

Hidden Liquidity in a Pure Order-Driven Market



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Abstract

This letter focuses on hidden orders and shows how they contribute to liquidity. Based on a rebuilt order book from Euronext data, the part of liquidity which is not disclosed to market participants is described and its determinants are analyzed.

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1. INTRODUCTION

A majority of securities markets around the world are now based on an electronic limit order book. Their greater transparency, compared with dealer systems, is probably the main reason for their current popularity. The trading systems of such markets often enforce a price-time priority order precedence rule. During the continuous session, submitted orders are totally or partially executed if they hit a quote on the opposite side of the order book and are registered in the book otherwise. For most markets, this continuous session begins with an open call auction and sometimes ends with a closing call auction.

Despite their great transparency, a large number of order-driven markets allow traders to submit hidden orders. On Euronext, for example, traders are allowed to submit orders with a quantity that will not be fully disclosed to other market participants. The disclosed quantity is the number of shares the trader wishes to be displayed on the market screens. In return, the hidden quantity loses time priority.

To date, literature on hidden orders is scarce. The first paper that deals with hidden orders is Harris (1996), where the motives for submitting such orders are investigated. Recent studies include Pardo and Pascual (2003), who focus on hidden liquidity for Spanish stocks, and Anand and Weaver (2004), who analyze the abolition of hidden orders and their reintroduction on the Toronto Stock Exchange.

The letter is organized as follows. Section 2 explains the importance of hidden orders and the resulting hidden liquidity. The determinants of hidden liquidity are analyzed in Section 3. Concluding remarks are provided in Section 4.

2. HOW IMPORTANT IS HIDDEN LIQUIDITY

Our sample contains 82 Euronext blue-chips, *i.e.* the stocks belonging to AEX, BEL20 or CAC40 indexes, over the three-month period from October 1 to December 31, 2002. Following the methodology described in De Winne & D'Hondt (2004) to rebuild the order book, we have 19,670,023 order book states occurring in continuous trading for all the stocks. For each order book state, we can distinguish the hidden depth from the disclosed depth associated with every quote.

Some descriptive statistics aggregated by index are given in tables 1 and 2. The first table reports the number of orders as well as the number of hidden orders submitted over our three-month sample period. Hidden orders represent only 4% of all orders for the CAC40 or BEL20 stocks and 7.6% of all orders for the Dutch index stocks. Whatever the index, we find that the undisclosed part equals on average 75% of the total order size.¹ Table 2 reveals that, even if there are few hidden orders in our sample, they involve large volumes. Indeed, 11% of hidden orders for CAC40 or BEL20 stocks and 4% of hidden orders for AEX stocks involve a total quantity at least equal to the Normal Block Size (NBS).² Moreover, most hidden orders specify a total quantity larger than half the NBS.

Table 1: Frequency of hidden orders (HO)

Index	Number of orders	Number of HO	HO%
AEX	6,459,484	489,597	7.6
BEL20	663,587	26,656	4
CAC40	13,214,587	556,098	4

1 - Results not reported here but available upon request.

2 - For each stock we calculate the Normal Block Size from the Normal Block Amount, *i.e.* the thresholds used by Euronext authorities to define block trades.

Table 2: Proportion of large hidden orders (HO). NBS refers to the Normal Block Size.

AEX	BEL20	CAC40
Proportion of HO with a total quantity larger than the NBS		
4,18%	10.71%	11.11%
Proportion of HO with a total quantity larger than the NBS/2		
99,55%	92.22%	99.26%

As hidden orders deal with large volumes, the question of their impact on market transparency is a relevant issue. To define the magnitude of hidden liquidity, we compute several variables for each order book state. For purposes of comparison across stocks, we express the depth in euros (Depth in €) by multiplying the number of shares available on both sides of the order book at the first five limits by the previous trade price. We obtain three ratios by dividing the undisclosed depth available at the first limit, at the first five limits or in the whole order book by the corresponding total depth. Then, we calculate time-weighted averages for each stock for all these variables. Table 3 shows averages of these results across stocks within an index or a market capitalization quartile.

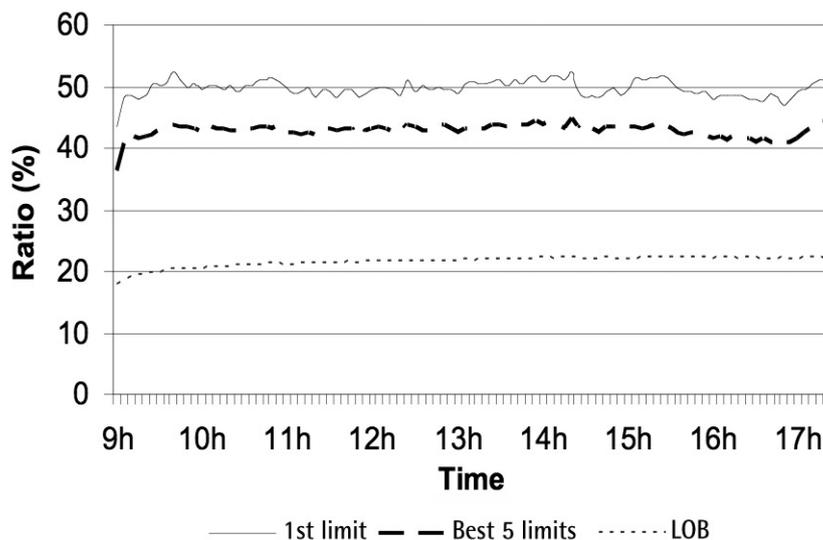
Table 3: Depth and hidden liquidity. Q1, Q2 and Q3 are respectively equal to €4.2, 8.8 and 15.2 billion.

	Depth in €	Ratio 1st limit	Ratio first 5 limits	Ratio whole book
Panel A : Results aggregated according to the index				
AEX	1,105,499	43.7 %	33.1 %	11.8 %
BEL20	498,517	48.9 %	43.2 %	20.4 %
CAC40	1,200,082	56.1 %	49.5 %	27.2 %
Panel B : Results aggregated according to quartiles based on market capitalization				
1st quartile	479,324	47.5 %	39.8 %	18.6 %
2nd quartile	723,799	57.5 %	51.9 %	27.6 %
3rd quartile	1,179,043	53.0 %	44.8 %	20.2 %
4th quartile	1,679,995	45.6 %	37.5 %	19.0 %

Table 3 evidences the large impact of hidden orders on market transparency. Hidden liquidity represents around 20% of the total quantity available in the whole order book. When we focus on the first five limits, hidden liquidity can reach 50% of the total depth (CAC40 stocks). Finally, the impact is greatest at the best limit, where hidden quantity can represent more than half the total depth. Results for market capitalization quartiles do not give any additional information. However, findings aggregated by index show that hidden liquidity seems to be lower for Dutch stocks.

To identify a potential pattern for hidden liquidity, we concentrate on how the ratios fluctuate throughout the continuous session. So, for each stock, we first compute the average depths (total and hidden) for every five minute interval over the continuous session and then calculate the corresponding ratios of hidden depth. Figure 1 shows the cross-sectional averages of these ratios. We observe some volatility of the ratios around their respective average level, except for the ratio computed from the whole order book. At the beginning of the continuous session, depths are lower because the opening call auction matches lots of orders while the opposite phenomenon occurs before the closing call auction when traders fill the order book. Since lots of hidden orders are present at the top of the order book, ratios are consequently affected at the beginning and the end of the trading session.

Figure 1: Pattern of depth ratios. 1st limit, Best 5 limits and LOB respectively refer to ratios computed from the first limit, the best five limits and all limits of the order book.



3. DETERMINANTS OF HIDDEN LIQUIDITY

In the literature, several reasons justify the use of hidden orders. Harris (1997) and Aitken *et al.* (2001) suggest that hidden quantities help liquidity providers to limit their order exposure risk. Order exposure may lead to higher execution costs because it can reveal the trader's motives, the price impact of future trades or free trading options. According to other authors like Pardo & Pascual (2003), traders use hidden orders to mitigate adverse selection costs. They specify undisclosed quantities when the risk of trading against informed traders is high.

To analyze the determinants of hidden liquidity in our sample, we first use traditional proxies for order exposure risk. Tick size is expected to be negatively related to hidden liquidity because it makes front-running expensive on markets enforcing a time precedence rule. Price volatility should be positively related to hidden liquidity because it increases the option value of orders. Trading activity is expected to be negatively related to hidden liquidity since the order exposure risk is smaller for frequently traded stocks. In addition, trading activity may also be viewed as a proxy for adverse selection costs. We can admit that the risk of informed trading is lower for stocks with a high trading activity because they are more followed up by financial analysts than infrequently traded stocks. As in Aitken *et al.* (2001), trading activity can be replaced by market capitalization. So, we expect a negative relationship between hidden liquidity and market capitalization.

To check whether the above factors really affect hidden liquidity, we cross-sectionally estimate the following OLS regression models:

$$HL_j = \alpha + \beta_1 Tick_j + \beta_2 Volat_j + \beta_3 Act_j + \varepsilon_j \quad (1)$$

$$HL_j = \alpha + \beta_1 Tick_j + \beta_2 Volat_j + \beta_3 Capi_j + \varepsilon_j \quad (2)$$

In Equations (1) and (2), hidden liquidity for stock j , HL_j , is computed by dividing the average hidden depth at the best limit by the average total depth at this limit. Both averages are time-weighted. $Tick_j$ represents the inverse of mean price for stock j and $Volat_j$ is the average daily High-Low.³ We proxy the stock j trading activity, Act_j , by the average daily trading volume (expressed in €). Finally, the market capitalization for stock j , $Capi_j$, is computed on the first day of our sample period.

Table 4: Determinants of hidden depth at the first limit. (**) and (***) indicate significant results at a level of 5% and 1% respectively.

	Model 1	Model 2
Intercept	0.471***	0.499***
Tick	-0.485***	-0.445***
Volat	1.996***	1.358**
Act	-7.86E-12***	-
Capi	-	-2.22E-12***
R-Square	0.292	0.287

In both models, the estimates are consistent with our expectations and highly significant. So, hidden liquidity is negatively related to tick size and trading activity or market capitalization while volatility increases hidden liquidity.

4. CONCLUSION

Although transparency is a hot topic in market microstructure research, the literature devoted to hidden orders is not very extensive to date. However, the use of hidden quantities becomes a widespread practice on lots of securities markets such as Nasdaq, the Toronto Stock Exchange or the Australian Stock Exchange. Our regression analysis reveals that hidden liquidity on Euronext is larger for stocks with a low tick size, a high volatility and a low trading volume or market capitalization. As shown in this letter, hidden liquidity on CAC 40 stocks reaches 50% of total depth at the best five limits. Given the large volumes involved by hidden orders, hidden liquidity will undoubtedly become a key point in market transparency issues.

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