

## **Executive summary**

The offering of kick-backs for transmitting clients' orders (Payment for Order Flow – short: PFOF) is the subject of criticism as kick-backs can cause conflicts of interests for the transmitting broker. The transmission of clients' orders to PFOF offering execution venues could conflict with the clients' interests if best execution is not guaranteed there. This is implied by studies conducted by the Dutch supervisory authority Autoriteit Financiële Markten (AFM) and the Spanish supervisory authority Comisión Nacional del Mercado de Valores (CNMV). With this background, BaFin conducted an own study to analyse the quality of execution on German trading venues. Methodologically, BaFin's study follows the methodology of the AFM's study<sup>1</sup> of 9 February 2022 and further refines the approach adopted there by taking into account the (principle of) total consideration.

In its study, BaFin included purchases and sales of equities on the PFOF-relevant trading platforms Tradegate Exchange, the Lang & Schwarz Exchange, Gettex and Quotrix (hereinafter: PFOF markets). BaFin included trades in all German equities for which BaFin is the competent supervisory authority. These equate to almost 30% of trades at these trading venues.

According to the Financial Markets Directive (MiFID II), the quality of execution is determined not only by the execution price but also by the fees associated with execution (the total consideration). Hence, by taking into account additional factors that influence the total consideration (transaction sizes, transaction costs related to the trading venue and differences in liquidity in the equities being traded) an extended methodology was chosen to reduce methodological constraints and to increase the validity of the statements on the quality or actual attractiveness of order execution on PFOF-relevant trading platforms.

BaFin's study arrives at differentiated results. Executions in purchases and sales of equities on PFOF markets appear to be advantageous for smaller transaction volumes on average. In particular, for transaction volumes of up to EUR 2,000 in DAX equities and up to EUR 500 in non-DAX equities, retail clients achieve better overall results on PFOF markets than on the reference markets. The advantageousness of smaller transaction volumes is due in particular to venue-related transaction fees including minimum fees for order execution, which some reference markets charge for order execution.

Also relevant is the question of whether similar volumes were being traded on the reference markets at the time of execution at the PFOF market. The study indicates that execution prices at PFOF markets deteriorate when the executed volume on the PFOF markets exceeds the trading volume on the reference markets at the time of execution.

In addition, the liquidity of the equity being traded would appear to itself have an effect on execution quality. In proportional terms, therefore, DAX equities are more often associated with better execution quality for the client on PFOF markets than other German equities.

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<sup>1</sup> <https://www.afm.nl/en/professionals/nieuws/2022/februari/kwaliteit-orderuitvoering-pfof>.

## 1 Data basis and methodology

In this study, BaFin analysed transaction reports pursuant to Art. 26 of the Markets in Financial Instruments Regulation (MiFIR) and enriched those with further information from the Financial Instruments Reference Database System (for short FIRDS). Based on those data, the quality of the execution prices on the relevant PFOF markets ("Dataset A") was analysed following the methodology of the Comparative Pricing Model<sup>2</sup> described by the AFM.

The prices for each execution in Dataset A for which a retail client was either buyer or seller according to the transaction reporting data<sup>3</sup> were compared with the execution prices for the shares in question at the same second on the ten other most liquid markets (in terms of the number of transactions reported), hereinafter referred to as the "reference markets" ("Dataset R").

Each execution on the PFOF markets in Dataset A was then labelled as better than, worse than or within the price range on the reference markets in Dataset R. Where the client acted as buyer (seller), the execution was deemed to be

- better if the price was lower (higher) than all the prices on the reference markets,
- similar if the price lay somewhere between the lowest and highest price on the reference markets, or
- worse if the price was higher (lower) than all the prices on the reference markets.

Further details on the Comparative Pricing Model can also be found in the AFM study.

The following adjustments and expansions to the methodology described by the AFM were made in order to obtain results that were as meaningful and usable as possible:

### 1.1 Size of data sample and reference market

BaFin's study covers all German equities for which BaFin is the Relevant Competent Authority (RCA)<sup>4</sup>, which means nearly 30% of transaction reports. This is a large portion of trading activities on the PFOF markets mentioned. German equities were defined as all equities with ISO country code "DE".

The AFM's study only covers a very small proportion of trading activities on the PFOF-markets investigated – less than 1% of transaction reports. This can be clearly seen in the table below:

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<sup>2</sup> <https://www.afm.nl/en/professionals/nieuws/2022/februari/kwaliteit-orderuitvoering-pfof>.

<sup>3</sup> The role of the client was determined using the buyer and seller identification in the transaction reports, where private individuals can be identified by means of a "National ID". All reports that could be allocated directly to one of the trading venues in Dataset A based on the Market Identifier Code reported were taken into consideration. To obtain as complete a picture as possible, the study also covered all transaction reports for which the client's transaction was marked as "XOFF" (off-exchange) in the reporting system but to which an on-exchange execution on one of the markets in Dataset A could be attributed in the data by checking against predefined criteria.

<sup>4</sup> The Relevant Competent Authority for a financial instrument is the authority responsible for the most important market in terms of liquidity. The Relevant Competent Authority for most equities with ISO country code "DE" is BaFin.

Table 1

**Breakdown of transaction messages for equities by ISIN country code and RCA**

Tradegate and Lang &amp; Schwarz trading venues

		Relevant national competent authority (RCA)			Total
		DE	NL	other	
ISIN country code	US	30.81%	0.00%	0.80%	31.60%
	DE	29.73%	0.00%	0.00%	29.73%
	CA	11.26%	0.00%	1.44%	12.70%
	GB	2.58%	0.67%	0.64%	3.88%
	NL	2.25%	0.74%	0.37%	3.36%
	other	9.93%	0.08%	8.72%	18.73%
	Total	86.55%	1.49%	11.96%	100.00%

Percentage of transaction reports in accordance with Art. 26 MiFIR regarding trades in equities (in this case CFI codes ES\*\*\*\* and EP\*\*\*\*) in 2021 by ISIN country code of the equity and relevant national competent authority as per FIRDS master data on financial instruments at the Tradegate Exchange and Lang & Schwarz Exchange trading venues. The figures with a blue background indicate the percentage of reports included in BaFin's data sample (29.73% with a DE ISIN and RCA = DE). The dark blue box demarcates the scope of reports on equities for which BaFin is the RCA.

As German rather than Dutch equities are being analysed here, Xetra rather than Euronext in Amsterdam is the most important reference market in Dataset R (see Table 2).

### 1.2 Taking account of fees at specific trading venues

BaFin's study takes into account trading venue-specific fees, which makes the execution quality on the PFOF markets more comparable relative to the reference markets from an investor perspective. A comparatively restricted approach not considering transaction fees cannot provide an accurate answer to the question, from the client's perspective, of execution quality in the sense of a cost-efficiency analysis comparing various execution options. Article 27 paragraph 1 subparagraph 2 MiFID II also requires to evaluate best execution for retail clients on the basis of total consideration (price and transaction fees).

In light of this, BaFin's study considers (volume-dependent) transaction fees for trades on the most relevant reference markets for German equities (insofar as this could be determined through research; see Table 2; as well as a detailed break-down on the included transaction costs in Annex III). Costs that could not be directly matched to an individual order were not taken into account. The final venue-specific costs of an order execution are therefore likely to be even higher in many cases.

### 1.3 Taking transaction size and liquidity differences into consideration

BaFin's study also took the transaction size of the respective executions into consideration, in data set A. This is because a distinction has been made between executions on the PFOF markets under consideration that exceed the compared transactions on the reference markets in terms of their volumes and those for which this is not the case. Volume ranges were also formed based on the distribution of actual transaction sizes taken from the transaction reports (see Figure 9) in order to facilitate a volume-based analysis.

In addition, liquidity differences in traded equities were taken into account, with the simplifying assumption that DAX equities generally have higher liquidity than non-DAX equities.

## 1.4 Trading platforms investigated

The study analysed the execution quality on the following PFOF markets:

- Tradegate Exchange (hereafter "**Tradegate**")
- Hamburg Stock Exchange – Lang & Schwarz Exchange (hereafter "**L&S**")
- Düsseldorf Stock Exchange – Quotrix (hereafter "**Quotrix**")
- Munich Stock Exchange – Gettex (hereafter "**Gettex**")

Table 2 below orders these PFOF markets by relevance and compares them to the other reference markets.

Table 2

**Breakdown of pricings identified at EU trading venues, including PFOF markets**

German equities listed on the PFOF markets

Trading venue	Percentage of total pricings identified	Are transaction fees considered?
Xetra	39.47%	Yes
CBOE Europe (NL)	24.51%	No, as impossible to determine
Turquoise Europe (NL)	9.26%	Yes
Aquis Exchange Europe (FR)	9.21%	No, as impossible to determine
Tradegate	8.65%	No
L&S	4.00%	No
Gettex	1.68%	No
Stuttgart Stock Exchange	0.82%	Yes
Equiduct	0.72%	No
Frankfurt Stock Exchange, excluding Xetra	0.55%	Yes
Quotrix	0.47%	No
Hamburg Stock Exchange, excluding L&S	0.13%	Yes
Other	0.53%	No
<b>Total</b>	<b>100.00%</b>	<b>-</b>

*Percentage of total pricings identified for German equities in 2021 at trading venues in the EU (regulated markets and MTFs, grouped by operating MIC, excluding "DARK" and "OFF-BOOK" segments), including PFOF markets (highlighted in yellow). The stock exchanges listed also include the corresponding regulated unofficial markets ("Freiverkehr").*

*Calculations are based on transaction reports in accordance with Art. 26 MiFIR regarding trades in equities (CFI codes ES\*\*\*\* and EP\*\*\*\*) for which BaFin is the relevant national competent authority as per FIRDS master data on financial instruments. Only transactions with prices in euros were included.*

## 2 Analysis results

### 2.1 Overview of PFOF markets

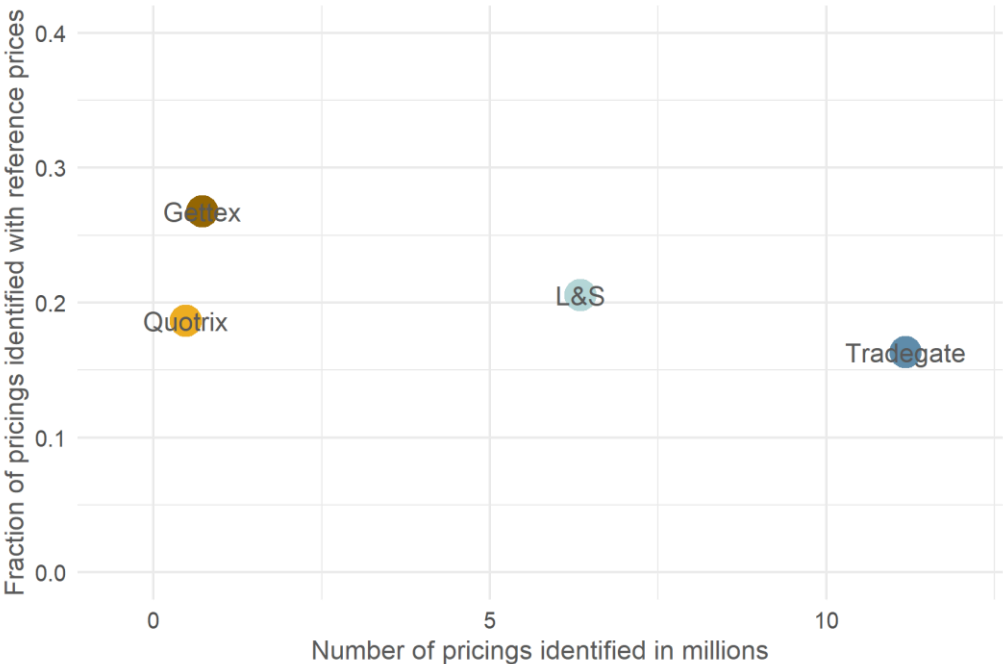
First of all, the relevance of the various PFOF markets needs to be considered. To this end, the total number of transactions executed on them in 2021 was analysed alongside the percentage of transactions with a reference price in Dataset R. The corresponding findings are shown in Figure 1.

In total, the analysis identified nearly 20 million retail transactions in DE equities on the four markets mentioned. In terms of the total number of transactions executed, two markets – Tradegate Exchange und Lang & Schwarz Exchange – clearly dominate PFOF market activities with around 90% of the business.

It should also be noted that it was only possible to find a simultaneously executed transaction or transactions on the reference markets for 3.4 million of the total 20 million transactions on the PFOF markets, i.e. on average for only around one in five executions. This means that only these 3.4 million transactions were included in the evaluations done as part of the study.

The percentage of orders executed on PFOF markets with reference prices on a reference market is also higher if only executions involving DAX equities are considered. Assuming that DAX equities are generally the most liquid ones, this is to be expected. This observation holds true for all PFOF markets.

Figure 1  
**Number of pricings identified on each PFOF market**



Total number of pricings reported in 2021 on the PFOF markets shown with a private individual as buyer or seller (X axis) plus, in each case, the percentage of pricings with a reference price.

## 2.2 Percentages of transactions with a better, similar or worse execution quality

### 2.2.1 Overall analysis

Taking the AFM study as a model, first the percentages of transactions executed at all PFOF markets at better, worse or similar prices, taking into account transaction costs compared with the reference markets were determined. Then, a distinction was made between DAX and non-DAX equities and between transactions with a volume of more and less than EUR 2,000.<sup>5</sup> Whether the volume of transactions at the PFOF trading venue was higher or lower than the total number of executions on the reference markets was also taken into account.

Figure 2

#### Number of transactions on PFOF markets with better, similar or worse execution prices

Orders executed with transaction sizes...

... not exceeding the trading volumes on all reference markets



...higher than the trading volumes on all reference markets at the time of execution



Number of transactions on PFOF markets that were executed at better, similar or worse prices, taking into account transaction costs, than on the corresponding reference markets. **Orders executed with a transaction size of up to EUR 2,000 are shaded more darkly in each case.** A distinction was made between trades executed on the PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets (bottom) and trades for which this is not the case (top).

<sup>5</sup> Therefore, roughly half of all transactions analysed on the PFOF markets with allocatable reference prices had a transaction volume not exceeding EUR 2,000. A detailed overview of the breakdown of reported transactions by transaction size can also be found in Annex I.

Table 3

**Percentage of transactions on PFOF markets with better, similar or worse execution prices**

Orders executed with transaction sizes not exceeding the total trading volumes on all reference markets

Transactions involving...	Better	Similar	Worse	Total
...DAX equities	24%	47%	29%	100%
...of which with transaction volumes of up to EUR 2,000	28%	53%	19%	100%
...non-DAX equities	24%	39%	37%	100%
...of which with transaction volumes of up to EUR 2,000	28%	42%	30%	100%

*Percentage of transactions on PFOF markets that were executed at better, similar or worse prices, taking into account transaction cost, than on the corresponding reference markets. Only those orders whose volumes do not exceed those of the corresponding transactions on the reference markets were considered.*

As Figure 2 shows, especially transactions on PFOF markets that exceeded the total volume of all reference transactions result mainly in worse execution prices. However, the fundamental question must be asked as to whether considering this scenario can even produce valid results. In any case, it is unclear at what prices – if indeed at all – such a transaction could have been executed outside the chosen PFOF market. This scenario will thus not be considered in the description of the results at the level of individual markets.

Insofar as the reference markets exhibit an appropriate level of market depth in the sense of the volume of transactions being executed there, the vast majority of trades on PFOF markets – 71% of analysed transactions involving DAX equities and 63% of analysed transactions involving other German equities – were executed at similar (47% for DAX equities and 39% for non-DAX equities) or even better prices (24% for DAX equities and non-DAX equities) than on the reference markets. Considering only transactions with a trading volume of up to EUR 2,000, the percentage of orders executed at similar or better prices increases to as much as 81% for DAX equities and 70% for their non-DAX counterparts.

Table 3 provides detailed information on the percentage breakdown of the transactions.

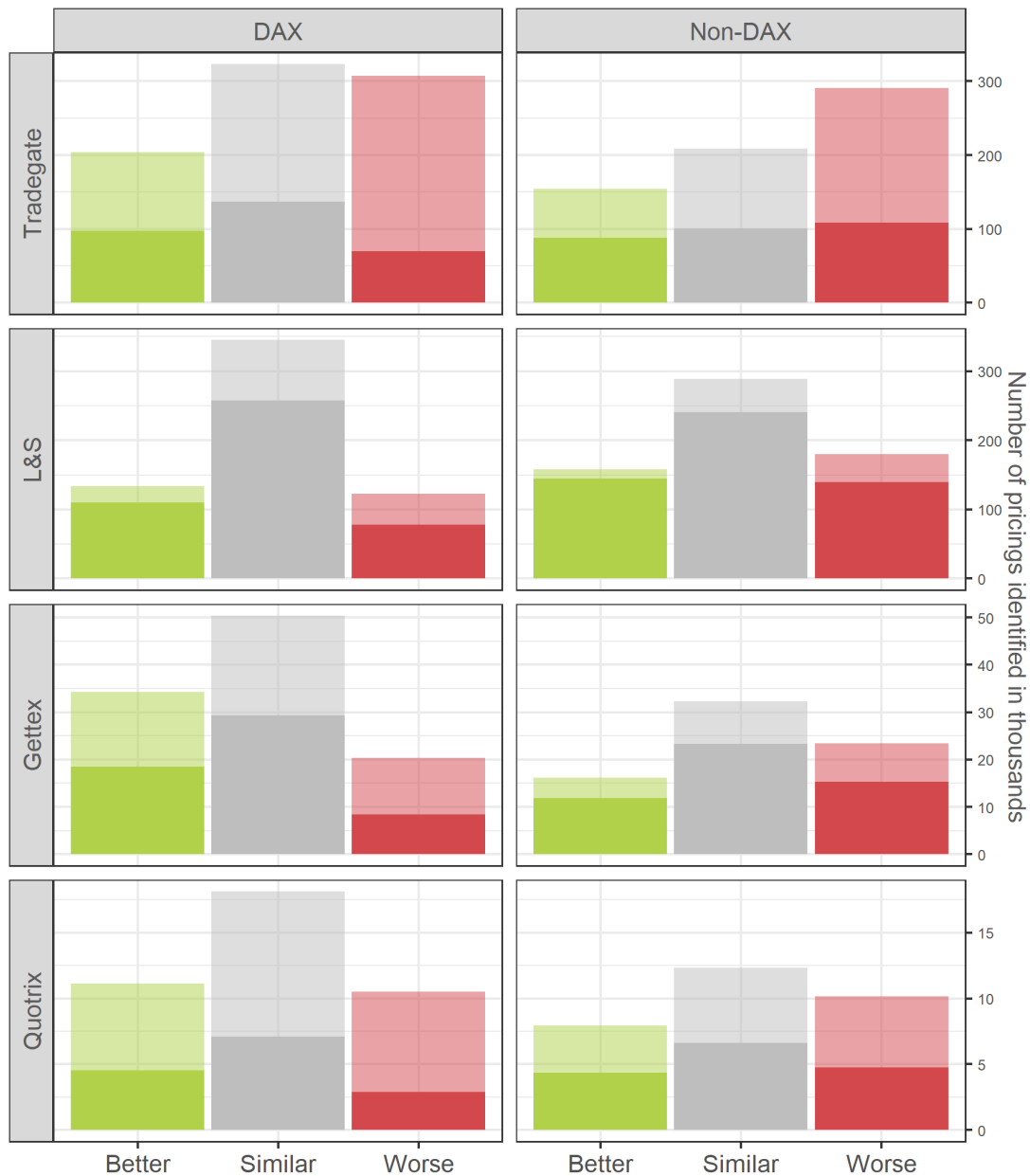
Apart from the orders not executed at similar prices, there are more instances of worse than better execution at PFOF trading venues for both DAX and non-DAX equities. However, considering the size of a transaction into the analysis as well shifts this ratio partially in favour of better execution. If the scope is restricted to orders executed with a volume not exceeding EUR 2,000, the number of instances of worse execution is only marginally higher than that for better execution in the case of non-DAX equities. With DAX equities, by contrast, the ratio flips: in this case, the number of orders executed at better prices is well above the number of orders executed at worse prices at low transaction volumes.

The transactions that did not exceed the trading volumes on all reference markets at the time of execution were also analysed for each PFOF market (see Figure 3).

This reveals differences, some of them marked, in the extent of the effects described above. For instance, considering transactions worth less than EUR 2,000 results in a marked decline in both the number and percentage of orders executed at worse prices, especially in the case of Tradegate. Amongst transactions in DAX equities with volumes of up to EUR 2,000, therefore, the number of orders executed at better prices exceeds the number of orders executed at worse ones.

Figure 3

**Number of transactions with better, similar or worse execution prices on each PFOF market**



Number of transactions on each PFOF market that were executed at better, similar or worse prices, taking into account transaction costs, than on the corresponding reference markets. **Orders executed with a transaction size of up to EUR 2,000 are shaded more darkly in each case.** Only those orders on the PFOF markets studied whose volumes do not exceed those of the corresponding transactions on the reference markets were considered.



### 2.2.2 Analysis by transaction volume

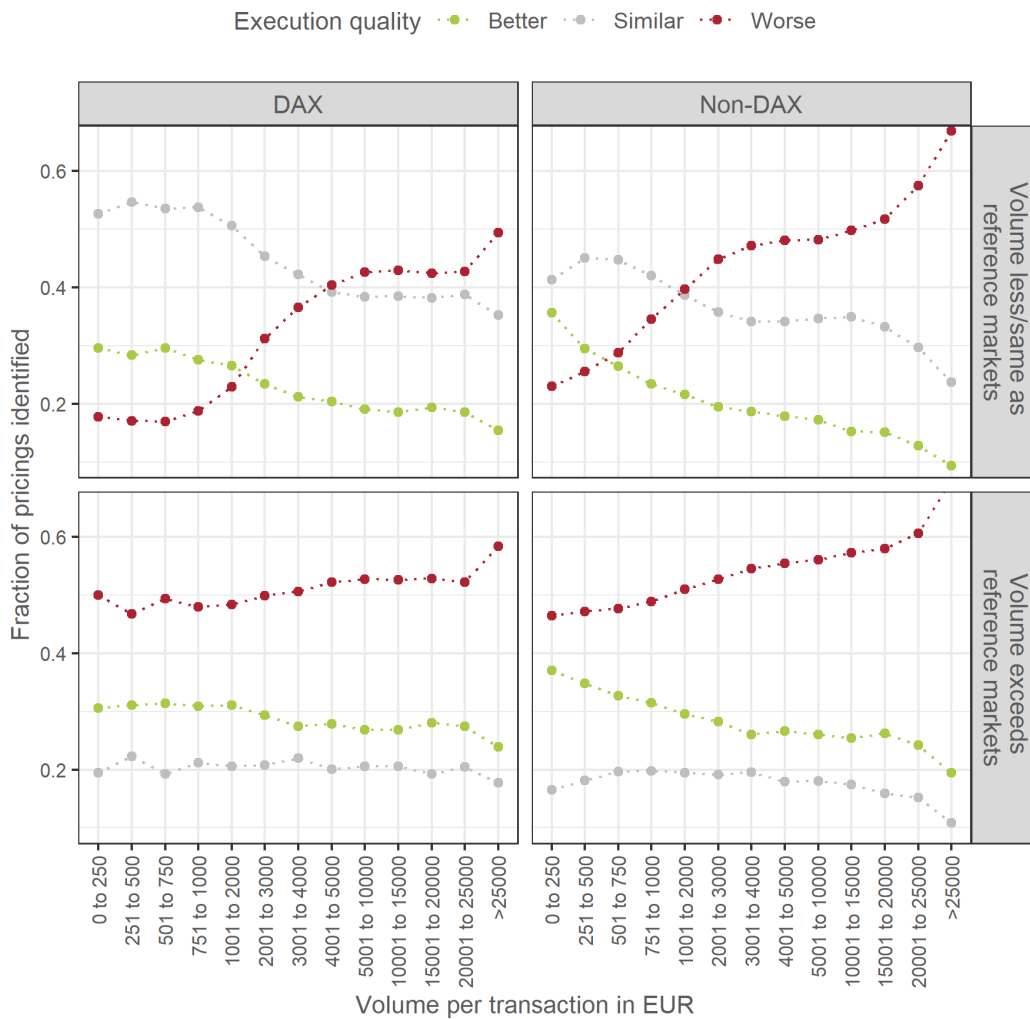
The study reveals that transaction volume has a significant impact on order execution quality. "Better" execution quality on PFOF markets is associated with a smaller transaction size as a basic principle, as Figure 4 below clearly reiterates.

Splitting observations into DAX and non-DAX equities also shows once again that the liquidity of the instruments being traded influences execution quality. This does not affect the underlying message that smaller transaction volumes tend to be associated with "better" execution quality.

In addition, there is further confirmation that orders executed on PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets are associated with worse execution prices.

Figure 4

**Percentage of orders executed at better, similar or worse quality for transactions of different sizes**



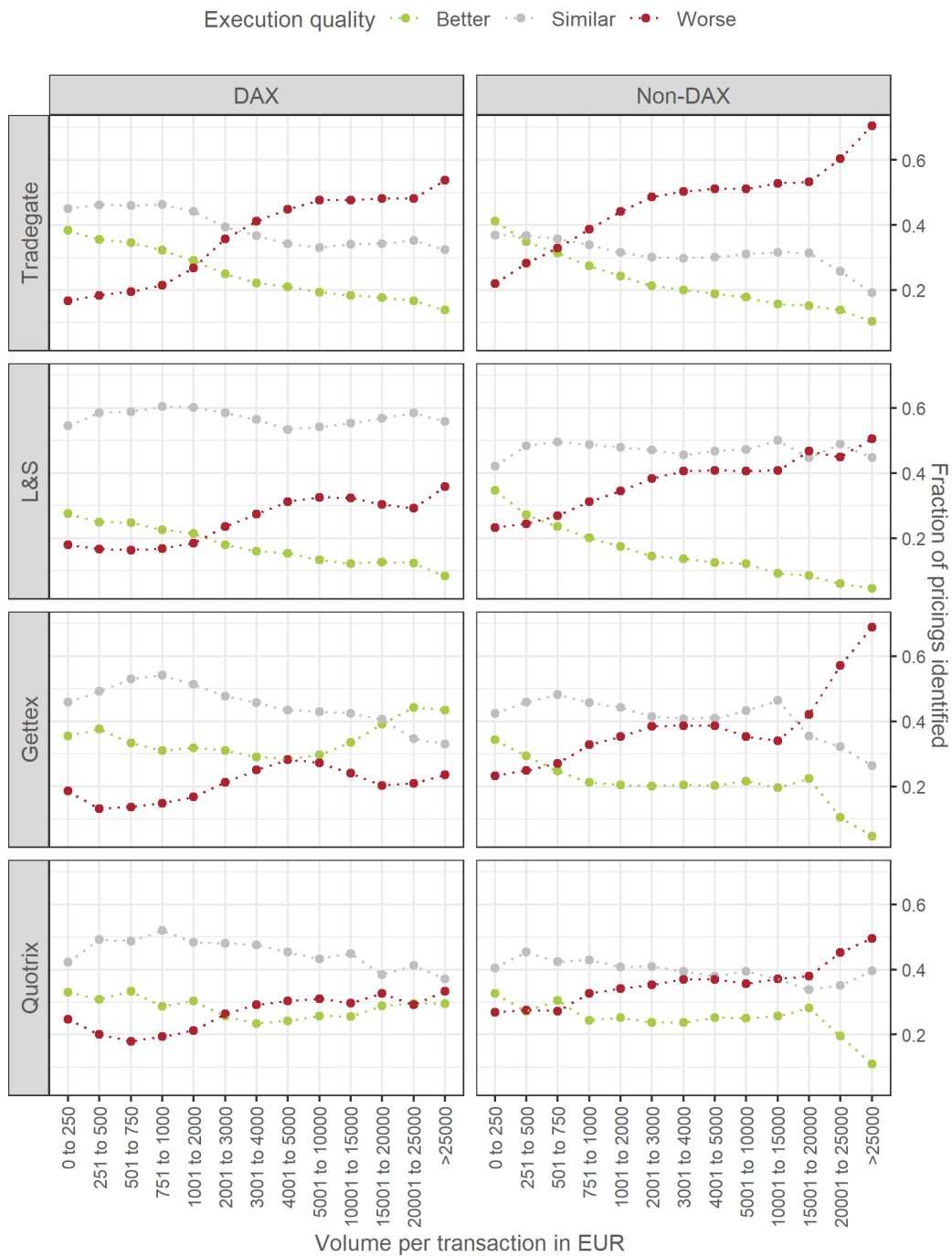
Groups of transaction sizes (X axis) and the percentage of them that represent better, similar or worse execution quality (Y axis), taking into account transaction costs, in trades by private individuals on PFOF marketplaces compared with the corresponding reference markets in 2021. A distinction was made between trades executed on the PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets (bottom) and trades for which this is not the case (top).

Ultimately, the analyses demonstrate that orders placed on PFOF markets that do not exceed the trading volumes on the reference markets at the time of execution appear to be advantageous to the client on average up to a transaction volume of between EUR 2,000 and EUR 3,000 when trading DAX equities and up to a transaction volume in a range of EUR 500 to 750 when trading non-DAX equities.

To supplement the aggregated analysis covering all PFOF markets, the transactions that did not exceed the trading volumes on the reference markets at the time of execution were analysed here too for each PFOF market (see Figure 5).

Figure 5

**Percentage of orders executed at better, similar or worse quality for transactions of different sizes on each PFOF market**



Groups of transaction sizes (X axis) and the percentage of them that represent better, similar or worse execution quality (Y axis), taking into account transaction costs, in trades by private individuals on each PFOF marketplace compared with the corresponding reference markets in 2021. Only those orders on the PFOF markets studied whose volumes do not exceed those of the corresponding transactions on the reference markets were considered.

Here too, there are differences – some of them marked – between the PFOF markets studied. Thus, for example, the transaction volume threshold up to which orders were executed at better prices for clients on average is much lower for the high-turnover markets of Tradegate and L&S than it is for Gettex (for DAX equities).

## 2.3 Relative price improvements and deteriorations

### 2.3.1 Overall analysis

This section takes a look at the distribution of relative price improvements and deteriorations in order to gauge more accurately the extent to which orders executed on PFOF markets differ from those executed on the reference markets.

The relative price improvements and deteriorations of a PFOF market are calculated as a ratio of the difference between the execution prices on the PFOF market and the volume-weighted execution prices on the reference markets on the one hand to the volume-weighted execution prices on the reference markets on the other, in each case taking into account transaction costs.

A positive value represents a price improvements for the client or, put another way, a better price on the PFOF market compared to the reference markets, while a negative value indicates a price deteriorations or worse price on the PFOF market compared to the reference markets.

Figure 6 shows, first of all, the aggregated distribution of price improvements and deteriorations determined for all PFOF trading venues, split into DAX and non-DAX equities, based on the availability of total trading volumes comparable to the PFOF transaction on the reference markets and taking account of the EUR 2,000 transaction volume threshold.

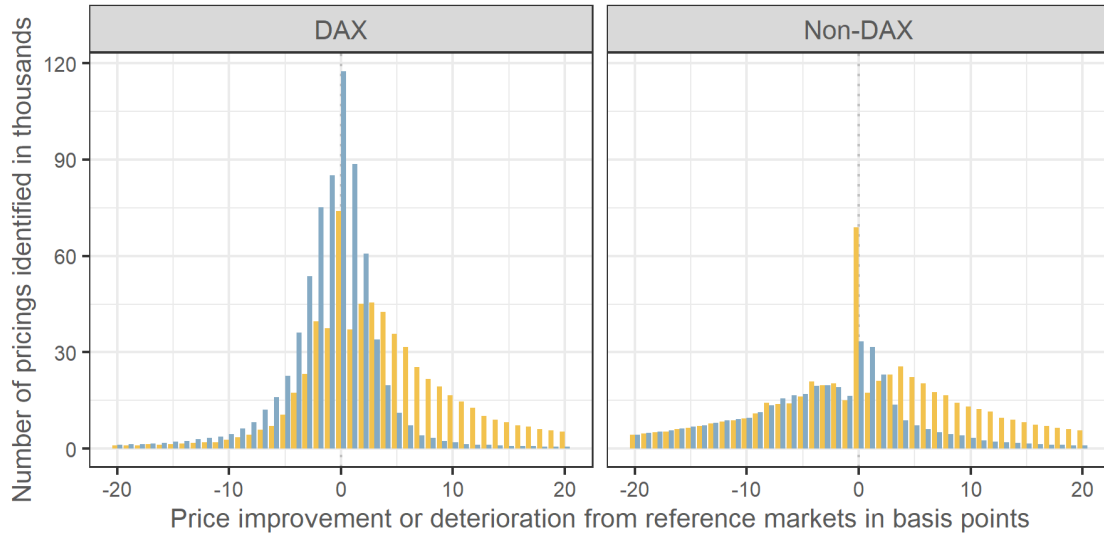
This shows that the spread of relative price differences is narrower for DAX equities than their non-DAX counterparts. In other words, trading in DAX equities tends to involve smaller relative price improvements and deteriorations compared to the reference markets than it does for non-DAX equities. The marked impact of transaction size on execution quality is also evident once again here. Figure 6 clearly shows that small-scale transactions up to EUR 2,000 shift the relative price improvements and deteriorations in the client's favour.

Figure 6

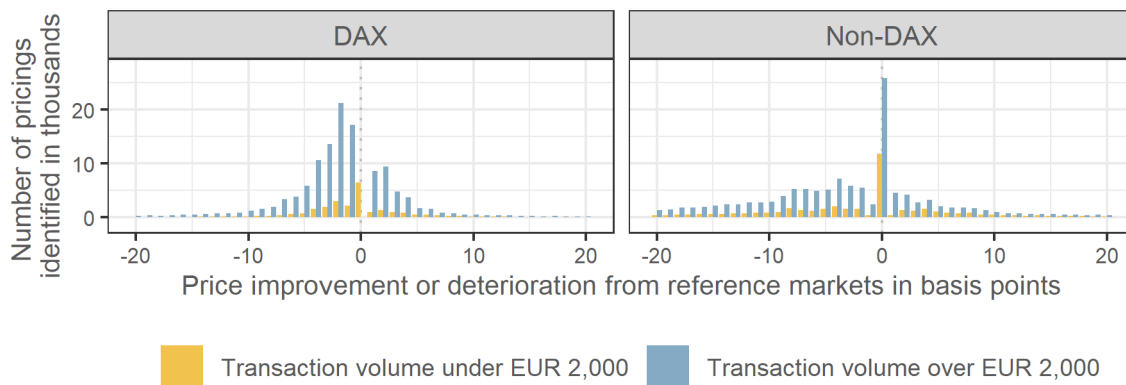
**Relative price improvements and deteriorations in trades on PFOF markets to the execution price on the reference markets with transaction volumes up to EUR 2,000 (yellow) and over EUR 2,000 (blue).**

Orders executed with transaction sizes ...

... not exceeding the trading volumes on all reference markets



...higher than the trading volumes on all reference markets at the time of execution



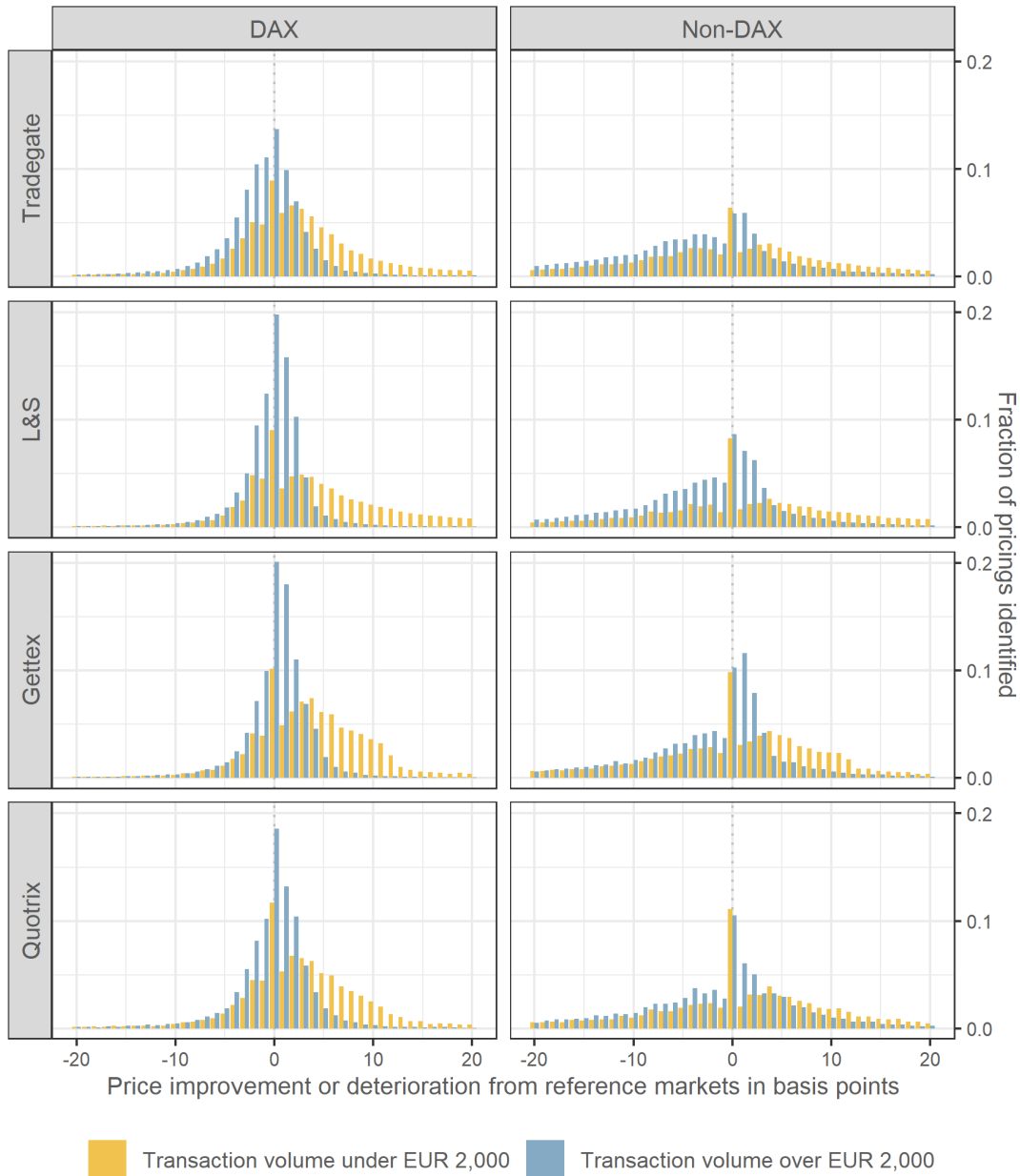
Transaction volume under EUR 2,000 Transaction volume over EUR 2,000

*Breakdown of transactions on the PFOF markets studied by relative price improvements and deteriorations compared to the corresponding execution prices on the reference markets, taking into account transaction costs and finally expressed in basis points (rounded). From the investor's point of view, negative figures represent a price deterioration compared with the reference market (price disadvantage), positive figures represent a price improvement (price advantage). A distinction was made between trades executed on the PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets (bottom) and trades for which this is not the case (top).*

The results of differentiating the data by individual PFOF market studied are shown in Figure 7. These confirm that the findings described above hold true across the board for every individual PFOF market, even though the extent of the shift in relative price improvements and deteriorations in the client's favour when considering small transaction sizes is not as marked or even in all cases. The individual PFOF markets also differ in terms of the spread of their relative price improvements and deteriorations.

Figure 7

Relative price improvements and deteriorations to the execution price on the reference markets for each PFOF market with transaction volumes up to EUR 2,000 (yellow) and over EUR 2,000 (blue).



*Break-down of transactions on the PFOF markets studied by relative price improvements and deteriorations compared to the corresponding execution prices on the reference markets, taking into account transaction costs and finally expressed in basis points (rounded). From the investor's point of view, negative figures represent a price deterioration compared to the reference market (price disadvantage), positive figures represent a price improvement (price advantage). Transactions with a trading volume of up to EUR 2,000 and over EUR 2,000 are shown separately. Only those orders on the PFOF markets studied whose volumes do not exceed those of the corresponding transactions on the reference markets were considered.*

### 2.3.2 Analysis by transaction volume

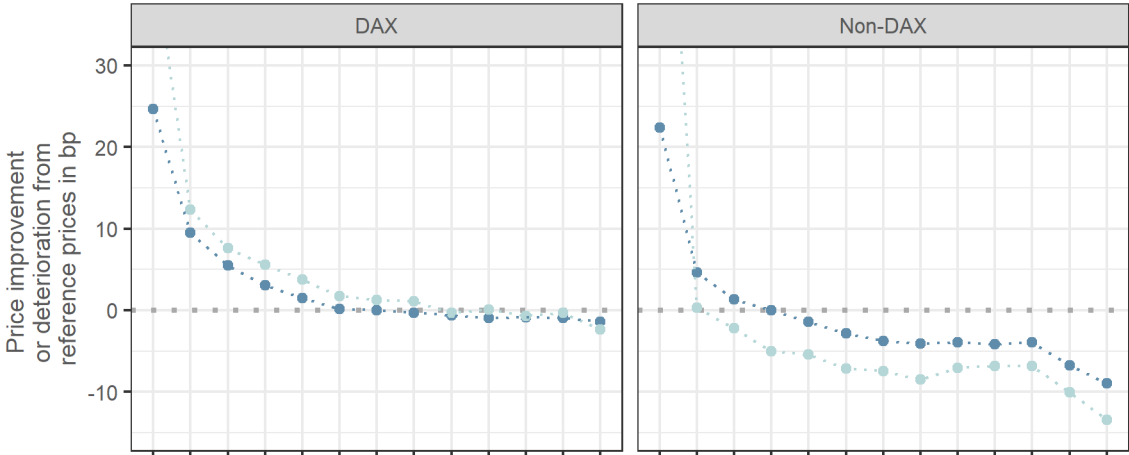
Figure 4 highlights once again the correlation between transaction volume and the expected price improvements or deteriorations when executing orders on a PFOF market compared to the reference prices. This reaffirms the idea that smaller transaction volumes tend to be associated with greater price improvements, while price deteriorations are to be expected upwards of a certain transaction size.

However, the transaction volume threshold beyond which the price improvements are lost varies depending on the statistical measure and the subset of equities. Measured against the median, therefore, this is the case upwards of around EUR 4,000 for DAX equities and from as little as around EUR 1,000 for non-DAX equities. Measured against the unweighted mean, this threshold is not reached until around EUR 15,000 for DAX equities and from as little as around EUR 500 for non-DAX equities.

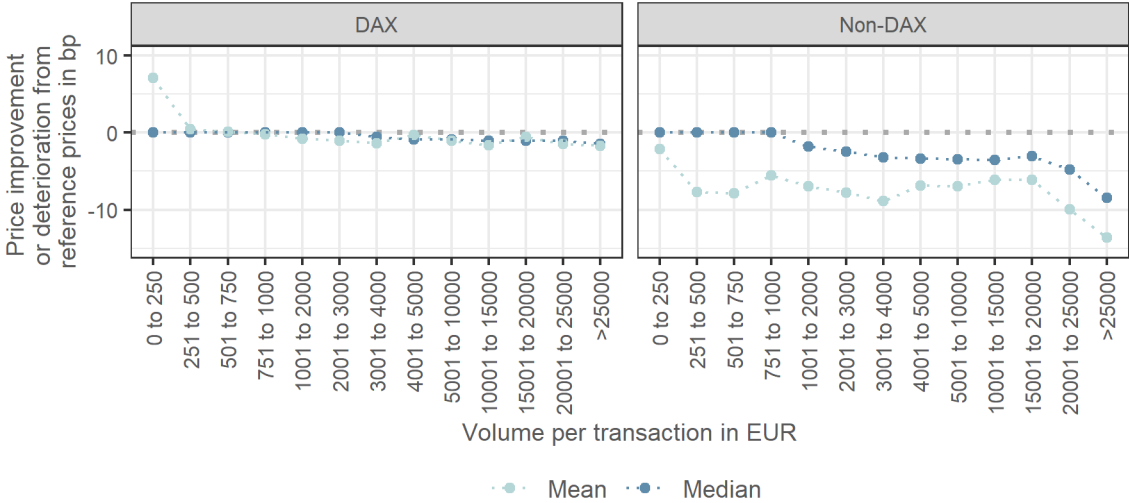
In addition, there is further confirmation that orders executed on PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets tend to be less advantageous for the client.

Figure 8  
**Relative price improvements and deteriorations in transactions on PFOF markets depending on transaction size**

Orders executed with transaction sizes ...  
 ... not exceeding the trading volumes on all reference markets



...higher than the trading volumes on all reference markets at the time of execution



Relative price improvement or deteriorations (unweighted mean in light blue, median in dark blue) on orders executed on the PFOF markets studied for each transaction size range compared to the corresponding execution prices on the reference markets, taking into account transaction costs and expressed in basis points (rounded). From the investor's point of view, negative figures represent a price deterioration compared to the reference market (price disadvantage), positive figures represent a price improvement (price advantage). A distinction was made between trades executed on the PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets (bottom) and trades for which this is not the case (top).

The table below uses example transaction sizes to highlight once again how the outcome is dependent on volume.

Table 4

**Average improvement/deteriorations for the client of executing orders on PFOF markets**

Price differentials, taking into account transaction costs, on executions involving transaction volumes that do not exceed those of the corresponding transactions on the reference markets.

Transaction size	DAX		Non-DAX	
	Average price improvement/deteriorations (mean) in bp	Improvement/deteriorations from client's perspective in EUR	Average price improvement/deteriorations (mean) in bp	Improvement/deteriorations from client's perspective in EUR
EUR 500	12.34 bp	0.62 EUR	0.28 bp	0.01 EUR
EUR 1,000	5.56 bp	0.56 EUR	-5.01 bp	-0.50 EUR
EUR 2,000	3.76 bp	0.75 EUR	-5.45 bp	-1.09 EUR
EUR 5,000	1.08 bp	0.54 EUR	-8.46 bp	-4.23 EUR
EUR 25,000	-0.30 bp	-0.75 EUR	-10.03 bp	-25.08 EUR

*Only those transactions on the PFOF markets studied were considered whose volumes do not exceed those of the corresponding transactions on the reference markets. The average price improvements and deteriorations are unweighted mean values. From the investor's point of view, negative figures represent a price deterioration compared with the reference market (price disadvantage), positive figures represent a price improvement (price advantage).*

Thus, for example, executing a transaction with a volume of EUR 500 on a PFOF market brings an average benefit of EUR 0.62 if trading DAX stocks and EUR 0.01 if trading non-DAX stocks.

A EUR 2,000 transaction involving DAX stocks is likely to attract an average benefit of EUR 0.75 on a PFOF market, while a transaction of exactly the same volume involving a non-DAX stock is likely to disadvantage the client to the tune of EUR 1.09.

As breaking the data down by each trading venue only reveals marginal differences between individual PFOF markets, no separate chart has been produced to illustrate this. The details are provided in table form in Annex II.

### 3 Summary and criticism

This study evaluates the execution quality on selected German trading venues that offer payment for order flow.

Included in the study were reports pursuant to Art. 26 MiFIR on transactions in all German equities for which BaFin is the Relevant Competent Authority. This comprises nearly 30% of the transactions and thus a relevant part of the trading activities on the PFOF-relevant trading venues.

In terms of methodology, the study is based on the Comparative Pricing Model described by the AFM in its study in order to be able to make comparable statements for trading in German equities in the discussion conducted. BaFin's study adds further elements to the methodology to reduce methodological limitations and further increase the meaningfulness of the results. In this way, transaction costs related to specific trading venues, transaction volumes and differences in the liquidity of the equities being traded were taken into account.



As a result, the study paints a more nuanced picture.

On average, execution on trading venues that offer PFOF appears to be advantageous from the client's point of view for smaller transaction volumes. In particular, for transaction volumes of up to EUR 2,000 in DAX equities and up to EUR 500 in non-DAX equities, retail clients achieve better overall results on PFOF markets than on the reference markets. By way of comparison, according to the transaction data available to BaFin, the average transaction size (median) of clients of neo-brokers is approximately EUR 350 for trading in DAX equities and approximately EUR 250 for trading in non-DAX equities.

According to Art. 27 (1) of the Markets in Financial Instruments Directive (MiFID II) and section 82 (3) of the (German) Securities Trading Act, best execution for retail clients is determined on the basis of total consideration, resulting from the price of the financial instrument and the costs in connection with the execution. This study therefore also takes into account any trading venue-specific transaction costs when comparing execution prices. As some reference markets charge for minimum costs for order execution, the size of a transaction is key to determine execution quality in the light of total consideration. In particular, due to these trading venue-specific transaction costs, the execution of smaller transaction volumes on PFOF markets turns out to be more advantageous than larger transaction volumes.

It should be noted at this point that, if further explicit costs are taken into account, the limit up to which transaction volumes executed on a PFOF market is to be assessed as advantageous from the retail client's point of view compared to execution on the reference markets could shift again. Thus, the present study considers only those costs that were directly attributable to an individual order in securities. Additional fixed costs incurred by intermediaries for connection to the trading venue or use of the infrastructure, or resulting broker-specific fees charged for execution via certain trading venues, were not taken into account.

The study results make it clear that other aspects of the transaction also influence the quality of execution. For one thing, the underlying liquidity of the equity being traded has an effect on execution quality. In proportional terms, therefore, DAX equities are more often associated with better execution quality for the client on PFOF markets than other German equities.

On the other hand, the consideration of the circumstance whether similar volumes were being traded on the reference markets at the time of execution at the PFOF market has an impact on the study results. The study indicates that execution quality suffers if the executed volume on the PFOF markets exceeds the matched trading volume on the reference markets in the same equity at the time of execution.

Although the findings described hold true in general, how much influence the individual factors exert on execution quality as well as the execution quality per se vary from case to case depending on the PFOF trading venue being studied.

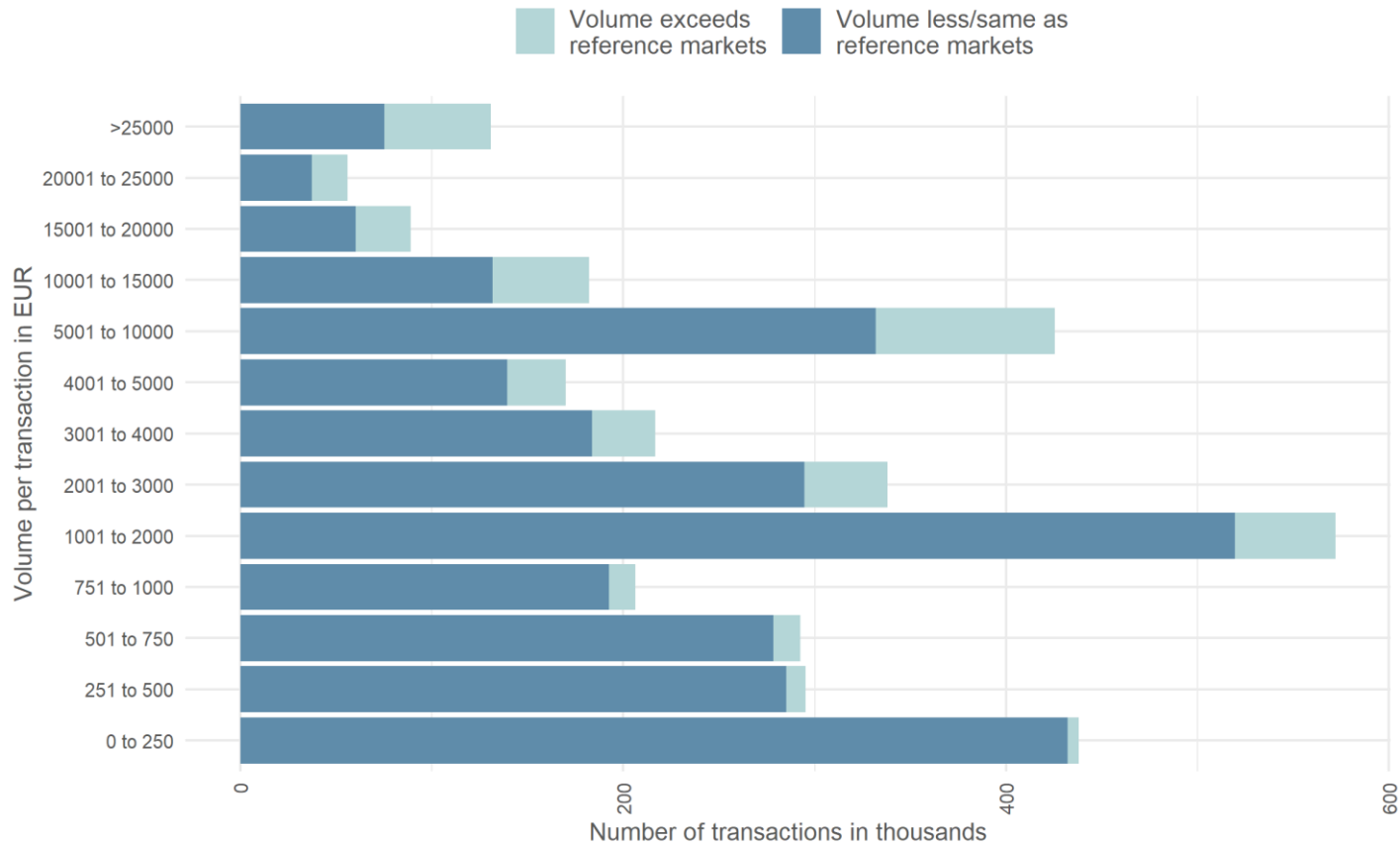
However, the question is as to whether the Comparative Pricing Model can actually deliver valid results, where the equities are less liquid and the number of available reference prices is correspondingly low or whether the database is too limited for valid results. Therefore, it could be useful to ensure that the full market information available at the relevant point in time including order book data is incorporated into the evaluation as well. An approach based on complete market information might assess the advantageousness of execution quality on the PFOF trading venue being studied differently than this present study's approach based on transaction data only.

In conclusion, however, let it be reiterated that this study assesses execution quality of orders on PFOF markets in comparison to the execution quality of orders on defined reference markets, taking into account venue-specific transaction costs. Causal links that would indicate whether the PFOF itself influences the quality of prices on the trading platforms investigated cannot be derived from this analysis – or from the AFM’s study. Furthermore, BaFin did not examine with this study which (long-term) impacts on the market quality and the effectiveness of the price formation mechanism on the (reference) markets could evolve, by a shift of the order flow to quote-driven execution venues determined by market makers. This would require a different methodological approach or study design.

## Annex I

Figure 9

Number of orders executed on PFOF markets by transaction size



The figure shows executed orders that could be compared against others executed at the same as them on the reference markets. A distinction was made between trades executed on the PFOF markets whose volumes exceed those of the corresponding transactions on the reference markets (light blue) and trades for which this is not the case (dark blue).

## Annex II

### Aggregated analysis covering all PFOF markets – DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	1,580,176	382,866	3,982.14	736,490	4,338.02	460,820	8,060.19	7.621	0.762	2.286	0.696
	0 to 250	172,293	50,937	136.65	90,671	143.20	30,685	138.78	43.671	4.367	13.101	24.622
	251 to 500	133,305	37,760	374.41	72,819	376.23	22,726	376.71	12.342	1.234	3.703	9.517
	501 to 750	139,560	41,228	600.96	74,638	603.78	23,694	605.01	7.636	0.764	2.291	5.468
	751 to 1,000	100,854	27,782	888.43	54,139	886.92	18,933	889.43	5.563	0.556	1.669	3.078
	1,001 to 2,000	274,244	72,859	1,399.32	138,655	1,405.97	62,730	1,449.86	3.763	0.376	1.129	1.489
	2,001 to 3,000	161,361	37,743	2,425.10	73,205	2,428.16	50,413	2,453.62	1.744	0.174	0.523	0.169
	3,001 to 4,000	102,246	21,655	3,445.42	43,204	3,445.31	37,387	3,449.42	1.254	0.125	0.376	0.000
	4,001 to 5,000	78,121	15,916	4,519.47	30,629	4,515.53	31,576	4,518.25	1.083	0.108	0.325	-0.344
	5,001 to 10,000	195,118	37,209	6,966.95	74,812	6,950.32	83,097	7,002.88	-0.283	-0.028	-0.085	-0.603
	10,001 to 15,000	85,795	15,969	11,837.18	33,007	11,869.36	36,819	11,842.47	0.047	0.005	0.014	-0.947
	15,001 to 20,000	43,013	8,328	17,389.76	16,434	17,370.28	18,251	17,362.53	-0.727	-0.073	-0.218	-0.827
	20,001 to 25,000	30,360	5,636	22,191.79	11,760	22,188.13	12,964	22,202.32	-0.302	-0.030	-0.091	-0.928
>25,000	63,906	9,844	40,215.88	22,517	41,899.58	31,545	49,496.47	-2.383	-0.238	-0.715	-1.428	
Y	Total	207,993	56,716	15,631.92	41,469	15,527.66	109,808	22,270.52	-1.126	-0.113	-0.338	-1.023
	0 to 250	652	199	168.67	127	172.77	326	178.94	7.073	0.707	2.122	0.000
	251 to 500	2,488	772	386.03	553	393.21	1,163	389.47	0.437	0.044	0.131	0.000
	501 to 750	4,243	1,331	607.01	816	610.65	2,096	610.02	0.149	0.015	0.045	0.000
	751 to 1,000	4,537	1,401	893.69	959	891.02	2,177	893.84	-0.207	-0.021	-0.062	0.000
	1,001 to 2,000	18,414	5,724	1,449.80	3,782	1,474.57	8,908	1,463.68	-0.798	-0.080	-0.239	0.000
	2,001 to 3,000	15,930	4,674	2,456.89	3,310	2,464.19	7,946	2,462.87	-1.032	-0.103	-0.310	0.000
	3,001 to 4,000	12,532	3,439	3,454.88	2,752	3,455.87	6,341	3,458.12	-1.399	-0.140	-0.420	-0.549
	4,001 to 5,000	11,764	3,276	4,545.15	2,353	4,521.49	6,135	4,540.14	-0.309	-0.031	-0.093	-0.848
	5,001 to 10,000	39,429	10,579	7,208.62	8,095	7,140.36	20,755	7,242.95	-1.049	-0.105	-0.315	-0.882
	10,001 to 15,000	25,060	6,729	11,953.84	5,161	11,920.42	13,170	11,956.43	-1.650	-0.165	-0.495	-1.066
	15,001 to 20,000	16,487	4,614	17,468.62	3,177	17,425.64	8,696	17,454.79	-0.584	-0.058	-0.175	-1.009
	20,001 to 25,000	13,375	3,665	22,289.11	2,736	22,283.70	6,974	22,262.82	-1.429	-0.143	-0.429	-1.022
>25,000	43,082	10,313	50,290.66	7,648	48,743.36	25,121	69,444.46	-1.750	-0.175	-0.525	-1.461	

## Aggregated analysis covering all PFOF markets – non-DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	1,382,251	335,803	1,959.32	541,757	2,429.41	504,691	3,864.97	10.065	1.006	3.019	0.000
	0 to 250	259,832	92,573	102.98	107,415	116.96	59,844	106.46	75.756	7.576	22.727	22.405
	251 to 500	151,853	44,735	367.00	68,389	371.40	38,729	376.48	0.278	0.028	0.084	4.627
	501 to 750	138,907	36,748	598.59	62,202	599.86	39,957	605.05	- 2.193	-0.219	-0.658	1.330
	751 to 1,000	91,729	21,472	885.14	38,554	885.41	31,703	888.46	- 5.009	-0.501	-1.503	0.000
	1,001 to 2,000	245,411	53,003	1,393.73	94,931	1,397.22	97,477	1,427.44	- 5.449	-0.545	-1.635	-1.378
	2,001 to 3,000	133,349	25,929	2,452.18	47,601	2,448.81	59,819	2,455.20	- 7.114	-0.711	-2.134	-2.826
	3,001 to 4,000	81,434	15,209	3,446.95	27,791	3,453.07	38,434	3,463.14	- 7.469	-0.747	-2.241	-3.780
	4,001 to 5,000	61,243	10,946	4,485.74	20,885	4,497.45	29,412	4,492.84	- 8.464	-0.846	-2.539	-4.060
	5,001 to 10,000	136,779	23,570	6,827.13	47,380	6,860.83	65,829	6,890.26	- 7.070	-0.707	-2.121	-3.963
	10,001 to 15,000	45,948	7,012	11,805.23	16,061	11,792.58	22,875	11,868.97	- 6.805	-0.680	-2.041	-4.165
	15,001 to 20,000	17,363	2,632	16,607.18	5,761	16,677.28	8,970	16,860.29	- 6.843	-0.684	-2.053	-3.914
	20,001 to 25,000	7,040	905	21,866.50	2,093	21,990.86	4,042	22,142.98	- 10.031	-1.003	-3.009	-6.780
>25,000	11,363	1,069	41,927.37	2,694	41,228.06	7,600	47,400.77	- 13.462	-1.346	-4.039	-8.926	
Y	Total	241,857	66,154	7,057.77	43,442	6,916.26	132,261	10,207.94	- 7.393	-0.739	-2.218	-3.177
	0 to 250	5,079	1,878	140.92	841	137.18	2,360	143.35	- 2.138	-0.214	-0.641	0.000
	251 to 500	7,611	2,648	390.96	1,377	390.83	3,586	388.74	- 7.742	-0.774	-2.323	0.000
	501 to 750	9,861	3,223	604.14	1,938	603.54	4,700	607.31	- 7.899	-0.790	-2.370	0.000
	751 to 1,000	9,147	2,876	891.21	1,806	893.07	4,465	893.42	- 5.513	-0.551	-1.654	0.000
	1,001 to 2,000	34,072	10,072	1,442.97	6,640	1,451.43	17,360	1,459.28	- 6.951	-0.695	-2.085	-1.791
	2,001 to 3,000	27,401	7,742	2,476.78	5,233	2,471.70	14,426	2,472.15	- 7.784	-0.778	-2.335	-2.478
	3,001 to 4,000	20,605	5,351	3,470.02	4,019	3,478.41	11,235	3,483.36	- 8.895	-0.889	-2.668	-3.186
	4,001 to 5,000	18,936	5,041	4,512.07	3,400	4,501.48	10,495	4,511.60	- 6.872	-0.687	-2.062	-3.346
	5,001 to 10,000	54,021	14,032	7,075.82	9,715	7,040.78	30,274	7,095.68	- 6.966	-0.697	-2.090	-3.464
	10,001 to 15,000	25,395	6,445	11,920.79	4,421	11,907.94	14,529	11,938.01	- 6.089	-0.609	-1.827	-3.570
	15,001 to 20,000	12,092	3,164	16,721.13	1,919	16,801.66	7,009	16,825.09	- 6.120	-0.612	-1.836	-3.080
	20,001 to 25,000	5,158	1,250	22,122.88	784	22,071.39	3,124	22,103.63	- 9.975	-0.997	-2.992	-4.798
>25,000	12,479	2,432	53,203.41	1,349	55,278.76	8,698	71,144.50	- 13.571	-1.357	-4.071	-8.443	

## Tradegate – DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	834,034	204,188	5,146.07	322,882	6,255.17	306,964	9,915.76	3.088	0.309	0.926	0.000
	0 to 250	31,432	12,035	143.89	14,138	149.16	5,259	149.62	42.121	4.212	12.636	25.421
	251 to 500	37,814	13,458	381.72	17,425	383.20	6,931	386.13	11.705	1.170	3.511	9.464
	501 to 750	43,140	14,894	609.58	19,802	612.81	8,444	612.79	7.200	0.720	2.160	5.066
	751 to 1,000	43,239	13,914	891.88	20,006	893.08	9,319	896.33	4.742	0.474	1.422	2.761
	1,001 to 2,000	148,618	43,253	1,418.98	65,604	1,432.76	39,761	1,472.00	3.601	0.360	1.080	1.149
	2,001 to 3,000	102,866	25,652	2,429.75	40,464	2,437.05	36,750	2,460.32	1.067	0.107	0.320	0.000
	3,001 to 4,000	68,826	15,267	3,448.29	25,238	3,453.37	28,321	3,451.68	0.513	0.051	0.154	-0.340
	4,001 to 5,000	54,326	11,434	4,521.36	18,590	4,523.02	24,302	4,523.37	0.805	0.081	0.242	-0.734
	5,001 to 10,000	136,131	26,351	6,960.04	45,074	6,971.10	64,706	7,012.84	-1.198	-0.120	-0.359	-0.952
	10,001 to 15,000	63,091	11,607	11,762.86	21,486	11,853.06	29,998	11,835.03	-0.698	-0.070	-0.209	-1.294
	15,001 to 20,000	31,156	5,514	17,291.41	10,644	17,325.57	14,998	17,363.51	-0.814	-0.081	-0.244	-1.313
	20,001 to 25,000	22,693	3,793	22,149.91	8,000	22,155.06	10,900	22,196.63	-1.134	-0.113	-0.340	-1.345
>25,000	50,702	7,016	42,056.44	16,411	41,831.91	27,275	49,826.01	-3.141	-0.314	-0.942	-1.793	
Y	Total	154,605	42,011	16,251.71	28,205	16,282.87	84,389	23,533.12	-1.222	-0.122	-0.366	-1.190
	0 to 250	262	96	178.18	39	171.73	127	180.49	7.092	0.709	2.128	0.000
	251 to 500	1,186	407	391.07	222	403.10	557	393.69	0.625	0.062	0.187	0.000
	501 to 750	2,038	708	613.41	321	617.66	1,009	618.43	0.222	0.022	0.067	0.000
	751 to 1,000	2,701	901	893.48	478	897.93	1,322	897.12	-0.127	-0.013	-0.038	0.000
	1,001 to 2,000	12,471	4,028	1,465.16	2,320	1,487.71	6,123	1,480.19	-0.676	-0.068	-0.203	0.000
	2,001 to 3,000	11,808	3,549	2,454.65	2,260	2,474.32	5,999	2,465.19	-0.892	-0.089	-0.268	-0.674
	3,001 to 4,000	9,435	2,628	3,462.66	1,905	3,464.71	4,902	3,457.14	-1.399	-0.140	-0.420	-1.005
	4,001 to 5,000	8,948	2,565	4,552.93	1,644	4,517.35	4,739	4,542.14	-0.267	-0.027	-0.080	-1.005
	5,001 to 10,000	29,811	8,088	7,186.30	5,620	7,141.97	16,103	7,235.02	-1.206	-0.121	-0.362	-1.050
	10,001 to 15,000	19,519	5,168	11,889.93	3,650	11,891.97	10,701	11,948.18	-2.018	-0.202	-0.606	-1.306
	15,001 to 20,000	12,315	3,272	17,404.12	2,165	17,358.69	6,878	17,437.18	-1.183	-0.118	-0.355	-1.208
	20,001 to 25,000	10,283	2,656	22,217.48	1,990	22,247.44	5,637	22,249.55	-1.804	-0.180	-0.541	-1.238
>25,000	33,828	7,945	51,657.34	5,591	48,303.86	20,292	70,561.97	-1.435	-0.144	-0.431	-1.631	

## Tradegate – non-DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	653,231	154,005	3,111.27	208,398	3,867.60	290,828	5,223.35	-1.472	-0.147	-0.442	-2.568
	0 to 250	40,496	16,636	123.74	14,949	133.75	8,911	133.12	55.804	5.580	16.741	23.627
	251 to 500	42,084	14,691	375.65	15,478	379.81	11,915	386.31	5.611	0.561	1.683	4.866
	501 to 750	43,344	13,615	608.33	15,482	609.48	14,247	614.67	-0.273	-0.027	-0.082	1.030
	751 to 1,000	39,226	10,746	889.53	13,311	891.19	15,169	893.74	-2.905	-0.290	-0.871	-0.003
	1,001 to 2,000	132,290	32,244	1,414.31	41,759	1,426.58	58,287	1,449.28	-4.712	-0.471	-1.414	-2.180
	2,001 to 3,000	85,892	18,302	2,457.66	25,859	2,457.70	41,731	2,461.70	-7.012	-0.701	-2.104	-3.597
	3,001 to 4,000	57,278	11,427	3,449.52	17,086	3,459.56	28,765	3,468.84	-7.549	-0.755	-2.265	-4.455
	4,001 to 5,000	44,421	8,398	4,481.26	13,339	4,493.44	22,684	4,491.38	-8.967	-0.897	-2.690	-4.891
	5,001 to 10,000	103,312	18,402	6,832.17	32,142	6,873.52	52,768	6,904.71	-7.288	-0.729	-2.186	-4.691
	10,001 to 15,000	35,952	5,649	11,785.57	11,337	11,765.53	18,966	11,858.26	-6.744	-0.674	-2.023	-4.673
	15,001 to 20,000	14,214	2,168	16,548.40	4,468	16,555.46	7,578	16,806.08	-6.240	-0.624	-1.872	-4.027
	20,001 to 25,000	5,554	772	21,883.51	1,431	21,920.20	3,351	22,126.08	-10.244	-1.024	-3.073	-7.148
>25,000	9,168	955	42,957.95	1,757	42,684.44	6,456	48,229.99	-14.036	-1.404	-4.211	-9.498	
Y	Total	182,246	52,184	7,631.67	30,121	7,573.38	99,941	10,754.49	-6.021	-0.602	-1.806	-3.343
	0 to 250	2,312	935	152.51	304	153.56	1,073	151.10	0.437	0.044	0.131	0.000
	251 to 500	4,281	1,669	395.22	610	391.54	2,002	392.47	-2.366	-0.237	-0.710	0.000
	501 to 750	5,484	1,988	607.60	866	610.43	2,630	613.16	-5.513	-0.551	-1.654	0.000
	751 to 1,000	5,946	2,064	893.87	979	896.14	2,903	897.52	-2.031	-0.203	-0.609	0.000
	1,001 to 2,000	24,409	7,725	1,451.90	4,227	1,467.61	12,457	1,468.86	-5.037	-0.504	-1.511	-2.004
	2,001 to 3,000	20,981	6,217	2,479.39	3,680	2,475.97	11,084	2,474.96	-6.612	-0.661	-1.984	-2.811
	3,001 to 4,000	16,301	4,402	3,471.98	2,988	3,482.31	8,911	3,485.88	-8.783	-0.878	-2.635	-3.434
	4,001 to 5,000	15,128	4,214	4,505.91	2,520	4,500.89	8,394	4,510.52	-5.683	-0.568	-1.705	-3.539
	5,001 to 10,000	43,595	11,682	7,075.12	7,418	7,035.78	24,495	7,093.11	-5.830	-0.583	-1.749	-3.631
	10,001 to 15,000	20,406	5,343	11,907.23	3,436	11,877.24	11,627	11,906.96	-5.139	-0.514	-1.542	-3.571
	15,001 to 20,000	9,837	2,654	16,695.32	1,508	16,690.97	5,675	16,729.31	-4.645	-0.465	-1.394	-3.003
	20,001 to 25,000	4,017	1,099	22,123.88	597	22,008.90	2,321	22,056.95	-8.549	-0.855	-2.565	-4.249
>25,000	9,549	2,192	54,105.29	988	58,757.91	6,369	77,982.95	-12.111	-1.211	-3.633	-8.443	

## L&S – DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	601,366	133,245	1,579.50	345,107	2,436.37	123,014	3,627.07	14.832	1.483	4.450	2.289
	0 to 250	139,171	38,320	134.24	75,784	142.01	25,067	136.42	44.063	4.406	13.219	24.457
	251 to 500	90,444	22,475	371.22	52,909	374.28	15,060	372.68	12.748	1.275	3.824	9.495
	501 to 750	68,426	16,993	602.23	40,211	605.82	11,222	605.46	7.866	0.787	2.360	5.486
	751 to 1,000	47,471	10,772	884.54	28,688	882.84	8,011	882.22	6.371	0.637	1.911	3.259
	1,001 to 2,000	99,683	21,433	1,366.60	59,888	1,381.75	18,362	1,407.39	4.492	0.449	1.348	1.790
	2,001 to 3,000	44,600	7,984	2,403.37	26,097	2,412.00	10,519	2,429.24	3.049	0.305	0.915	0.462
	3,001 to 4,000	24,364	3,918	3,428.81	13,770	3,433.09	6,676	3,440.67	3.014	0.301	0.904	0.137
	4,001 to 5,000	16,627	2,549	4,497.38	8,878	4,497.36	5,200	4,491.33	0.960	0.096	0.288	0.000
	5,001 to 10,000	38,980	5,182	6,943.00	21,126	6,906.01	12,672	6,954.39	1.872	0.187	0.562	0.000
	10,001 to 15,000	13,970	1,700	11,727.48	7,737	11,825.19	4,533	11,865.63	2.687	0.269	0.806	-0.152
	15,001 to 20,000	6,252	798	17,374.52	3,552	17,376.65	1,902	17,315.91	2.293	0.229	0.688	0.000
20,001 to 25,000	4,270	525	22,174.78	2,498	22,213.19	1,247	22,223.56	2.362	0.236	0.709	0.000	
>25,000	7,108	596	37,605.27	3,969	43,603.05	2,543	48,370.04	0.192	0.019	0.057	-0.716	
Y	Total	33,700	7,803	10,058.20	8,734	12,576.68	17,163	16,684.23	-1.219	-0.122	-0.366	-0.667
	0 to 250	375	101	159.10	84	172.01	190	177.17	7.677	0.768	2.303	0.000
	251 to 500	1,200	333	380.60	308	385.63	559	386.03	0.369	0.037	0.111	0.000
	501 to 750	1,524	392	606.85	351	610.90	781	607.03	-0.492	-0.049	-0.148	0.000
	751 to 1,000	1,485	390	893.12	395	885.58	700	888.74	-0.628	-0.063	-0.188	0.000
	1,001 to 2,000	4,498	1,205	1,407.21	1,145	1,452.73	2,148	1,421.17	-1.456	-0.146	-0.437	0.000
	2,001 to 3,000	3,004	785	2,450.05	789	2,435.33	1,430	2,449.89	-1.411	-0.141	-0.423	0.000
	3,001 to 4,000	2,149	515	3,436.77	588	3,437.60	1,046	3,463.46	-1.710	-0.171	-0.513	0.000
	4,001 to 5,000	1,859	405	4,493.11	479	4,530.31	975	4,523.18	-1.644	-0.164	-0.493	-0.662
	5,001 to 10,000	6,034	1,341	7,178.31	1,591	7,096.85	3,102	7,265.00	-0.691	-0.069	-0.207	-0.656
	10,001 to 15,000	3,126	701	11,998.44	876	11,913.22	1,549	11,963.55	-0.692	-0.069	-0.208	-0.677
	15,001 to 20,000	2,046	483	17,499.10	541	17,475.83	1,022	17,470.48	2.314	0.231	0.694	-0.656
20,001 to 25,000	1,652	400	22,368.78	463	22,309.72	789	22,250.78	-1.118	-0.112	-0.335	-0.705	
>25,000	4,748	752	46,688.72	1,124	53,256.40	2,872	67,527.40	-4.495	-0.450	-1.349	-1.319	



## L&S – non-DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	626,656	157,653	752.25	288,718	1,379.44	180,285	1,819.84	24.303	2.430	7.291	1.341
	0 to 250	216,961	75,142	98.10	91,481	113.94	50,338	101.35	79.878	7.988	23.963	22.276
	251 to 500	103,694	28,302	362.81	50,134	368.49	25,258	371.75	-1.760	-0.176	-0.528	4.626
	501 to 750	69,386	16,365	598.76	34,390	602.50	18,631	605.21	-3.658	-0.366	-1.097	1.423
	751 to 1,000	43,190	8,677	880.52	21,036	882.33	13,477	883.30	-6.743	-0.674	-2.023	0.000
	1,001 to 2,000	91,010	15,970	1,357.43	43,585	1,373.50	31,455	1,393.47	-6.485	-0.648	-1.945	-0.529
	2,001 to 3,000	36,965	5,394	2,437.88	17,412	2,436.30	14,159	2,440.45	-7.750	-0.775	-2.325	-2.002
	3,001 to 4,000	18,171	2,485	3,435.46	8,293	3,437.08	7,393	3,443.91	-7.318	-0.732	-2.195	-2.589
	4,001 to 5,000	12,312	1,546	4,483.35	5,751	4,497.39	5,015	4,493.08	-7.734	-0.773	-2.320	-2.803
	5,001 to 10,000	23,368	2,835	6,647.82	11,045	6,789.38	9,488	6,815.42	-6.884	-0.688	-2.065	-2.789
	10,001 to 15,000	6,729	618	11,813.44	3,368	11,891.78	2,743	11,918.48	-7.227	-0.723	-2.168	-3.360
	15,001 to 20,000	2,019	172	17,030.90	903	17,138.02	944	17,249.92	-8.563	-0.856	-2.569	-4.638
	20,001 to 25,000	1,056	65	21,963.01	516	22,159.13	475	22,230.63	-8.782	-0.878	-2.635	-4.610
>25,000	1,795	82	33,116.76	804	39,164.27	909	43,827.79	-13.349	-1.335	-4.005	-6.668	
Y	Total	42,380	9,176	4,088.73	9,651	5,142.96	23,553	8,438.69	-12.576	-1.258	-3.773	-3.032
	0 to 250	2,651	895	127.93	520	127.39	1,236	135.81	-3.991	-0.399	-1.197	0.000
	251 to 500	3,031	895	383.14	708	389.65	1,428	383.75	-14.546	-1.455	-4.364	0.000
	501 to 750	3,081	851	605.58	771	605.20	1,459	606.15	-12.055	-1.206	-3.617	0.000
	751 to 1,000	2,502	623	884.35	662	886.24	1,217	886.24	-12.833	-1.283	-3.850	0.000
	1,001 to 2,000	7,359	1,733	1,402.42	1,896	1,421.54	3,730	1,428.70	-12.856	-1.286	-3.857	-1.425
	2,001 to 3,000	4,581	996	2,457.79	1,154	2,460.09	2,431	2,456.74	-12.987	-1.299	-3.896	-2.291
	3,001 to 4,000	2,972	591	3,454.82	721	3,461.28	1,660	3,468.51	-8.896	-0.890	-2.669	-2.819
	4,001 to 5,000	2,497	471	4,519.07	578	4,515.46	1,448	4,504.43	-12.590	-1.259	-3.777	-3.417
	5,001 to 10,000	6,534	1,220	6,954.10	1,393	7,002.91	3,921	7,076.60	-13.646	-1.365	-4.094	-3.555
	10,001 to 15,000	2,965	497	11,922.35	608	12,009.60	1,860	12,044.96	-11.605	-1.160	-3.481	-3.969
	15,001 to 20,000	1,221	174	17,146.50	215	17,300.32	832	17,232.04	-17.902	-1.790	-5.371	-5.401
	20,001 to 25,000	752	68	22,259.00	129	22,257.32	555	22,252.88	-16.363	-1.636	-4.909	-6.772
>25,000	2,234	162	49,625.46	296	47,134.80	1,776	53,861.31	-17.549	-1.755	-5.265	-7.888	

## Gettex – DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	104,954	34,277	5,109.51	50,365	4,072.48	20,312	5,992.51	4.301	0.430	1.290	1.360
	0 to 250	961	341	150.37	441	151.91	179	141.24	39.038	3.904	11.712	23.957
	251 to 500	4,022	1,511	355.98	1,981	363.41	530	363.70	10.862	1.086	3.259	11.574
	501 to 750	23,162	7,731	583.64	12,273	584.83	3,158	587.49	8.243	0.824	2.473	6.321
	751 to 1,000	8,078	2,505	886.03	4,372	884.38	1,201	885.30	6.677	0.668	2.003	3.556
	1,001 to 2,000	20,061	6,386	1,374.61	10,319	1,375.00	3,356	1,424.45	2.547	0.255	0.764	2.201
	2,001 to 3,000	10,081	3,128	2,435.58	4,812	2,435.12	2,141	2,451.04	3.593	0.359	1.078	1.084
	3,001 to 4,000	6,207	1,803	3,452.76	2,844	3,433.03	1,560	3,448.44	1.210	0.121	0.363	0.601
	4,001 to 5,000	4,813	1,364	4,532.68	2,091	4,510.43	1,358	4,525.40	1.188	0.119	0.356	0.344
	5,001 to 10,000	13,012	3,875	7,028.14	5,585	7,000.43	3,552	7,008.86	1.728	0.173	0.518	0.519
	10,001 to 15,000	5,423	1,819	12,312.34	2,298	12,115.59	1,306	11,952.91	0.252	0.025	0.076	0.413
	15,001 to 20,000	3,902	1,524	17,786.65	1,584	17,716.66	794	17,470.66	-1.190	-0.119	-0.357	0.463
	20,001 to 25,000	2,128	943	22,241.63	739	22,156.29	446	22,130.35	0.253	0.025	0.076	0.480
>25,000	3,104	1,347	30,662.48	1,026	35,869.80	731	44,845.77	1.761	0.176	0.528	0.480	
Y	Total	9,885	3,396	12,264.39	2,311	11,244.99	4,178	14,812.65	-0.152	-0.015	-0.046	0.000
	0 to 250	7	0	n.a.	2	249.89	5	200.13	-11.017	-1.102	-3.305	-2.239
	251 to 500	78	22	381.36	17	392.14	39	377.93	-1.133	-0.113	-0.340	-0.559
	501 to 750	511	167	586.55	108	590.85	236	584.06	0.751	0.075	0.225	0.000
	751 to 1,000	244	75	900.73	61	874.85	108	891.29	0.875	0.087	0.262	0.000
	1,001 to 2,000	968	318	1,411.29	214	1,458.21	436	1,437.97	0.233	0.023	0.070	0.000
	2,001 to 3,000	727	212	2,469.63	181	2,461.06	334	2,470.80	-0.824	-0.082	-0.247	0.000
	3,001 to 4,000	564	163	3,414.87	160	3,441.84	241	3,466.95	-0.951	-0.095	-0.285	0.000
	4,001 to 5,000	569	177	4,547.89	138	4,539.88	254	4,573.17	2.418	0.242	0.725	0.000
	5,001 to 10,000	1,957	612	7,409.32	485	7,232.72	860	7,297.01	-0.345	-0.034	-0.103	0.000
	10,001 to 15,000	1,226	441	12,374.83	324	12,234.51	461	12,062.82	-0.647	-0.065	-0.194	0.000
	15,001 to 20,000	1,288	552	17,873.16	282	17,921.06	454	17,764.92	0.011	0.001	0.003	0.000
	20,001 to 25,000	676	292	22,454.15	134	22,174.58	250	22,314.26	0.465	0.046	0.139	0.000
>25,000	1,070	365	34,870.18	205	41,127.53	500	65,415.75	-1.167	-0.117	-0.350	0.000	

## Gettex – non-DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	71,925	16,199	2,018.05	32,289	2,112.73	23,437	2,594.51	-2.875	-0.288	-0.863	0.000
	0 to 250	1,180	405	128.69	501	140.81	274	136.54	57.693	5.769	17.308	16.159
	251 to 500	4,298	1,260	352.20	1,970	368.75	1,068	371.69	0.333	0.033	0.100	3.442
	501 to 750	20,941	5,172	577.40	10,113	579.57	5,656	584.50	-1.091	-0.109	-0.327	1.348
	751 to 1,000	7,288	1,554	880.43	3,338	881.04	2,396	883.26	-5.343	-0.534	-1.603	0.000
	1,001 to 2,000	16,658	3,416	1,358.83	7,366	1,364.85	5,876	1,392.37	-5.122	-0.512	-1.537	-0.133
	2,001 to 3,000	7,066	1,420	2,436.80	2,927	2,436.76	2,719	2,434.60	-5.758	-0.576	-1.727	-1.089
	3,001 to 4,000	3,747	767	3,448.07	1,531	3,458.64	1,449	3,458.74	-6.822	-0.682	-2.046	-1.244
	4,001 to 5,000	2,739	556	4,537.81	1,123	4,528.19	1,060	4,518.04	-5.252	-0.525	-1.576	-1.401
	5,001 to 10,000	5,635	1,215	7,010.38	2,434	6,949.19	1,986	6,817.82	-4.685	-0.468	-1.405	-0.494
	10,001 to 15,000	1,540	302	11,817.18	714	11,571.44	524	11,806.06	-10.860	-1.086	-3.258	-0.370
	15,001 to 20,000	463	104	17,446.81	164	17,250.90	195	17,080.08	-13.101	-1.310	-3.930	-2.210
	20,001 to 25,000	180	19	21,598.37	58	21,717.75	103	22,115.10	-10.088	-1.009	-3.026	-4.297
>25,000	190	9	28,780.72	50	35,751.31	131	38,272.96	13.355	1.336	4.007	-7.555	
Y	Total	7,982	1,772	4,953.53	1,847	4,372.77	4,363	6,983.64	-11.019	-1.102	-3.306	-2.718
	0 to 250	42	14	188.36	7	187.18	21	168.45	-15.670	-1.567	-4.701	-0.841
	251 to 500	180	42	378.93	43	389.62	95	377.68	-24.005	-2.400	-7.201	-2.550
	501 to 750	873	200	582.23	239	577.33	434	584.82	-10.592	-1.059	-3.177	0.000
	751 to 1,000	459	94	891.55	125	898.14	240	880.85	-7.443	-0.744	-2.233	-1.697
	1,001 to 2,000	1,393	278	1,424.04	349	1,408.94	766	1,445.68	-9.473	-0.947	-2.842	-2.913
	2,001 to 3,000	956	233	2,475.36	217	2,472.17	506	2,473.61	-8.859	-0.886	-2.658	-2.124
	3,001 to 4,000	675	153	3,488.22	166	3,486.01	356	3,483.48	-10.060	-1.006	-3.018	-2.220
	4,001 to 5,000	634	136	4,579.74	154	4,475.21	344	4,521.02	-12.638	-1.264	-3.791	-2.365
	5,001 to 10,000	1,540	400	7,096.70	357	7,166.55	783	7,222.10	-11.407	-1.141	-3.422	-1.896
	10,001 to 15,000	622	130	11,966.28	116	11,863.94	376	12,055.22	-10.738	-1.074	-3.221	-3.772
	15,001 to 20,000	261	57	17,539.01	51	17,393.43	153	17,237.45	-12.775	-1.277	-3.832	-4.428
	20,001 to 25,000	112	13	21,798.42	13	21,294.43	86	22,021.39	-13.213	-1.321	-3.964	-7.947
>25,000	235	22	34,193.88	10	41,359.41	203	49,713.05	-19.958	-1.996	-5.988	-10.795	

## Quotrix – DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	39,822	11,156	7,911.35	18,136	7,129.64	10,530	9,744.93	2.555	0.255	0.766	0.499
	0 to 250	729	241	139.24	308	148.18	180	149.04	41.557	4.156	12.467	17.500
	251 to 500	1,025	316	378.51	504	389.97	205	387.71	5.812	0.581	1.744	7.086
	501 to 750	4,832	1,610	591.09	2,352	591.76	870	587.29	5.341	0.534	1.602	5.098
	751 to 1,000	2,066	591	888.23	1,073	891.70	402	885.76	-0.180	-0.018	-0.054	2.646
	1,001 to 2,000	5,882	1,787	1,404.17	2,844	1,410.16	1,251	1,437.84	-0.354	-0.035	-0.106	1.596
	2,001 to 3,000	3,814	979	2,446.75	1,832	2,443.69	1,003	2,469.44	-0.174	-0.017	-0.052	0.385
	3,001 to 4,000	2,849	667	3,457.53	1,352	3,445.33	830	3,444.26	4.173	0.417	1.252	0.100
	4,001 to 5,000	2,355	569	4,548.71	1,070	4,545.88	716	4,526.11	8.119	0.812	2.436	0.062
	5,001 to 10,000	6,995	1,801	7,005.34	3,027	6,857.58	2,167	6,979.43	1.781	0.178	0.534	0.011
	10,001 to 15,000	3,311	843	12,056.44	1,486	11,954.15	982	11,816.06	2.780	0.278	0.834	0.165
	15,001 to 20,000	1,703	492	17,287.35	654	17,224.30	557	17,341.03	-9.156	-0.916	-2.747	0.118
	20,001 to 25,000	1,269	375	22,513.89	523	22,619.31	371	22,384.60	4.685	0.469	1.406	0.311
>25,000	2,992	885	41,923.15	1,111	42,382.05	996	46,761.34	0.048	0.005	0.014	0.262	
Y	Total	9,803	3,506	23,872.04	2,219	22,003.68	4,078	27,294.36	-0.279	-0.028	-0.084	0.000
	0 to 250	8	2	195.73	2	148.09	4	187.05	-3.856	-0.386	-1.157	-0.851
	251 to 500	24	10	372.38	6	419.60	8	392.32	-0.467	-0.047	-0.140	0.000
	501 to 750	170	64	590.49	36	605.16	70	609.67	3.040	0.304	0.912	0.000
	751 to 1,000	107	35	890.43	25	884.37	47	883.75	1.037	0.104	0.311	0.000
	1,001 to 2,000	477	173	1,459.83	103	1,455.25	201	1,470.75	0.096	0.010	0.029	0.000
	2,001 to 3,000	391	128	2,539.97	80	2,469.92	183	2,473.84	-2.750	-0.275	-0.825	0.000
	3,001 to 4,000	384	133	3,420.24	99	3,416.94	152	3,439.27	-0.335	-0.033	-0.100	0.000
	4,001 to 5,000	388	129	4,550.17	92	4,522.03	167	4,532.19	1.024	0.102	0.307	0.000
	5,001 to 10,000	1,627	538	7,391.45	399	7,179.02	690	7,261.47	-0.319	-0.032	-0.096	0.000
	10,001 to 15,000	1,189	419	12,224.28	311	11,947.47	459	12,017.77	0.861	0.086	0.258	0.000
	15,001 to 20,000	838	307	17,380.77	189	17,309.82	342	17,350.43	0.271	0.027	0.081	0.000
	20,001 to 25,000	764	317	22,636.66	149	22,785.24	298	22,502.50	1.276	0.128	0.383	0.000
>25,000	3,436	1,251	48,275.36	728	47,295.35	1,457	59,041.98	-1.228	-0.123	-0.368	0.000	

## Quotrix – non-DAX equities

Volume exceeds reference markets	Volume of each transaction	Number of transactions with a reference price	Better execution		Similar execution		Worse execution		Price improvements/deteriorations			
			Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Number of transactions	Average transaction volume (EUR)	Mean (bp)	...with a EUR 1,000 transaction volume (EUR)	...with a EUR 3,000 transaction volume (EUR)	Median (bp)
N	Total	30,439	7,946	3,462.21	12,352	3,534.91	10,141	4,202.95	-4.887	-0.489	-1.466	0.000
	0 to 250	1,195	390	131.18	484	144.75	321	143.33	20.504	2.050	6.151	4.470
	251 to 500	1,777	482	388.04	807	396.76	488	391.80	-7.014	-0.701	-2.104	1.649
	501 to 750	5,236	1,596	582.42	2,217	584.29	1,423	588.13	-3.083	-0.308	-0.925	1.519
	751 to 1,000	2,025	495	885.76	869	888.20	661	891.29	-7.567	-0.757	-2.270	0.000
	1,001 to 2,000	5,453	1,373	1,419.49	2,221	1,418.16	1,859	1,428.27	-7.022	-0.702	-2.107	0.000
	2,001 to 3,000	3,426	813	2,450.38	1,403	2,465.28	1,210	2,449.79	-5.614	-0.561	-1.684	-0.356
	3,001 to 4,000	2,238	530	3,443.65	881	3,467.83	827	3,444.67	-7.730	-0.773	-2.319	-1.054
	4,001 to 5,000	1,771	446	4,513.64	672	4,526.10	653	4,500.67	-5.887	-0.589	-1.766	-0.504
	5,001 to 10,000	4,464	1,118	6,999.71	1,759	6,955.35	1,587	6,947.79	-6.023	-0.602	-1.807	-0.741
	10,001 to 15,000	1,727	443	12,036.28	642	11,995.80	642	12,025.01	-2.820	-0.282	-0.846	-1.199
	15,001 to 20,000	667	188	16,432.88	226	16,828.48	253	16,860.72	-10.140	-1.014	-3.042	-0.523
	20,001 to 25,000	250	49	21,574.40	88	22,333.20	113	22,301.25	-10.529	-1.053	-3.159	-4.296
>25,000	210	23	35,691.93	83	33,689.09	104	38,651.69	-13.647	-1.365	-4.094	-5.741	
Y	Total	9,249	3,022	7,396.68	1,823	8,023.78	4,404	10,461.50	-7.706	-0.771	-2.312	0.000
	0 to 250	74	34	144.91	10	113.50	30	159.67	-9.194	-0.919	-2.758	0.000
	251 to 500	119	42	400.68	16	418.68	61	400.18	-5.376	-0.538	-1.613	-2.261
	501 to 750	423	184	584.03	62	587.90	177	585.07	-3.582	-0.358	-1.075	0.000
	751 to 1,000	240	95	877.93	40	915.25	105	891.94	-12.378	-1.238	-3.714	0.000
	1,001 to 2,000	911	336	1,462.33	168	1,469.97	407	1,471.81	-7.091	-0.709	-2.127	0.000
	2,001 to 3,000	883	296	2,486.93	182	2,458.63	405	2,486.23	-7.703	-0.770	-2.311	0.000
	3,001 to 4,000	657	205	3,458.14	144	3,474.46	308	3,490.57	-10.482	-1.048	-3.145	0.000
	4,001 to 5,000	677	220	4,573.33	148	4,484.09	309	4,563.93	-6.966	-0.697	-2.090	0.000
	5,001 to 10,000	2,352	730	7,278.92	547	7,122.84	1,075	7,131.79	-6.654	-0.665	-1.996	0.000
	10,001 to 15,000	1,402	475	12,059.27	261	12,094.76	666	12,115.33	-6.200	-0.620	-1.860	-0.088
	15,001 to 20,000	773	279	16,534.37	145	17,005.30	349	17,231.57	-3.878	-0.388	-1.163	0.000
	20,001 to 25,000	277	70	22,035.20	45	22,591.85	162	22,304.77	-12.056	-1.206	-3.617	-4.708
>25,000	461	56	35,719.61	55	39,140.80	350	46,834.50	-21.389	-2.139	-6.417	-11.834	

## Annex III

Related, market-dependent transaction fees in accordance with the respective price lists

Execution venue	Share type	Turnover in €		Fee	Minimal fee in €	Maximum fee in €
		from	to			
Xetra	all equities	-	-	0.48 bp	0.60	72.00
Turquoise Europe (NL)	all equities	-	-	0.15 bp*	-	-
Stuttgart Stock Exchange	DAX equities	0	15,000	6.2 bp	2.09	63.00
		15,000	50,000	4.2 bp	9.30	63.00
		50,000	-	3.6 bp	21.00	63.00
	non-DAX equities	0	15,000	9.5 bp	2.73	63.00
		15,000	50,000	7.5 bp	14.25	63.00
		50,000	-	7 bp	37.50	63.00
Frankfurt Stock Exchange, excluding Xetra	all equities	-	-	6 bp	3.12	-
Hamburg Stock Exchange, excluding L&S	all equities	-	-	2.5 bp	1.30	11.00

*\*The Turquoise Europe™ Tariff Schedule shows different fees for "passive" (0 bp) and "aggressive" (0.3 bp) orders. Since the transaction reports analysed in this study do not differentiate between different order types, the average of the two values was used for reasons of simplification.*

Execution venues including PFOF markets not listed in the tabular overview above do not charge any transaction fees that were directly attributable to an individual order.