

MARCH 2022

**ANALYSIS OF THE EXECUTION OF
RETAIL INVESTORS' ORDERS IN THE
FIRST MONTHS OF THE COVID-19
CRISIS**

INTRODUCTION

In the thick of the Covid-19 crisis, in March 2020, the AMF observed some 150,000 new retail investors in French equities, and purchase volumes multiplied by 4 on Euronext Paris. Two years later, market volumes had returned to their pre-crisis levels, but the market share of retail investors remained at a higher level.

Between December 2019 and April 2020, retail investors traded more than €67 billion in French equities, or slightly less than 3% of the total trading volume. Most of these volumes were executed on two trading venues, each of which also proposes a specific offer to attract retail investors: Euronext Paris (64%) and Equiduct (20%).

Since 2016, the "Best of Book" (BoB) order matching service of the Paris stock exchange has provided additional liquidity to cope with retail investors' orders while interacting with the central order book. Between December 2019 and April 2020 the BoB captured between 14% and 34% of the volumes traded by retail investors on Euronext Paris. Equiduct, for its part, via Apex offers retail brokers zero-commission fee trading and execution at the Volume-weighted Best Bid and Offer (VBBO), in other words an average weighted by the volumes of the best bid and ask prices available on 16 reference platforms (Euronext Paris included, although without taking BoB prices into account).

On Euronext Paris, it has been observed that on average the BoB offered price improvements around 35% of the time (by comparison with the prices in the central order book). Moreover, a comparison between the execution prices (trading cost included) observed on Equiduct and the best limits simultaneously available on the Paris stock exchange shows that the prices on Equiduct are more attractive for most transactions – not thanks to better quotes (in other words, more competitive quotes for the retail investor) but thanks to zero trading costs. Furthermore, the small magnitude of any price improvement, around a few dozen cents on the basis of an average observed transaction size of €4,000 for a retail investor, should be considered in light of the far greater magnitude of any price deterioration (in other words, when the price is less competitive for the retail investor).

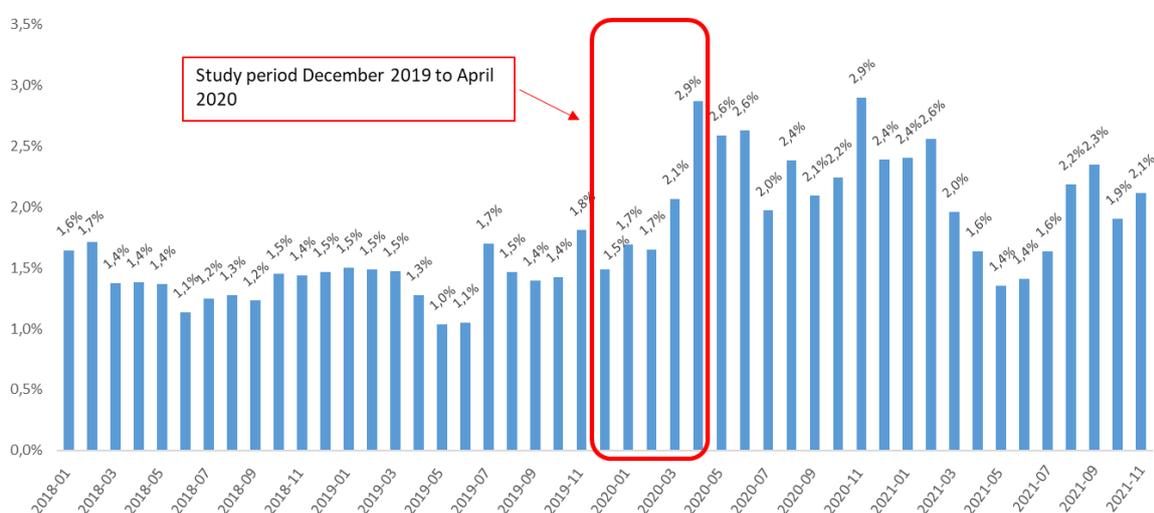
This study presents factual observations on how retail investors' orders are executed (price and probability of execution) depending on the selected platform, but nevertheless does not aim to provide recommendations on how to take them into account for working out best execution policies. Moreover, the study identifies execution services which involve one-third of retail flows being diverted from lit markets to the benefit of the handful of institutional investors that are members of the various programmes targeting retail investors. This note does not propose an in-depth analysis of the impact of this capture on the price formation process.

1. MARKET STRUCTURE: WHAT IS THE WEIGHT OF RETAIL INVESTORS IN FRENCH EQUITIES?

In the initial weeks following the start of the Covid-19 crisis, the AMF noted¹ some 150,000 new retail investors in French equities and a significant increase in the volumes traded by them on Euronext Paris. More specifically, in March 2020, retail investors' purchases on the Paris stock exchange were 4 times the customary monthly volumes.

Over the same period, the weight of retail investors² in the French equity market as a whole doubled between December 2019, when their market share amounted to 1.5%, and April 2020, when their weight in trading volumes peaked at 2.9% (see Chart 1 below).

Chart 1: Growth in market share of retail investors in the French equity market



Source: AMF (for the volumes traded by retail investors), Refinitiv (for the total volumes including OTC transactions) – all French equities

Via the transaction reporting required of investment firms by MiFID II ("RDT-TREM data"), the AMF has access to all the transactions performed on French instruments: market participants are identified by their LEI (Legal Entity Identifier) when they are professionals (legal entities), and by their national identifiers in the case of retail investors (individuals).³ Furthermore, from RDT-TREM data it is possible to distinguish between the transactions by retail investors and those by institutionals by filtering by type of participants' identifier.

Moreover, to be able to study the breakdown of retail investor flows by execution venue, allowance should be made for the fact that a retail investor cannot access the market directly and the intervention of one or more intermediaries is required in their transactions. There are two possible reporting processes:

- Intermediation chain with a single intermediary: the intermediary that has handled the retail order declares directly that it has traded on behalf of the retail investor in its RDT-TREM report on a platform or on a systematic internaliser (SI). It is then possible to know directly where the retail investor flow was executed.
- Intermediation chain with several intermediaries: the retail order has been handled by one or more intermediaries, and the transaction regarding the retail investor is reported as OTC. In this case, it is not

¹ <https://www.amf-france.org/fr/actualites-publications/publications/rapports-etudes-et-analyses/comportement-des-investisseurs-particuliers-pendant-la-crise-covid-19>

² See Annex 1 for the calculation of the retail market share.

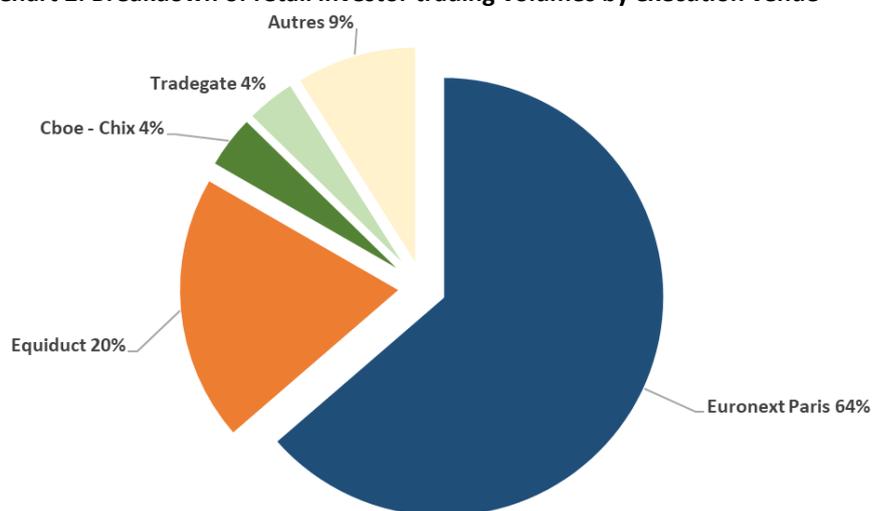
³ In France, for example, the national identifier of individuals is a code concatenating the individual's family name, first name and date of birth, while the Netherlands uses the passport number.

possible to conclude regarding the execution venue of the client flow without first chaining the transactions to reconcile the OTC reporting with the purchases/sales that have been executed by the intermediary/intermediaries on behalf of the client on a platform or on an SI.⁴

In some cases, the complexity of the reporting process, or the quality of the data, does not make it possible to trace (automatically) to the ultimate execution venue for the retail investor's order: between December 2019 and April 2020, this situation corresponded to around 16% of the amounts (these volumes are therefore not considered in the remainder of the study).

Analysis of the RDT-TREM data on retail investors' transactions between December 2019 and April 2020, in all French equities, shows that two trading venues together account for most of the flow: Euronext Paris which took 64% of the volumes, and Equiduct which captured 20% (see Chart 2 below).

Chart 2: Breakdown of retail investor trading volumes by execution venue



Source: AMF – all French equities

The study of the RDT-TREM data also highlighted the principal retail brokers (BRs) for French equities: of the 17 leading market participants, each of whose market share exceeds 1%, four foreign (but European) participants together account for about 11% of the total volumes: BR9 (4.4%), BR11 (3.7%), BR15 (1.9%) and BR16 (1.3%) (see Table 1 below).

⁴ Note, moreover, that the plurality of intermediaries may also be due to the investor's choice to hold several accounts with several brokers. In that case, the intermediaries are not cumulated in a given transaction, but the reports of the investor's operations would be spread/split among several market participants. In TREM, all this investor's transactions would in any case be reported and designated by the same national identifier, even if they came from various investment service providers (ISPs).

Table 1: Market share of the principal retail brokers

Retail brokers	Total volumes	Market share	% Euronext				% Other venues
			Paris	% Equiduct	%Cboe	%Tradegate	
BR1	7 545M	12,8%	78%	0%	18%	0%	5%
BR2	7 284M	12,4%	100%	0%	0%	0%	0%
BR3	5 542M	9,4%	28%	72%	0%	0%	0%
BR4	4 354M	7,4%	34%	66%	0%	0%	0%
BR5	3 192M	5,4%	97%	3%	0%	0%	0%
BR6	2 712M	4,6%	47%	14%	1%	12%	26%
BR7	2 668M	4,5%	56%	43%	0%	0%	0%
BR8	2 589M	4,4%	100%	0%	0%	0%	0%
BR9	2 559M	4,4%	100%	0%	0%	0%	0%
BR10	2 237M	3,8%	76%	0%	19%	0%	5%
BR11	2 154M	3,7%	98%	0%	0%	0%	2%
BR12	1 256M	2,1%	43%	57%	0%	0%	0%
BR13	1 230M	2,1%	44%	56%	0%	0%	0%
BR14	1 119M	1,9%	74%	0%	21%	0%	5%
BR15	1 105M	1,9%	19%	79%	0%	0%	2%
BR16	775M	1,3%	0%	0%	0%	40%	60%
BR17	622M	1,1%	100%	0%	0%	0%	0%
Other retail brokers	9 808M	16,7%					
Total	58 750M	100%					

Source: AMF – all French equities

In Table 1 above, it can be seen that the breakdown of the execution venues of a retail broker differs fairly significantly, especially between Euronext Paris and Equiduct: for example, BR2 (12.4%) executes all of its retail flow on Euronext Paris while BR3 (9.4%) executes almost three-quarters (72%) of its volumes on Equiduct.

Moreover, two market participants stand out thanks to a greater fragmentation of their flows. BR6 (4.6%) and BR16 (1.3%) execute 26% and 60% of their volumes respectively on a venue other than Euronext or Equiduct:

- in reality, 22% of the volumes of BR6 (4.6%) are traded on Virtu's systematic internaliser and,
- of the 60% executed on other platforms, 40% of the volumes of BR16 (1.3%) are spread over the XETRA platform (20%) and three German systematic internalisers (Lang & Schwarz Trade Center (7.6%), Baader Bank (7.4%) and Commerzbank Equity (5.6%)). The remaining 20% is highly fragmented among other trading venues which are not covered in this note since these are not very representative.

In the remainder of the note, all references to retail brokers refer to one of the retail brokers in Table 1 above. On the other hand, the other market participants met during the study will be identified either as liquidity providers (LPs), or as a third-party intermediary if they do not belong to any of the first two categories (especially to refer to the intermediaries who retail brokers use to access the market, but with whom individuals do not have a direct account).

2. SPECIFIC OFFERS FOR RETAIL INVESTORS

Euronext Paris, like Equiduct, has a specific offer for retail investors' orders. Through its Best of Book (BoB) service, the Paris stock exchange offers retail investors further liquidity, additional to that of the central order book – which nevertheless is also accessible in the same way as it is for professional investors. For its part, Equiduct's APEX model, which is intended exclusively for retail investors, posts zero trading costs and guarantees execution at the VBBO.

2.1. BEST OF BOOK: WHAT DIFFERENCES FOR RETAIL INVESTORS BY COMPARISON WITH THE CENTRAL ORDER BOOK?

The BoB aims to offer retail investors more competitive prices than those from the central order book. As part of this service, the BoB liquidity providers (so-called RLP members) accept higher trading costs to be able to capture the reputedly uninformed flow of retail investors, in other words a flow considered less risky for their market making strategy than the central order book flow which could include orders from reputedly more-informed rival

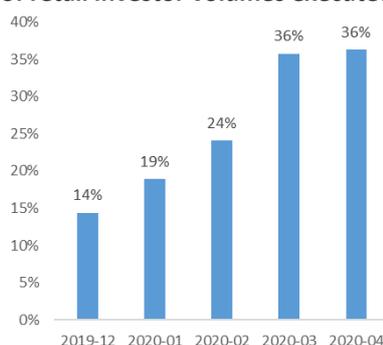
market participants (HFTs, for example). Depending on the time they are present in the order book and the level of liquidity offered,⁵ the RLP members are invoiced more or less substantial fees by Euronext.

As a reminder, RLP orders must be passive and can only be consumed by retail investors' orders placed by so-called RMO (Retail Member Organisation) members. An RLP order can only be executed against an RMO order if the price of the RLP order is at least equal to (or more competitive than) those of the central order book (otherwise the RMO order will be matched with an order from the central order book). Finally, an RLP order does not have priority over an identically priced order in the central order book.

In the remainder of this note, when reference is made to the central order book, it is therefore to be understood that RLP orders are excluded from it.

From/In the data on Euronext Paris orders collected by the AMF, it is possible to distinguish between orders coming from the BoB thanks to a specific flag. For example, between December 2019 and April 2020, 26% of retail investor trading volumes executed on the Paris stock exchange were executed via the BoB: this market share⁶ increased from 14% to 36% over the period (see Chart 3 below).

Chart 3: Proportion of retail investor volumes executed on Euronext via BoB



Source: AMF – all French equities

In fact, given that the additional liquidity offered by the RLP members can only be consumed by an aggressive flow, the proportion of volumes represented in Chart 3 above should be compared not with the total retail volume, but with the volumes resulting from the aggressive orders of retail investors, estimated at slightly less than half of the flow.⁷ In other words, in April 2020, 36% of the aggressive retail flow was captured by RLP orders. As a reminder, only aggressive orders stamped with the RMO flag can be posted opposite BoB quotes.

Over the period examined, almost three-quarters of retail volume were executed on Euronext Paris under the same conditions applicable for an institutional participant.

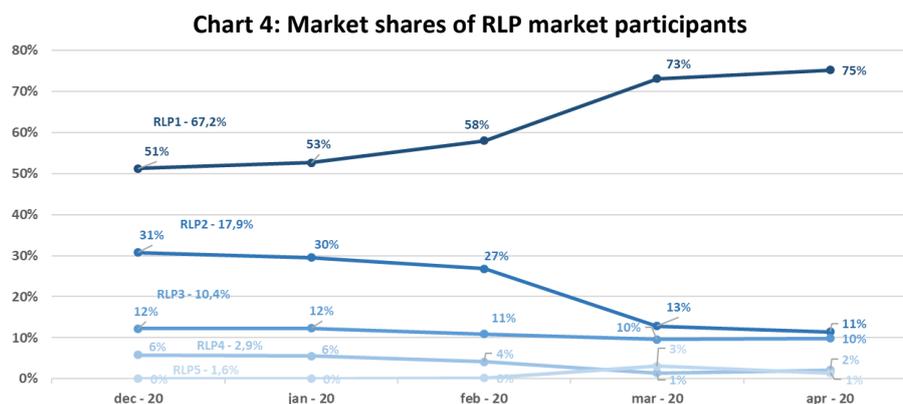
⁵ <https://www.euronext.com/sites/default/files/2021-02/Market%20Maker%20Liquidity%20Provider%20Trading%20Fee%20Guide%20Euronext%20Cash%20Markets%20-%2001MAR2021.pdf>

⁶ See Annex 1 for the calculation of the proportion/share? of retail volumes executed via BoB.

⁷ In order to estimate the aggressiveness ratio of retail investors, one week of client order data from BR3 (9.4%) was analysed to conclude on a breakdown.

2.1.1. Overview of Best of Book market participants

BoB comprises two categories of market participants: so-called RLP liquidity providers and their so-called RMO counterparties (whose end clients are retail investors). Over the period examined, this shows that five RLP members take part in the BoB (see Chart 4 below), with one of them capturing most of the flows. All are HFTs except member RLP 4 (an investment bank).



Source: AMF – all French equities

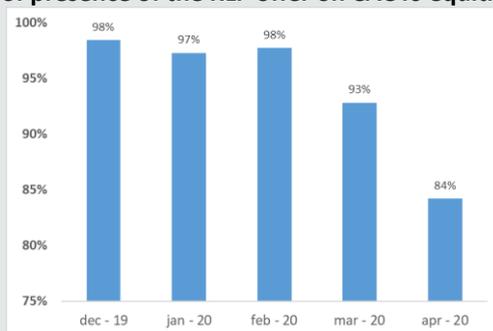
Chart 4 above, demonstrates that the leading market participant accounts for over half of the volumes: 51% in December 2019 and up to 75% in April 2020. This increase is offset by the decline in the market share of the second-largest RLP member whose weight fell from 30% in January 2020 to 11% in April 2020.⁸

⁸ Towards the end of 2021 (between August and November) a new trend appeared: whereas in August and September RLP1 still had slightly more than 50% of volumes, its market share fell between October and November 2021 and ended at 34% to the benefit of RLP5 which accounted for 30% of the flow in November 2021. On the other hand, RLP4 was removed from the RLP programme, hence reduced to 4 members at end-2021.

Focus on the time of presence when RLP members contribute to BoB liquidity

While Chart 4 above shows that the proportion of retail investor volumes executed via BoB increased between December 2019 and April 2020, it would seem, that in terms of average time of presence, the RLP offer was reduced during the Covid-19 crisis.

Chart 5: Average time of presence of the RLP offer on CAC40 equities over one trading day



Source: AMF – CAC40 equities – representative sample of 15 days⁹

In December 2019, when the average time of presence stood at 98%, in other words there was on average at least one RLP order immediately consumable 98% of the time during the trading day, this rate fell to 84% in April 2020. This decline could be explained either by a reduction in the RLPs' offer in reaction to the sharp increase in volatility over the period, or by an equivalent offer level combined with an increase in the retail investor flow: there are less RLP orders in the order book because they are executed more frequently and not immediately replaced.

Excluding exceptional periods (March-April lockdown), practically with a maximum rate of presence of the RLP offer, Chart 5 shows that retail investors' orders are captured ahead of the central order book over a large part of the trading day.

Moreover, the study of RMO counterparties shows that practically all the retail brokers allow their clients to trade via this additional liquidity, either by accessing the market themselves (which accounts for around 51% of the executed flow), or by going through a third-party intermediary (for 49% of the flow). However, it would seem that BR7 and BR15 do not propose BoB access to their clients: combined, these two participants account for 4.5% of the retail investor flow executed on Euronext Paris and around 6.4% of the total flow (all markets combined).

2.1.2. Best of Book: what price improvements for retail investors?

For the remainder of this sub-section, the study was performed on a representative sample of 15 days between December 2019 and April 2020 on CAC40 equities only (1 day per week at a rate of 3 days per month),¹⁰ or the equivalent of 11% of the total volumes traded over the period. In the next sections of the note, when/where the data period has been reduced to this time sample, the statement "representative sample of 15 days" is added in the legend to the chart.

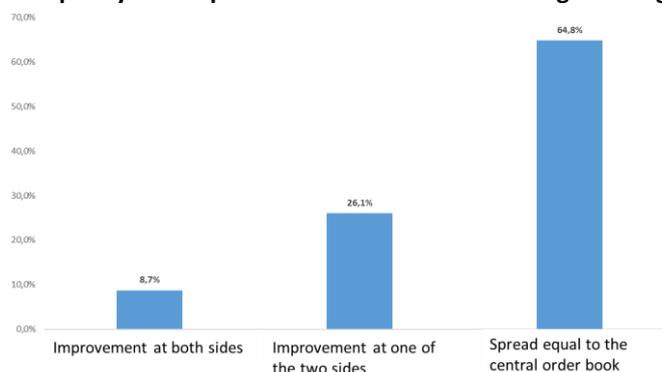
The simultaneous comparison between RLP quotes and the best limits of the central order book shows that the RLP orders improve¹¹ one of the two sides of the range 26% of the time (i.e., about 2h and 15 minutes over the trading session), and both sides in 8.7% of cases, or around 45 minutes (see Chart 6 below).

⁹ The study was carried out over 15 days between December 2019 and April 2020 on CAC40 equities only (1 day per week at a rate of 3 days per month), or the equivalent of 11% of the total volumes traded during the period.

¹⁰ For most of their work of monitoring and detecting market abuse, the AMF personnel do not include RLP orders in the production calculations which assess at all times the state of the order book for French equities. It was not possible to calculate on a broader sample than 15 days for operational reasons.

¹¹ The improvements take place by full increments of one tick.

Chart 6: quality of RLP prices in the course of an average trading day¹²

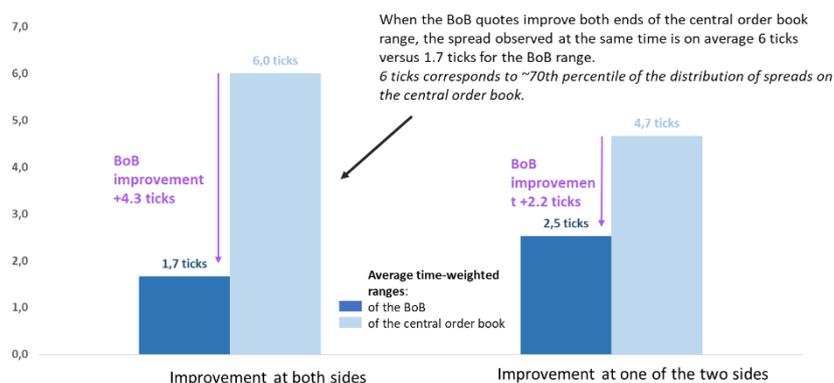


Source: AMF – CAC40 equities – representative sample of 15 days

As illustrated by Chart 6 above, the RLP orders merely replicate the range of the central order book in around two-thirds of an average trading day.

Chart 7 below draws the distinction between periods when the RLP quotes are better than the range of the central order book, at both sides or a single side. It can therefore be seen that the RLP orders improve both sides of the spread (left-hand part of Chart 8 below) when the spread on the central order book is relatively wide: on average equal to 6.3 ticks at that time, which corresponds to approximately the 70th percentile of the observed distribution of the spread over the period. Simultaneously in such cases, the observed RLP spread is on average 1.7 ticks.

Chart 7: quality of BoB prices according to the size of the central order-book range



Source: AMF – CAC40 equities – representative sample of 15 days

Chart 7 above also shows that the (time-weighted) improvement provided by the RLP orders is significant with 4.3 ticks on average when the spread is improved at both sides, and 2.2 ticks for the improvement of only one of the two sides.

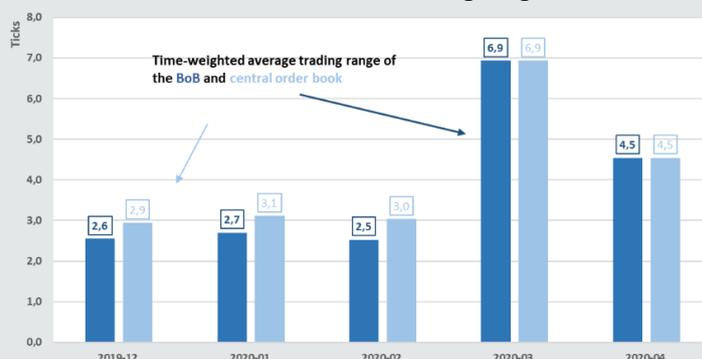
¹² In 0.4% of cases (not shown in Chart 7), the RLP quotes are outside the range of the central order book. In other words, the prices of RLP orders are apparently not as good as those of the central order book (but in this case, an aggressive RMO order will be executed against the best price available on the central order book and not the RLP order).

Focus on the reasons for the type of BoB improvement

The improvement provided by the BoB generally takes place following a widening of the central order-book range at a given point in time. Indeed, the narrowing occurs at only one of the two sides and each improvement is counted in units during the narrowing of this end of the spread, irrespective of the duration of this improvement. In this case, when the RLP spread is wider than or equal to the spread on the central order book, the RLPs are the source of 38% of the narrowing. When the improvement at one side of the spread is followed by an improvement at the other side of the spread, 52% of these cases are the direct result of an RLP order. On average, the improvements are therefore mostly (in 59% of cases) the joint result of a widening of the central order book and the presence in the book of a BoB order prior to the widening of the central order book.

Chart 8 below shows the evolution of the average trading ranges observed over the period: apart from the high-volatility months of March and April 2020 when the spreads widened considerably/markedly, it can be seen that the RLP orders generally improve the range.

Chart 8: Evolution of trading ranges



Source: AMF – CAC40 equities – representative sample of 15 days

Accordingly, whereas the previous results indicated that the improvement in RLP quotes was favoured by a wide spread, this is not what was observed in March and April 2020. Although this is counter-intuitive, it could be explained by the fact that the RLPs view a wider spread as an opportunity outside of periods of stress but as a risk factor in conditions of high volatility.

Analysing the breakdown of RLP members causing the BoB price improvements (when the improvement results from an RLP order and not a movement of the central order-book range), it appears that more than 41% of the improvements can be attributed to the orders of RLP1, which has a 67.2% market share (see Table 2 below). On the other hand, 41% of the improvements are due to RLP5, which has a market share of only 1.6%: these improvements therefore are mostly of no consequence.

Table 2: Price improvement when an RLP member is their originator

RLP members	% of cases in which the improvement at one of the two ends of the order book is originated by an RLP order	% of cases in which the improvement at both ends of the trading range is originated by an RLP order
RLP1 - 67.2%	41%	46%
RLP2 - 17.9%	5%	5%
RLP3 - 10.4%	11%	7%
RLP4 - 2.9%	3%	< 1%
RLP5 - 1.6%	41%	41%
Total	100%	100%

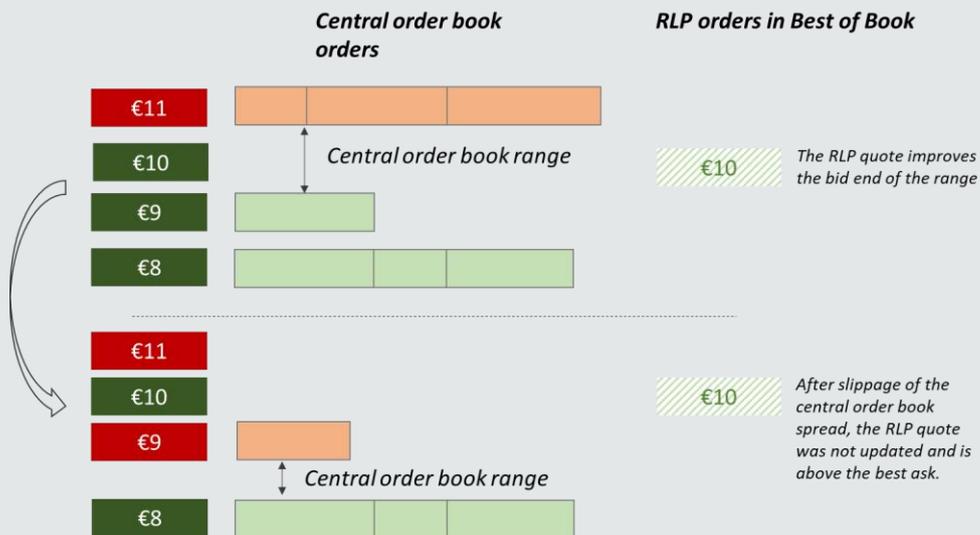
Source: AMF – CAC40 equities – representative sample of 15 days

Moreover, note that the average improvement when an RLP member is the originator is one tick.

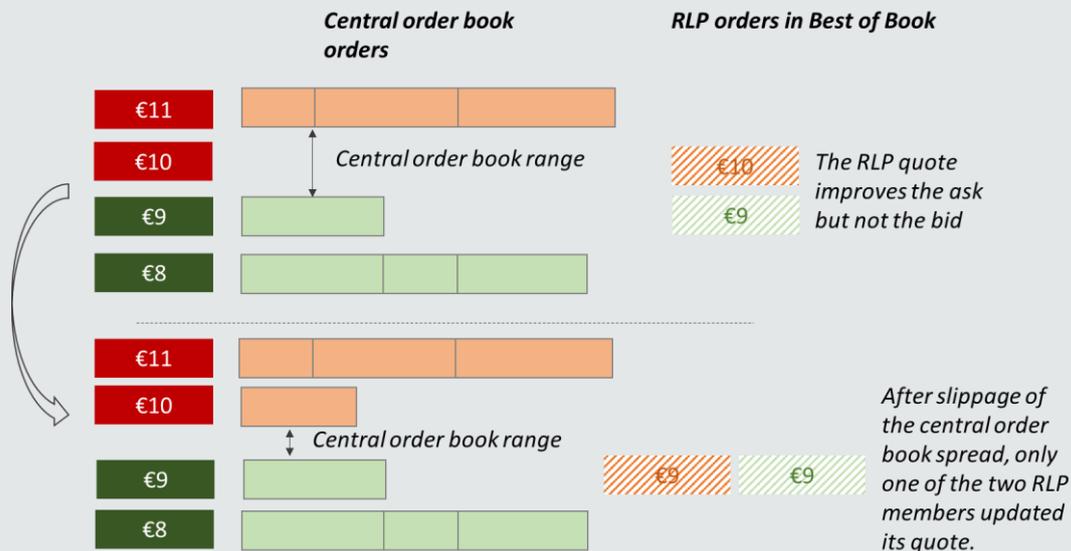
Focus on RLP quotation anomalies

Several RLP quotation anomalies were observed during the period studied. These can mostly be attributed to the same member, RLP4 (2.9%), which:

- almost 0.50% of the time allows an RLP buy order (sell order respectively) to exceed the best ask (best bid respectively) of the central order book after spread slippage (see example below);



- around 1.6% of the time does not adjust its quotes following a spread movement so that another RLP market participant becomes positioned at the same limit but in the opposite direction, the RLP spread then being zero (see example below).



As a reminder, these situations do not automatically trigger transactions, because only aggressive RMO orders (i.e. retail orders and not orders in the central order book) can be executed against RLP orders.

2.2. FOCUS ON THE EQUIDUCT MODEL

The Equiduct Apex model, via a single connection to their platform, offers its clients (retail brokers) consolidated virtual access to 16 order books¹³ (including the Euronext Paris book, but without the BoB's prices). Thus, Equiduct explains on its website¹⁴ that it guarantees its clients execution at the Volume-weighted Best Bid and Offer (VBBO), in other words a weighting of the best spreads observed on the 16 different order books by the available volumes.¹⁵ In practice, in their orders routed to the venue, liquidity providers specify only a quantity, the VBBO price being automatically calculated by the venue. If a retail investor's order cannot be executed at the VBBO (LP absent, insufficient liquidity or price limit outside the VBBO), the order is then redirected to the Hybrid Book ("HB") which operates as a conventional continuous order book.

In practice, only a little more than half – 55% – of the retail investor volumes traded on Equiduct are executed at the VBBO. The remainder, i.e. 45% of the volumes, is traded on the HB. In the remaining part of this note, the "Equiduct" reference covers all executions, VBBO and HB combined.

2.2.1. Overview of VBBO market participants and clients

Thanks to the flag available in the data collected via Refinitiv,¹⁶ reconciliation between these and the RDT-TREM data made it possible to distinguish between transactions executed via the VBBO and those executed on the HB, and hence gives the respective market shares of the various participants. Therefore, Table 3 below shows the principal liquidity providers ("LPs" in what follows) present on the Apex VBBO execution service.

Table 3: Market share of the principal VBBO LPs

Liquidity providers	VBBO Mkt Sh
LP1	85,7%
LP2	9,6%
LP3	2,3%
Other LPs	2,2%
Total	100%

Source: Refinitiv, AMF – all French equities

Of the three main market participants, the leading LP, in terms of liquidity provided via the VBBO execution offer, accounts for around 86% of the volumes, compared with scarcely 10% for the second member LP2.

Facing three preponderant LPs, the retail investor flow is more fragmented, with 7 main retail counterparties (i.e. with a market share of greater than 3% of the volumes executed via the VBBO). Moreover, slightly more than half of the retail flow is delegated to third-party intermediaries (note that LP2 also acts as a third-party intermediary, chiefly on behalf of BR6 (4.6%)).¹⁷ Table 4 below introduces the various market shares of these participants.

¹³ The Equiduct model means that retail brokers may have to connect to only one venue, have to receive market flows only from that venue (at the most competitive market price) and have to manage only one settlement and delivery chain.

¹⁴ <https://www.equiduct.com/services/apex-how-it-works>

¹⁵ The VBBO may be different from the Euronext Paris price because it uses the whole depth of the aggregate order book of the 16 venues to simulate immediate execution of the order in full. Hence, the probability of being executed at a better price, equivalent to or less than the Euronext Paris price, will be a directly increasing function of the order size.

¹⁶ See Annex 2 for details of the flags used in the Refinitiv data.

¹⁷ On Euronext Paris, slightly more than half of the retail flow is also delegated to third-party intermediaries. While Paris stock exchange fees could have accounted for this figure, the same explanation cannot be considered in the case of Equiduct. It therefore appears that the decision to delegate the retail flow or not depends on numerous factors which is not be studied in this note.

Table 4: Market share of the main retail counterparties executed via the VBBO

Retail counterparties	VBBO Mkt Sh
BR3 - 9.4%	32,0%
Third-party intermediary 3	24,5%
Third-party intermediary 4	13,7%
LP2	8,3%
Third-party intermediary 5	6,9%
BR15 - 1.9%	3,7%
BR4 - 7.4%	3,2%
Other	7,4%
Total	100%

Execution of more than 53% of the retail flow is delegated by the retail brokers

Source: Refinitiv, AMF – all French equities

Around one-third of the retail investor flow executed via the VBBO is provided by BR3 and is by far the leading retail broker on Equiduct, given that the next 4 market participants in the ranking by trading volumes are third-party intermediaries, each aggregating the flow of several brokers.

2.2.2. Hybrid Book: Who are the clients not served by the VBBO?

As a reminder, the Hybrid Book centralises passive orders of retail investors which are not executed via the VBBO;¹⁸ it accounts for about 45% of the total volumes traded on Apex (VBBO and HB combined). Table 5 below shows the market shares of the various members of the Hybrid Book operating as a conventional quote-driven order book.

Table 5: Breakdown of HB member clients

Members	HB Mkt Sh	Fraction of the member's volumes on HB relative to its total Apex flow (HB + VBBO)
LP3	35,4%	96%
BR3 - 9.4%	25,5%	53%
Third-party intermediary 3	19,0%	53%
LP1	11,3%	16%
LP2	4,5%	26%
BR4 - 7.4%	1,2%	35%
Third-party intermediary 5	0,9%	16%
BR15 - 1.9%	0,7%	22%
Third-party intermediary 4	0,1%	1%
Other	1,4%	18%
Total	100,0%	NA

Source: Refinitiv, AMF – all French equities

The leading market participant in terms of volumes traded on the HB is LP 3 the HFT, also active as an LP on the VBBO service, even though 96% of its volumes on Equiduct are traded on the HB (versus 4% via the VBBO). Conversely, LP1, with a majority (85.7%) of executions on the VBBO, accounts for only 11.3% of the retail investor flow routed to the HB, or 16% of the member's volumes.

Finally, the ranking of the leading three retail brokers is more or less the same as on the VBBO, with, as leaders:

- at the top of the ranking, BR3, which accounts for 25.5% of the volumes on the HB, representing 53% of its flow executed on Apex. BR3 therefore handles most of the volumes not served by the VBBO, and this represents over half of its flow sent to Equiduct;
- in second position, BR4, which accounts in all for 13.0% of the trading volume on the HB (with 11.8% via retail intermediary 3, and 1.2% trading directly by itself).

In practice, it appears that most of retail investors' passive flow routed to the HB is executed against one of the two leading liquidity providers. Only a very small proportion of the volumes traded on the HB shows two retail investors face-to-face (around 8%). For simplicity's sake, in the remainder of the note it will be considered that retail investors' orders are always passive and executed against an LP on the HB.

¹⁸ The HB can also capture (the) institutional flow (which remains a minority) but, for the study, only retail investors' transactions were selected.

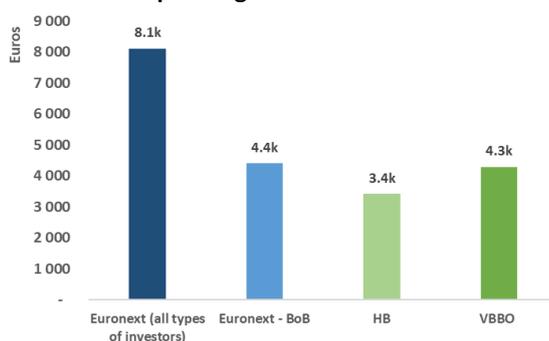
3. COMPARISON OF EURONEXT AND EQUIDUCT OFFERS

Although Euronext, the benchmark market for French equities, is naturally the leading source of liquidity, it is important to consider the attractiveness of Equiduct's prices by comparison with those of the Paris stock exchange.

3.1. WHAT LIQUIDITY AVAILABLE IS TO RETAIL INVESTORS?

The average transaction sizes (ATS) of retail investors on Euronext and Equiduct are very similar (see Chart 9 below).

Chart 9: ATS depending on the execution venue

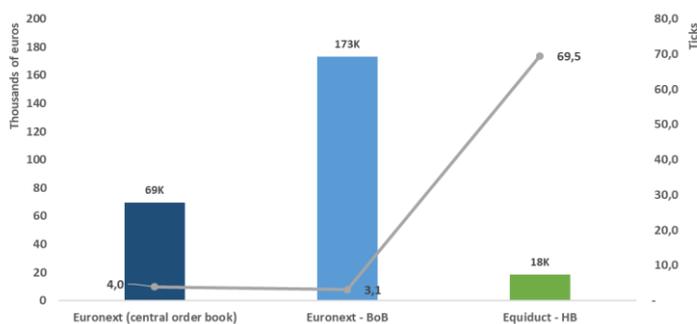


Source: Refinitiv, AMF – all French equities

The average transaction size observed for retail investors is equivalent to roughly half the size observed on the central order book of Euronext Paris (all types of market participants combined). With an ATS of €3.4k, the transactions on the HB are slightly smaller than the VBBO transactions for which the ATS is €4.3k, than those executed against RLP orders on the Paris stock exchange (€4.4k on average).

While transaction size seems similar on Euronext and Equiduct, however, depth available at the best limits is far greater on the Paris stock exchange, and especially on the BoB (see Chart 10 below).

Chart 10: depth (buy and sell combined) at the best limits, and range in ticks



Source: Refinitiv, AMF – CAC40 equities – (representative sample of 15 days for Euronext RLP)

Marked by the onset of the Covid-19 health crisis, from the end of February the market experienced a widening of spreads (see Chart 7 above) which influenced the calculation of the average range over the entire period. Accordingly, it can be seen in Chart 10 above that, although assessed at 4.0 ticks on average, the Euronext spread remains far narrower than that observed on Equiduct (69.5 ticks) and, with €69k versus €18k on Equiduct as the average available depth on the buy and sell sides at the best limits, the order book of the Paris stock exchange appears far more attractive. Moreover, the difference between the two stock exchanges increases if RLP orders

are taken into account: the range on Euronext Paris then narrows to 3.1 ticks on average, and the depth at the best limits peaks at €173k.

Lastly, on both Euronext and Equiduct, the average depth offered at the spread remains far greater than the average transaction size observed over the period (about €4k).

The following sub-section will endeavour to compare prices between Euronext and Equiduct, notably taking into account the fee schedules of each trading venue. However, the size of the spread is also an important item of information in considering the (implicit) costs of transactions. In the case of Equiduct, since the trading range concept is meaningful only for the HB, it is nevertheless still interesting to note that, on this segment, the implicit costs for retail investors are substantially higher than on the Paris stock exchange.

3.2. PRICE COMPARISON BETWEEN EURONEXT AND EQUIDUCT

It is proposed to compare the prices executed on Equiduct with the Euronext quotes available simultaneously, taking into account trading fees (in other words the costs of trading on the venues).¹⁹ To do so, it is assumed in the rest of the study that:

- the average cost of trading on Euronext (for a retail investor) is an estimated 0.75 bps;²⁰
- the fees (for a retail investor) on Apex are zero for VBBO execution and transactions performed on the HB (according to the stock exchange's fee schedule);²¹

Moreover, it is considered, for the analysis, that a retail investor's order on Equiduct is always passive on the HB and aggressive for VBBO execution. Also:

- when a retail investor is a buyer (seller respectively) on the HB, their execution price will be compared with the best bid (best ask respectively) on Euronext;
- when a retail investor is a buyer (seller respectively) *in the case of VBBO execution*, the trade price (VBBO) is then compared with the best ask (best bid respectively) on the Paris stock exchange.²²

3.2.1. HybridBook and Best Execution implications

Although this note does not aim to examine Best Execution policies, it is important to bear in mind a number of market mechanisms.

When comparing prices between the Equiduct transactions and the quotes available simultaneously on Euronext, it is important to distinguish between the VBBO model which, by capturing the aggressive retail investor flow, responds to such investors' demand for immediate execution, unlike the functioning of the HB which in practice centralises the passive orders of retail investors and those that have not been able to be executed via VBBO.

More specifically, by submitting passive orders, above all retail investors expect the guarantee of execution up to a certain fixed price, rather than immediate execution at the best available price. Also, concerning retail investors' passive flow in the HB order book waiting for a counterparty, it would be a better idea to examine orders which, for want of liquidity, might not have been executed (whereas those orders could have been filled if they had been sent to another venue), rather than examine the price available on Euronext Paris simultaneously.

¹⁹ Later on the last sub-section will propose making this comparison by also taking into consideration the RLP orders on Euronext Paris.

²⁰ According to the study published by Euronext: "No free lunch as trading on Equiduct's "Apex" turns out to be more costly than on Euronext's "Best of Book" <https://www.euronext.com/en/media/3641/download>

²¹ <https://www.equiduct.com/sites/default/files/documents/Equiduct-Fee-Schedule.pdf>

²² See Annex 1 for details of the calculations

This aspect is not dealt with in this note because, in the absence of data concerning orders on the HB order book, the scope of the study is focused exclusively on transactions, i.e. on all executed orders.

Moreover, it is also impossible, in the absence of data on Equiduct orders, to estimate the proportion of orders submitted intentionally to HB as distinct from the proportion following rerouting because of non-execution via VBBO. As an upper bound, in the extreme case in which all the volumes traded on the HB in fact resulted from the flow not served by the VBBO, then it would be 45% of the retail flow sent to Equiduct that would be concerned, or slightly less than 10% of all the volumes traded by retail investors in the French equity market.

Lastly, in the remainder of this third section, the results will be presented separately for VBBO executions and for transactions coming from the HB order book. However, when execution is observed in the HB order book, the reader is invited to consider the price difference as the result of the HB order book inertia in reflecting changes in the Euronext Paris order book. It seems hard to quantify the potential opportunity loss for a retail investor, if this order were executed on Equiduct later than if their passive order had been sent to Euronext Paris. Accordingly, although the comparison between the price of transactions in the HB order book and the quotes simultaneously available on Euronext does not make it possible to estimate this potential opportunity loss, it gives a qualitative assessment of the price difference that could exist between two order books with very different levels of liquidity and indicates, although its degree of magnitude cannot be established, that there are probably orders that were not executed on Equiduct when they could have been on Euronext Paris.

3.2.2. Equiduct: what price improvement versus the central order book of Euronext Paris?

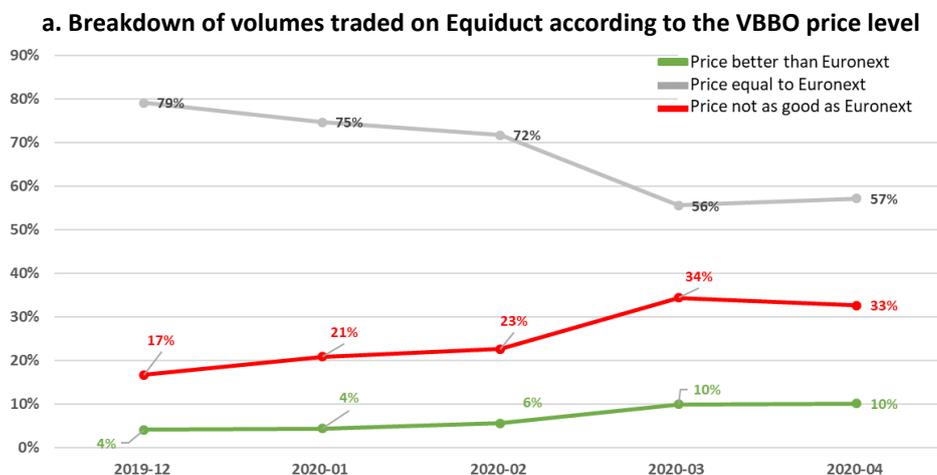
The following results, based solely on the best bid and offer prices of the Euronext Paris central order book, do not reflect all the conditions in which a retail investor could trade on the Paris stock exchange. However, analysis of the retail flow executed on Euronext showed that during the peak activity of the RLP programme over the period examined, around two-thirds of retail investor volumes were executed in the central order book in the same conditions as for an institutional participant. A comparison between the Equiduct prices and the BoB quotes on a restricted sample will be/is made in the following sub-section 3.2.3. Best of Book vs Equiduct: price comparison on a restricted sample.

The analysis proposed in this sub-section focuses on two aspects:

- Breakdown of trading volume depending on whether the execution price on Equiduct is not as good (less competitive), equal to or better (more competitive) than the Euronext quotes simultaneously available.
 - **Comparing prices with and without trading costs illustrates the Equiduct price advantage vs the quality of quotes on the Paris stock exchange;**
- Breakdown of the level of price improvements and deteriorations on Equiduct.
 - **This shows, in particular, an asymmetry between the magnitude of the price deteriorations on Equiduct, which are far more significant than the improvements;**

Initially, without taking trading costs into consideration, Chart 11a below shows the breakdown of trading volumes depending on whether the execution price on Equiduct is not as good, equal to or better than the Euronext quotes simultaneously available.

Chart 11a&b: Comparison of execution prices on Equiduct with the quotes of the Euronext Paris central order book (gross of fees)



Source: Refinitiv, AMF – CAC40 equities

b. Breakdown of volumes traded on HB according to the execution price positioning



Source: Refinitiv, AMF – CAC40 equities

NB: In the month of December 2019, at the time of execution in the HB order book, the buying price (selling price respectively) for a passive retail investor is aligned on the best bid price (best ask price respectively) on the Paris stock exchange.

Chart 11a shows that most of the volumes traded on Equiduct via the VBBO are executed at a price equal (excluding trading costs) to the quotes of the Euronext Paris central order book (grey curve).²³ In periods of severe stress, the trend is reversed slightly, with a major increase in the volumes traded at a less competitive price than the quotes of the Paris stock exchange (red curve) and slight growth in the volumes traded at a better price (green curve). Due to this, it is likely that the high volatility seen in March and April 2020 impacts calculation of the VBBO.

In Chart 11b, for which the breakdown of volumes is given according to the execution price positioning in the HB order book, it can be seen that, outside of periods of stress, the ranges between the two venues are aligned for

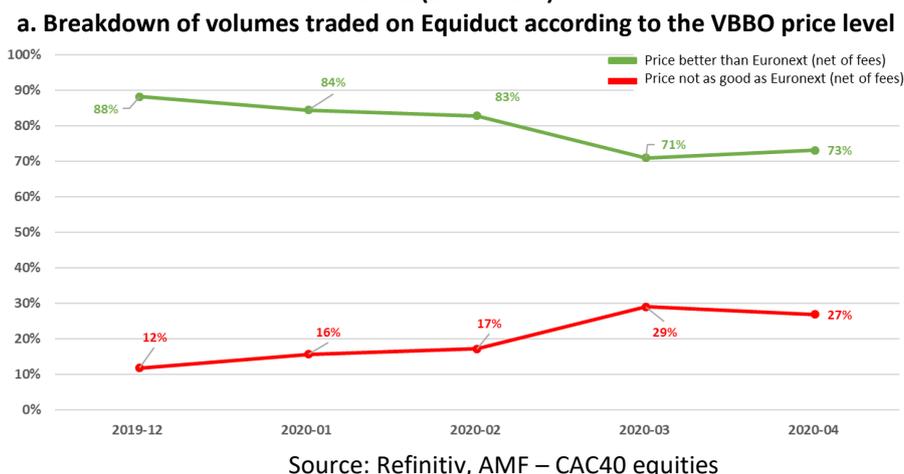
²³ Note that, due to the construction of the VBBO (average of quotes weighted by the volumes available on 16 different trading venues), it appears often equal to the Euronext quotes (excluding BoB). When the VBBO is better than the Euronext price, this can be explained by the existence of a quantity available at a better price on one of the 15 other venues. Moreover, when the VBBO is not as good as the Euronext price, this can be explained by the existence at the best price of a cumulative quantity on all 16 venues smaller than the size of the order reaching Equiduct.

around half of the transactions²⁴ (grey curve). Likewise, between December 2019 and February 2020, 42% to 47% of passive retail investor flows in the HB order book are executed at a time when the quotes of the Euronext central order book are more attractive (red curve). However, as already mentioned, this price difference reflects the inertia of the HB order book in keeping up with movements on the Paris stock exchange and is not included in the price comparison (because the priority of a retail investor via a passive order is to be executed up to a certain fixed price, which is complied with here). Here again, it would be appropriate to examine unexecuted orders, to find out whether they could have been executed if they had been sent to Euronext Paris.

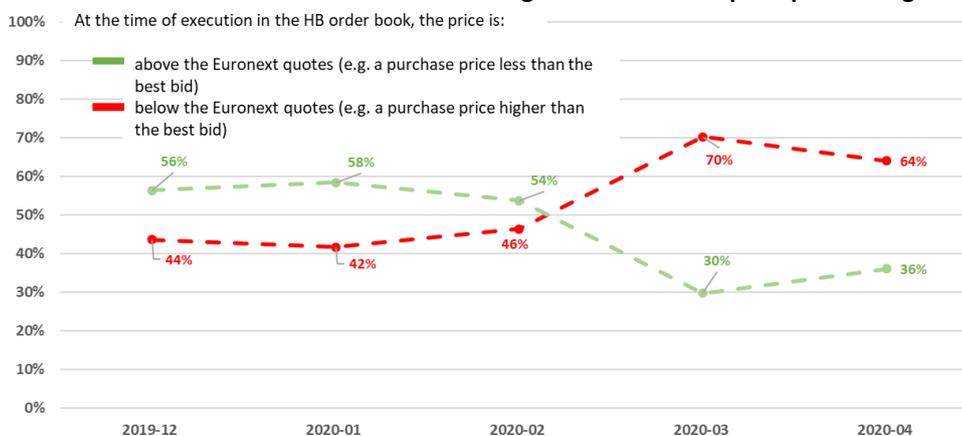
Lastly, in the months of March and April 2020, a period of high volatility, the ability of the HB order book to keep up with the movements of Euronext Paris decreased and divergence of the quotes between the two order books at the time of execution on HB became more frequent: this is the case for 79% of the volumes in March (Chart 13b below introduces the magnitude of the observed divergences).

While Chart 11a above showed that most of the volumes traded via the VBBO were executed at a price equal to the quotes of the Euronext Paris central order book, when fees are included it can then be seen that most of the volumes traded on Equiduct (via the VBBO) are traded at a better price than on the Paris stock exchange (see Chart 12a below).

Chart 12a&b: Comparison of execution prices on Equiduct with the quotes of the Euronext Paris central order book (net of fees)



b. Breakdown of volumes traded on HB according to the execution price positioning



²⁴ At the very least those accounting for slightly more than half of the trading volume.

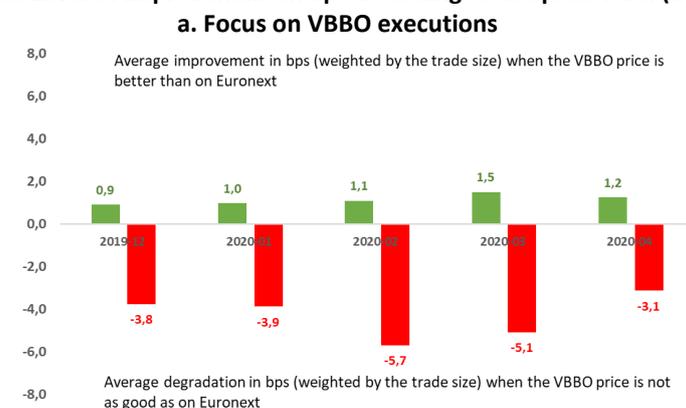
Accordingly, when the respective fee schedules are included in the calculations, the grey curves of Chart 11a above, illustrating the fraction of the volumes traded at a price equal to that available on Euronext Paris, vanish and are replaced by the green curves representing the flow executed via the VBBO at a better price.

Chart 12b repeats the exercise of Chart 11b for transactions from the HB order book taking fees into account.

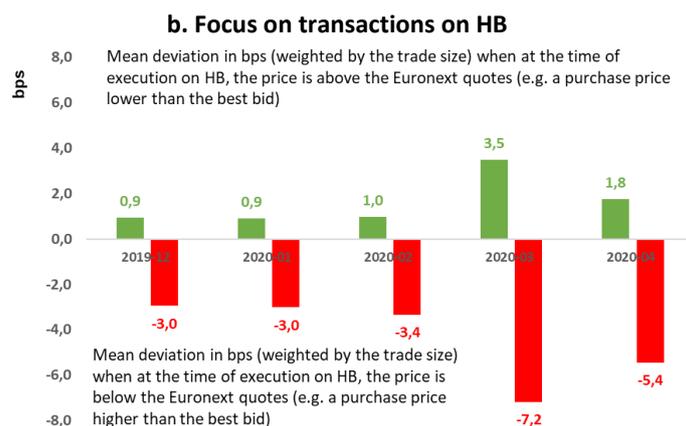
Thus, an improvement in the price net of fees on Equiduct is often noted, although this seems to be above all due to its price advantage, and not an improvement in the quotes. However, this price difference cannot be restricted only to transactions and should be viewed within the framework of all the services and prices proposed by the intermediary to its client, taking into account, for example, the fact that the routing policy provides or not for allowing access to numerous venues.

Charts 13a&b below show the level of improvement in bps - weighted by the volumes traded – observed for VBBO executions, and the price differences observed between the two venues at the time of transactions executed on the HB.

Chart 13a&b: Level of improvement in bps according to the price level (net of fees)



Source: Refinitiv, AMF – CAC40 equities



Source: Refinitiv, AMF – CAC40 equities

Chart 13a shows a significant asymmetry between the magnitude of price improvements and that of price deteriorations on Equiduct by comparison with the quotes of the Euronext Paris central order book for VBBO executions: an observed improvement during the period of between 0.9 bps and 1.5 bps, versus deterioration levels of as much as -5.7 bps in February. Therefore, **based on the size of the average transaction traded by a retail investor, which is €4k**, it should be noted that an observed **improvement** of 1.5 bps on Equiduct in March

2020 represents a **saving of only 60 cents**. On the other hand, when the **deterioration** levels reach -5.7 bps in February 2020, the **loss caused is estimated at around €2.3**.

Moreover, the mean deviations noted for transactions coming from the HB order book on Chart 13b show to what extent quotes may diverge between the two venues, at a time when execution is observed on the HB. As already mentioned, in periods of high stress (March and April 2020 for the period in question), volatility increases the number of cases in which the ranges diverge (when observing execution on the HB order book); Chart 13b also shows that, during these periods, the magnitude of the divergences increases.

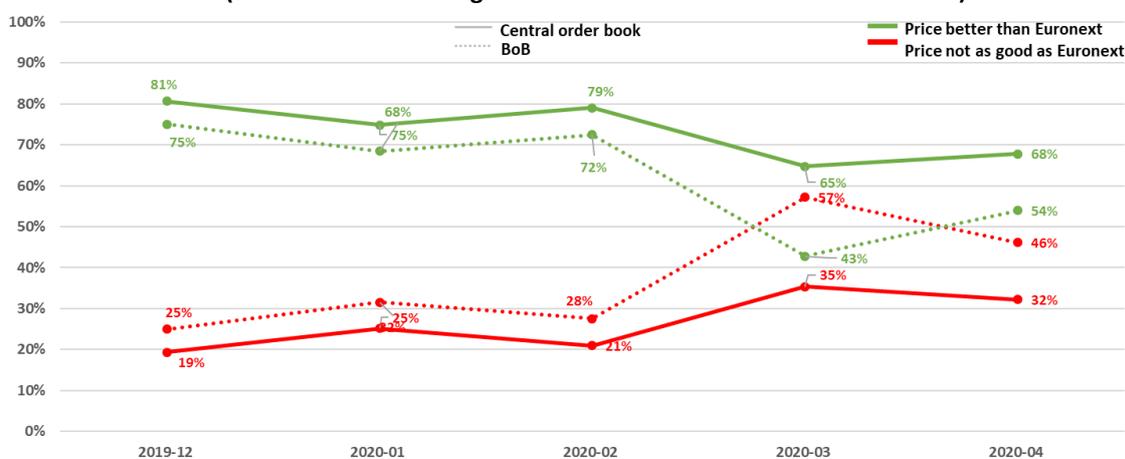
Given that the attractiveness of the VBBO service of the Equiduct trading venue apparently amounts to only a few dozen cents on a considered average investment of €4k for a retail investor (not to mention the potential loss amounting to a few euros), questions may be raised concerning the usefulness of diverting the retail flow from the central order books.

3.2.3. Best of Book vs Equiduct: price comparison on a restricted sample.

Since the BoB provides competitive liquidity for retail investors on Euronext Paris, it is appropriate to also take into account RLP orders when the quality of Equiduct prices is compared with that of the Paris stock exchange.

In Chart 14 below, it can be seen that unsurprisingly the consideration of RLP orders increases the proportion of volumes traded on Equiduct (via the VBBO) that are executed at a less competitive price than on Euronext.

Chart 14: Overall breakdown of volumes traded via the VBBO on Equiduct according to the price level – net of fees (with or without taking into consideration RLP orders on Euronext)



Source: Refinitiv, AMF – CAC40 equities – representative sample of 15 days

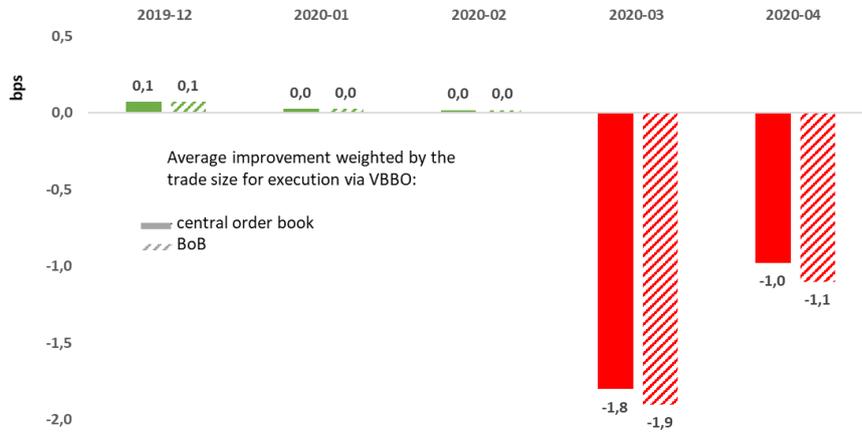
NB: The transactions on HB following a price movement on Euronext ought to have been excluded from the study of price improvements

Note, on Chart 14 above, that the same trends are observed as in the previous section: taking into account trading fees, the fraction of volumes executed at a better price on Equiduct represents a majority during the period considered between December 2019 and April 2020, although the trend reverses in March. The consideration of RLP orders backs up these observations.²⁵ Therefore, it appears that, in a period of high stress, the BoB offer of the Paris stock exchange posts markedly better execution conditions than those observed on Equiduct.

Lastly, although the prices seem to be more often less competitive when taking into consideration RLP orders, the average level of improvement seems to be weakly impacted (see Chart 15 below).

²⁵ In Chart 14, the curves for the central order book are not exactly the same as those in Chart 12a. This, as a reminder, can be explained by the fact that, for this section, only 15 days of the period are examined.

Chart 15: Average overall level of improvement in bps (net of fees) per month (with or without consideration of BoB)



Source: Refinitiv, AMF – CAC40 equities – representative sample of 15 days

Annex 1: Details of calculations

1) Calculation of retail investors' market share

$$Mkt Sh_{retail} = \frac{Bid_{retail} + Ask_{retail}}{2 \times market\ volumes\ (OTC\ included)}$$

2) Calculation of the fraction of the retail investor flow on Euronext served by BoB

$$Mkt Sh_{rlp}(Enx) = \frac{Bid_{rlp}(Enx) + Ask_{rlp}(Enx)}{Bid_{retail}(Enx) + Ask_{retail}(Enx)}$$

3) Calculation of the price improvement comparing prices executed on Equiduct and the Euronext range (with or without RLP orders)

a. In the case of VBBO executions

It is considered that the retail investor flow sent to VBBO is always aggressive.

$$\Delta(VBBO) = 10^4 x \left(\frac{Price_{eqdt}(S) - BidPrice_{enx}}{Price_{eqdt}(S)} \mid \frac{AskPrice_{enx} - Price_{eqdt}(B)}{Price_{eqdt}(B)} \right)$$

b. In the case of transactions on HB

It is considered that the retail investor flow sent to HB is always passive.

$$\Delta(HB) = 10^4 x \left(\frac{BidPrice_{enx} - Price_{eqdt}(B)}{Price_{eqdt}(B)} \mid \frac{Price_{eqdt}(S) - AskPrice_{enx}}{Price_{eqdt}(S)} \right)$$

Annex 2: Details of the flags used in the Refinitiv data

The following table shows the various meanings of the values available in the "Qualifier – Trade" field based on the data collected from Refinitiv. The first three values are those that were adopted for the study in order to distinguish between transactions coming from the Hybrid Book and order executions via VBBO.

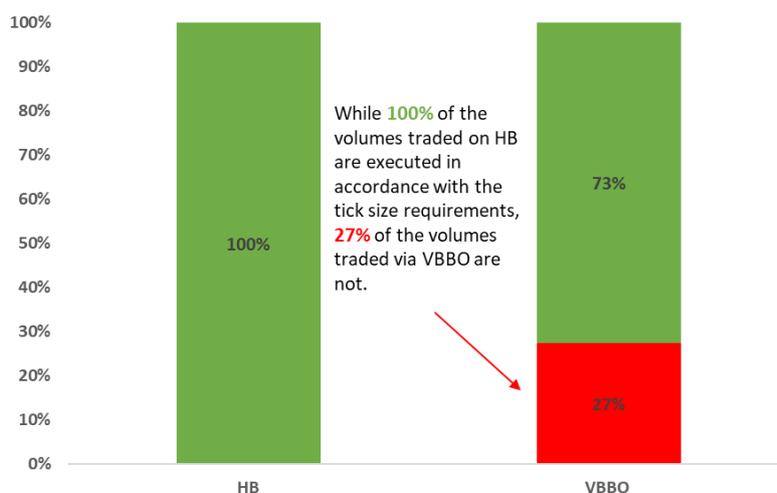
Value	Description
[LSTSALCOND]	HybridBook Trade
B[LSTSALCOND]	VBBO Trade (Buy side aggressor)
S[LSTSALCOND]	VBBO Trade (Sell side aggressor)
A[LSTSALCOND]	Auction Trade
U[LSTSALCOND]	Uncrossing Trade
O[LSTSALCOND]	Opening Cross Trade
C[LSTSALCOND]	Closing Cross Trade
N[LSTSALCOND]	Off-Book On-Exchange Trade

Source: Refinitiv

Annex 3: Compliance with tick size requirements on Equiduct

A study of the execution prices observed on Equiduct shows that the VBBO functionality apparently does not always comply with the tick size requirements (see chart below).

Chart: Compliance with tick size requirements on Equiduct



Source: Refinitiv, AMF – CAC40 equities

Barring a reporting error, it appears from the above chart that 27% of the volumes traded via the VBBO between December 2019 and April 2020 were traded at a different price from the single price present on the other venues serving as a reference for Equiduct. By definition, these transactions on a hybrid model do not comply with tick size requirements. To the best of our knowledge, neither the German regulator nor ESMA have examined this aspect since the change of the tick size rule.