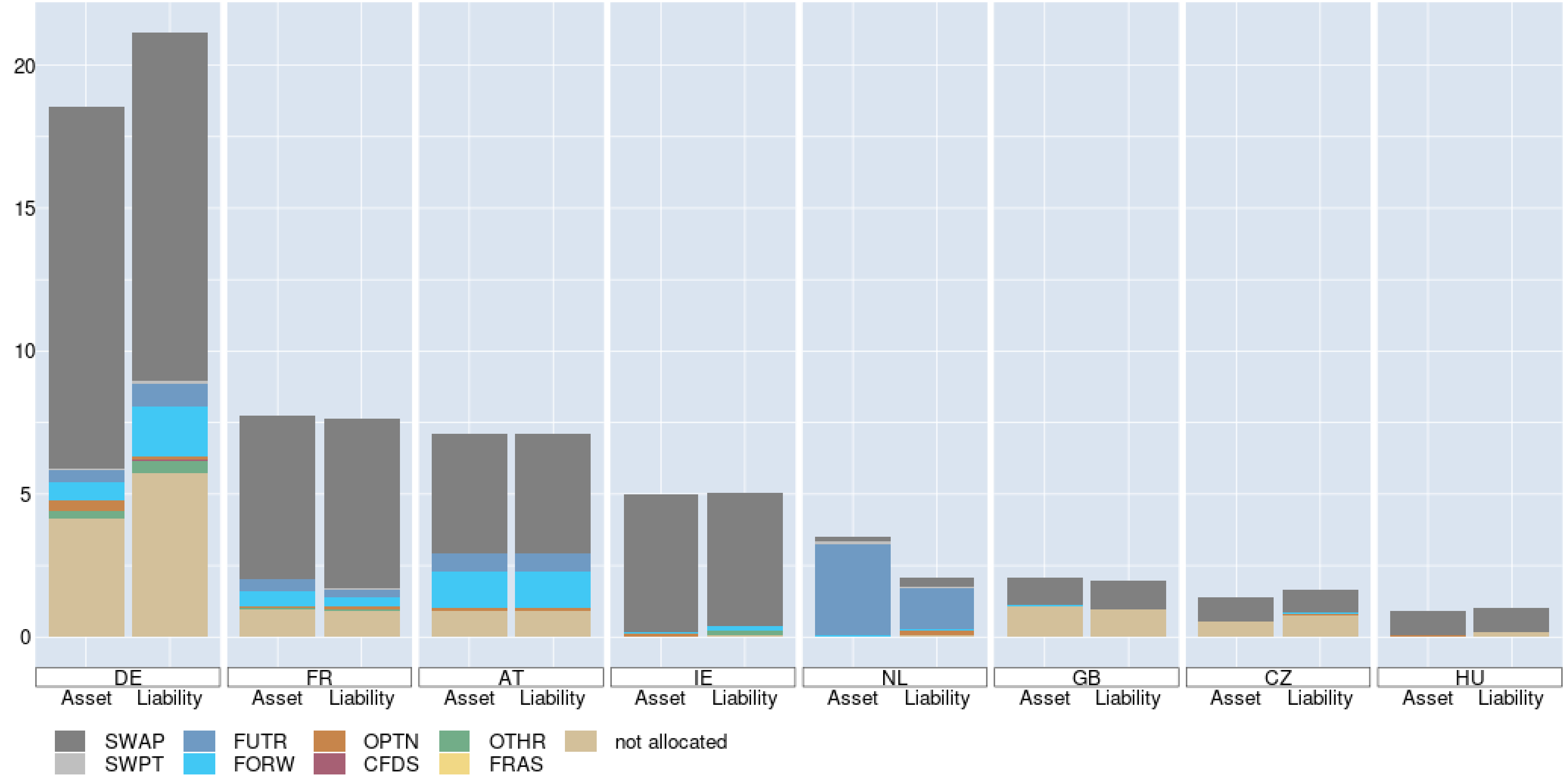
in billion EUR



Source: EMIR

Stocks of Austrian financial derivatives: Country und Contract Type

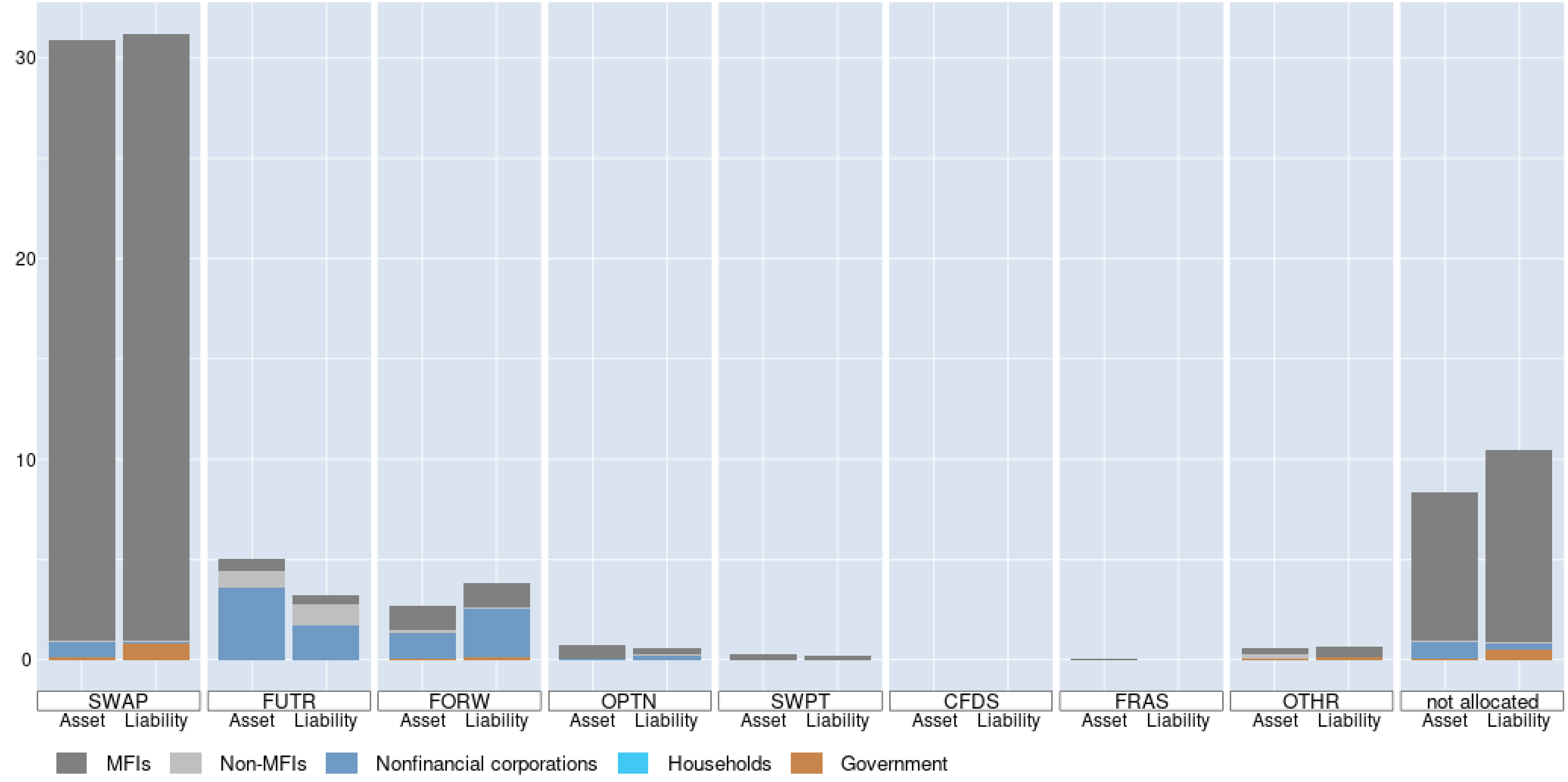
in billion EUR



Source: EMIR

Stocks of Austrian financial derivatives: Sector und Contract Type

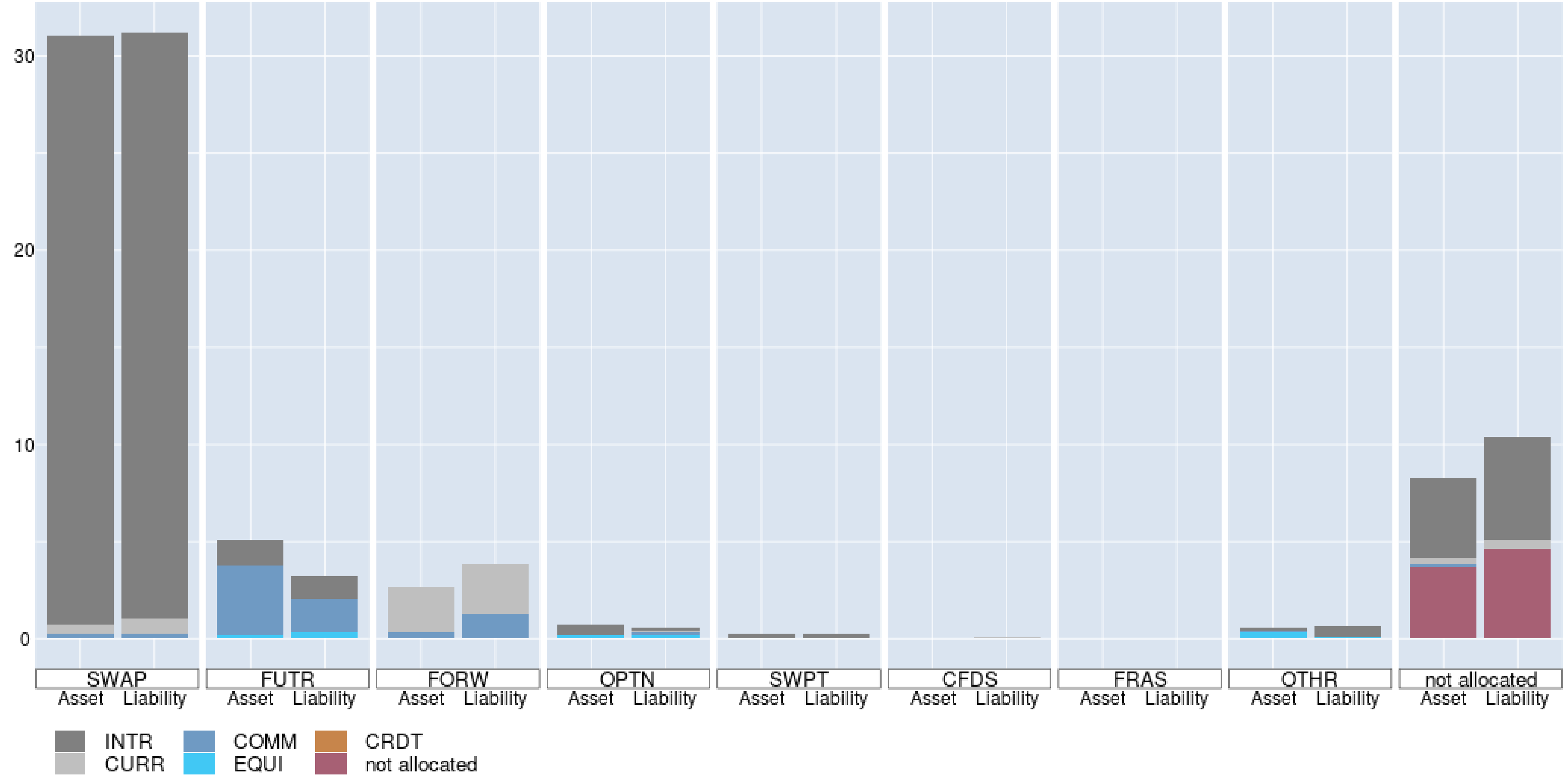
in billion EUR



Source: EMIR

Stocks of Austrian financial derivatives: Contract Type und Asset Class

in billion EUR



Source: EMIR

Aggregated Risk Indicator: ratio of Contract value and Notional

The Leverage Ratio *LR* of each country *i*, sector *j* and asset class *k* can be written as mean of

$$LR_{i,j,k} = \frac{CV_{i,j,k}}{N_{i,j,k}}$$

where

$$CV_{i,j,k} = \frac{Asset_{i,j,k} + Liability_{i,j,k}}{2}$$

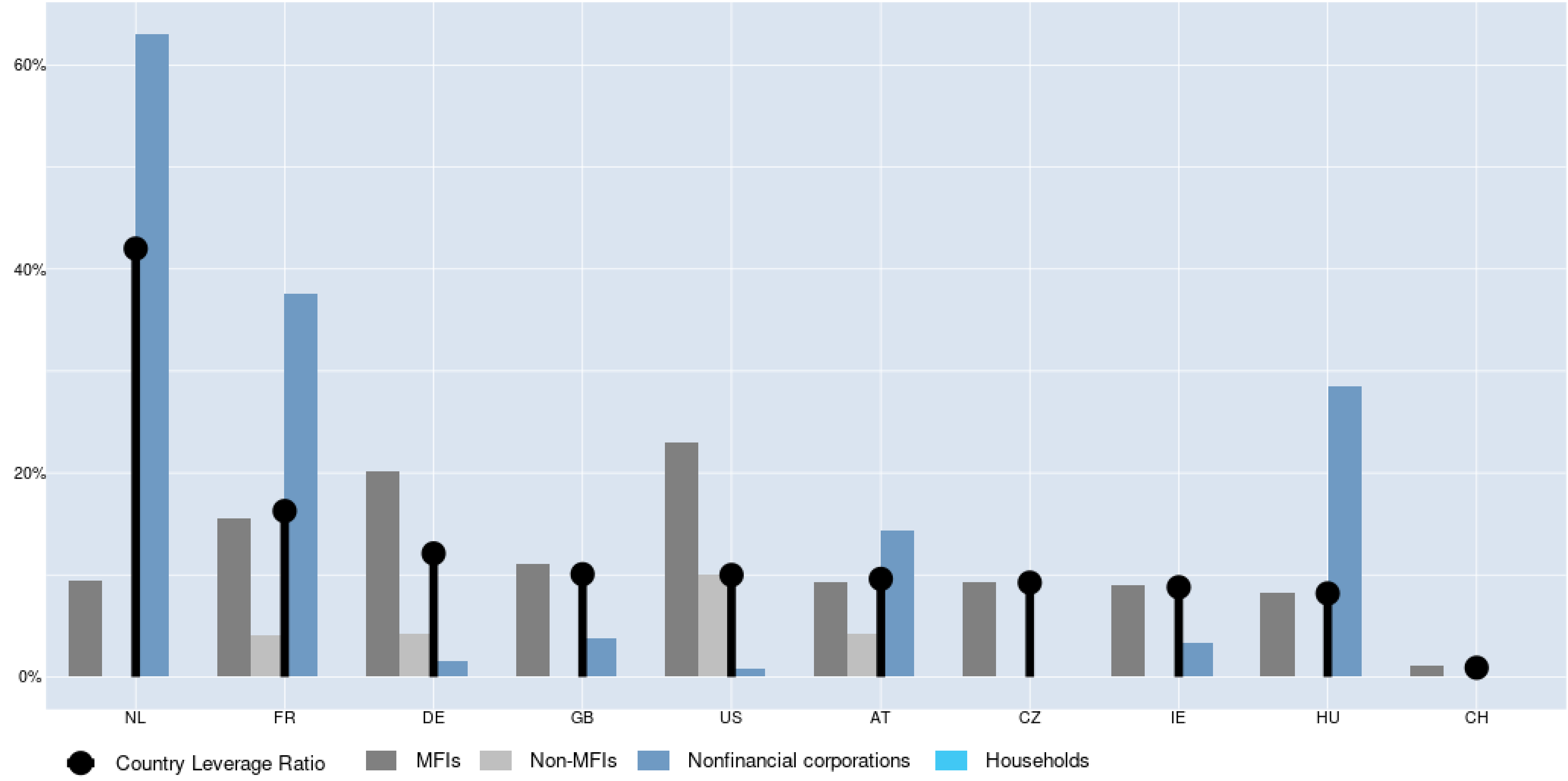
CV is the respective average contract value (=market value), and

$$N_{i,j,k} = \frac{Long_{i,j,k} + Short_{i,j,k}}{2}$$

N measures the average notional from long and short postions

Leverage Ratio of Austrian financial derivatives: Country and Sector

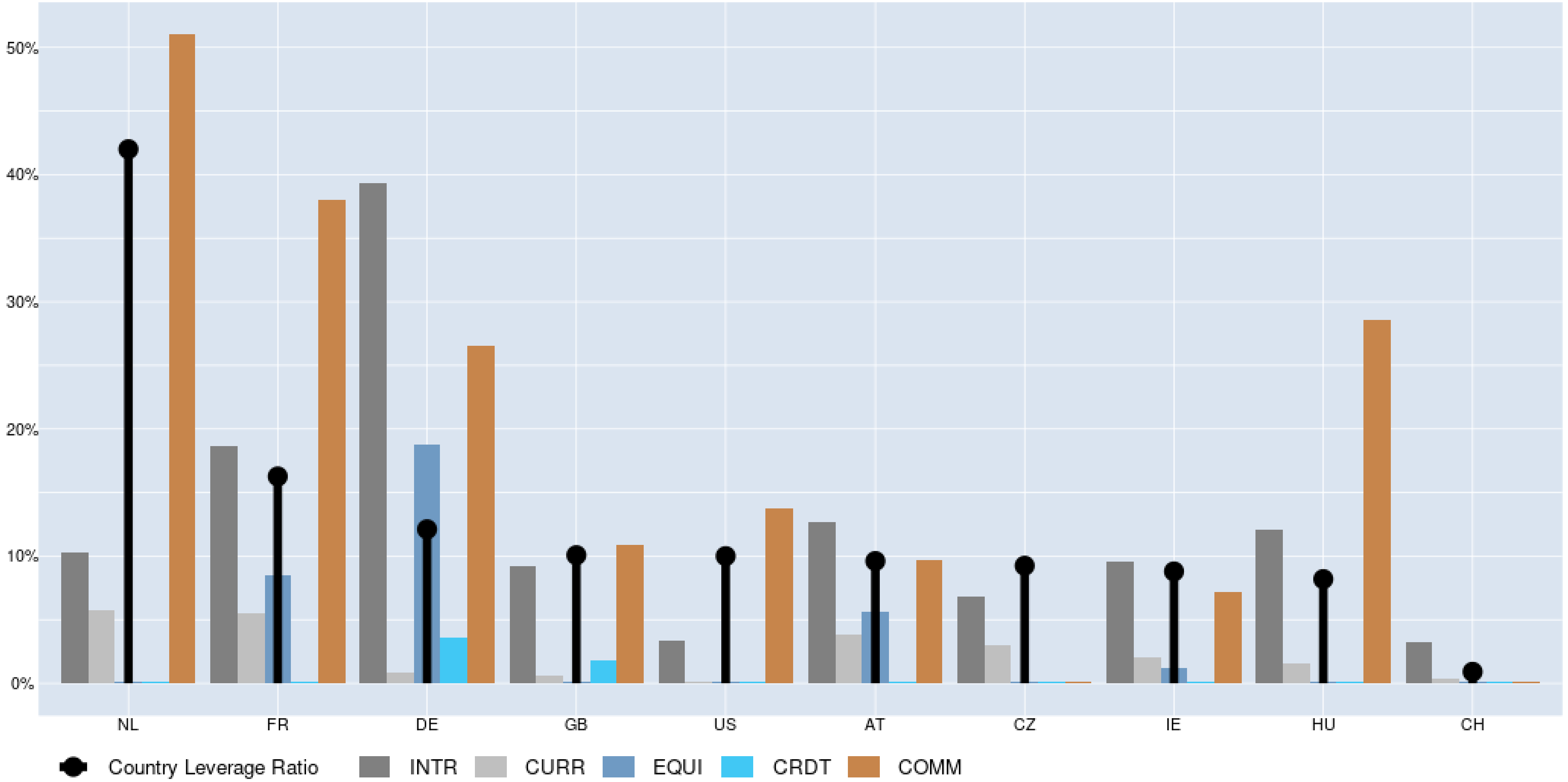
in %



Source: EMIR

Leverage Ratio of Austrian financial derivatives: Country and Asset Class

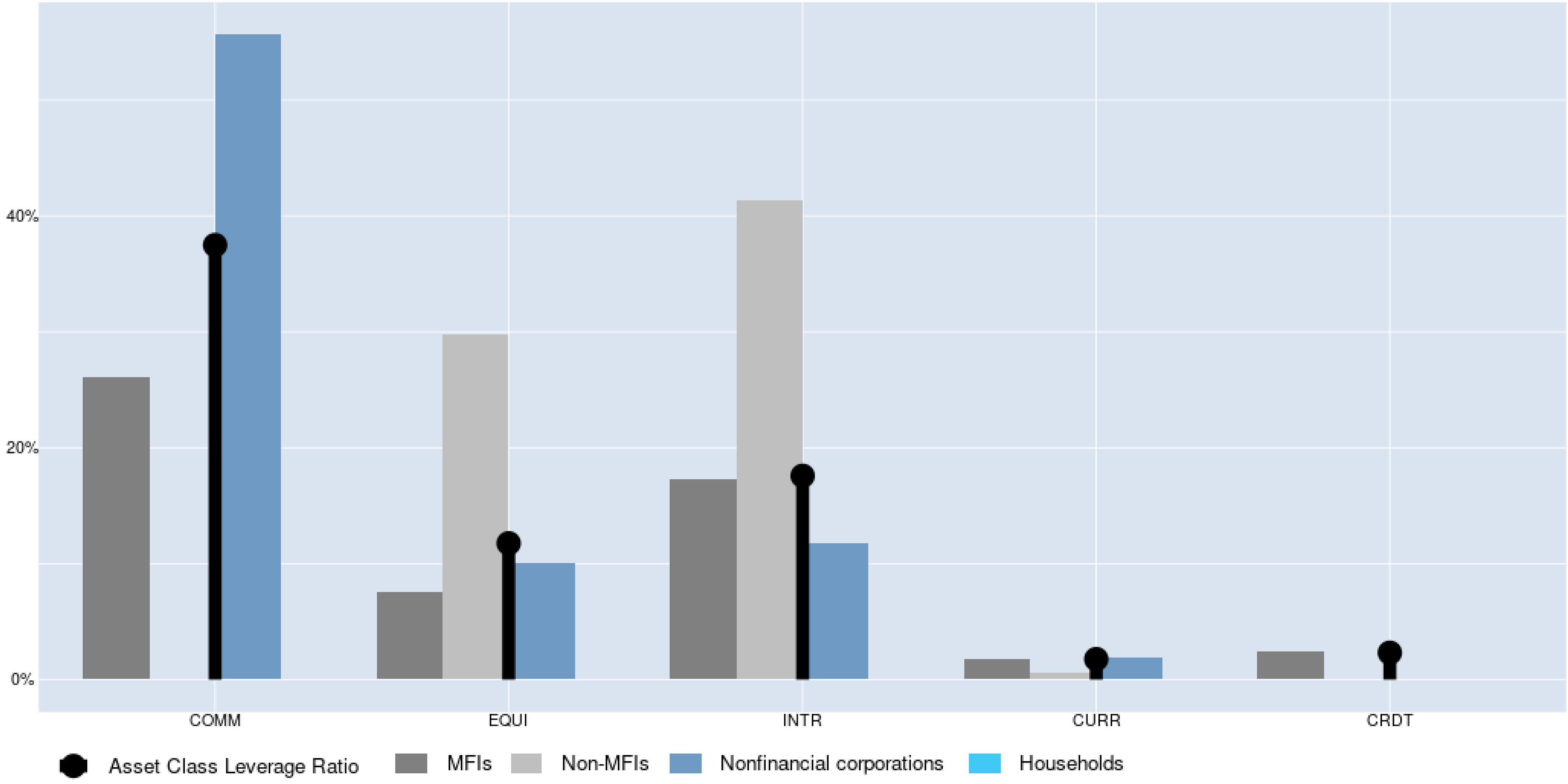
in %



Source: EMIR

Leverage Ratio of Austrian financial derivatives: Sector and Asset Class

in %



Source: EMIR

Conclusion

- Experimental data for financial derivatives stocks and notional values were sucessfuly derived from EMIR data
- Data can be used for statistical analysis broken down by country, sector, asset type and contract type
- Austrian MFIs are highly exposed to interest rate swaps with Germany
- Austrian non-financial corporations are significantly exposed to commodity futures vis-à-vis the Netherlands

Danke für Ihre Aufmerksamkeit

Thank you for your attention

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