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Sunshine Trading in an Emerging Stock Market

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Sunshine Trading in an Emerging Stock Market

Abstract

How is liquidity formed in financial markets? Do traders preannounce their orders to attract outside liquidity providers (a practice referred to as sunshine trading)? Using order-level data from the West-African Bourse, we find that i) large orders are placed early during the preopening period and are not cancelled, ii) for most of the stocks in our sample, preopening prices reveal information long before trading actually occurs, and iii) large volumes are traded without significant price movements. This evidence is consistent with sunshine trading. In addition, we find that the profits of the most active brokers are lower than the profits of less significant intermediaries. This result suggests that the main brokers do not collude to manipulate prices. We provide implications of our findings for global portfolio management.

1. Introduction

Infrequent trading is a widespread feature of stock markets. Easley et al. (1996) note that "on organized exchanges, many (if not most) listed stocks trade infrequently", and use the New York Stock Exchange and the London Stock Exchange as illustrations. Khwaja and Mian (2004) point at the same phenomenon in emerging markets. They indicate that, in Pakistan, Hungary, Portugal, Ireland, and Iceland, the 5 most traded stocks comprise around 70% of the turnover, implying that the trading activity of the remaining stocks is very limited. Infrequent trading is even more pronounced in African stock markets where, according to Kenny and Moss (1998), the turnover in Sub-Saharan countries did not exceed 10% of the capitalization in 1995.

In this context, understanding liquidity formation is crucial both for market designers who would like to promote trading, and for traders whose profits largely depend on the execution quality. Two market imperfections are known to impede liquidity: costly market participation (see Grossman and Miller, 1988) and asymmetric information (see Glosten and Milgrom, 1985). However, some trading arrangements and market organizations can mitigate the impact of these two factors. Admati and Pfleiferer (1991) show that sunshine trading whereby traders preannounce their orders can enhance liquidity by improving the coordination between demand and supply of liquidity. Dia and Pouget (2004) further demonstrate how a preopening period coupled with a long-term relationship among market participants can constitute an effective and credible way to implement sunshine trading. To our knowledge, our paper is the first to empirically study these issues.

Our investigation uses data from the West-African Bourse. This stock market represents an ideal venue to empirically identify sunshine trading. First, the West-African Bourse includes a preopening period. Second, participation in the West-African Bourse is likely to be costly for international investors who are the major liquidity providers in African stock markets. If they were to participate in this market (and thus provide liquidity), these global portfolio managers would have to learn about the macroeconomic conditions prevailing in West-Africa, and about the uncertainty surrounding a particular stock. This information gathering process is likely to be quite costly, in term of time and research effort, in a developing economy with relatively poor information availability. This cost of market participation is reinforced by the fact that the West-African Bourse is not included in global indexes such as the MSCI World Index or the IFC Global Emerging Markets Index. To the extent that portfolio managers are evaluated and compensated with respect to these benchmarks, this creates an additional opportunity cost of trading in West-Africa. Finally, only a small number of broker-dealers can submit orders to the market and these orders are not anonymous. The West-African Bourse thus offers an ideal venue for the development of the long-term relationships necessary for the credibility of sunshine trading.

Our empirical results can be summarized as follows: i) part of the large orders are placed early during the preopening period and are not cancelled, ii) for most of the stocks, tentative prices reveal information long before trading actually occurs, and iii) large volumes are transacted without significant price movements. Consistently with the theoretical models cited above, we argue that market participants implement sunshine trading to enhance market liquidity and welfare. One could argue that the long-term relationships among market participants, if they could sustain sunshine trading, could also allow these agents to collude and manipulate prices in their advantage. Indeed, Khwaja and Mian (2004) argue that the legal and institutional environment in emerging markets is not always able to protect outside investors, and show that in the Karachi Stock Exchange brokers did collude to manipulate prices. Our results differs from theirs. We find that the broker-dealers who are the most active cannot be identified as informed agents.[1] We thus conclude that they are not manipulating prices or, if they do, that they do not profit from this manipulation.

Our paper is related to the empirical literature on liquidity and price formation. Biais, Hillion, and Spatt (1995) study the formation process of the order book in the Paris Bourse. Lehmann and Modest (1994) investigate liquidity provision in the Tokyo Stock Exchange. De Jong, Nijman, and Roell (1995), Chan and Lakonishok (1997), and Bessembinder (2002) focus on the measurement of transaction costs in various market mechanisms. Biais, Hillion, and Spatt (1999), and Cao, Ghysels, and Hatheway (2000) study price formation during preopening periods in stock markets. The impact of communication through non-binding quotes on price discovery has also been investigated by Aggarwal and Conroy (2000), for initial public offerings, and by Peiers (1997), for foreign exchange markets. Price discovery during trading periods has been the focus of numerous studies including Stoll and Whaley (1990), Amihud and Mendelson (1991), and Madhavan and Panchapagesan (2000). Our work complements these papers by underlining the role of preopening periods in the liquidity formation process.

Our paper has implications for global portfolio management. It suggests that the liquidity on the West African Bourse is higher than what is suggested by the average state of the order book. Indeed the practice of sunshine trading appears to enable traders with high liquidity needs to attract liquidity providers. Our results indicate that there is a latent liquidity that is not reflected in the order book because of the market participation cost, and that is realized only when traders engage in sunshine trading. This implies that transaction costs on the West-African Bourse are overestimated when measured in terms of time-series averages (see for example the measure based on the average depth of the order book developed by

[1] This can come either from the fact that they do not possess private information or, as argued in Dia and Pouget (2004), from the fact that they reveal most of their information during the preopening period in order to reduce the adverse selection costs borne by the liquidity providers.

Kehr, Krahnen, and Theissen, 2001). This indicates that portfolio managers willing to trade on the Bourse might make better deals than what is suggested by the average trading activity.

This paper is organized as follows. Section 2 describes the West-African Bourse and our data. Liquidity and price formation are documented in Section 3 and 4, respectively. Section 5 concludes.

2. Description of the Market and of the Data

2.1. Structure of the West-African Bourse

Based in Abidjan, the West-African Bourse was launched in September 1998. [2] It can accommodate listing of companies originating from the various countries of the West-African Economic and Monetary Union (Union Economique et Monétaire Ouest-Africaine). In 2000, 40 stocks were traded on the market. 39 were from Ivory Coast and 1 from Senegal. The West-African Bourse is an electronic order market. Orders can be placed by sixteen broker-dealers via computers located at the Bourse offices or at the brokerage houses themselves. Only these sixteen agents can place orders. [3] The West-African Bourse operates three times a week on Monday, Wednesday and Friday. [4] It is organized as a preopening period followed by a call market. During the preopening period, from 8:30 am to 10:30 am, broker-dealers can place limit orders that can be freely cancelled or revised. Each time an order is entered in the system, an indicative market clearing price is computed and announced to the broker-dealers. Furthermore, these broker-dealers can observe the entire order book, i.e. the characteristics of the orders, the identity of the broker-dealer who placed the orders, and whether or not they trade for their own account. At 10:30, the orders present in the book are used to build the aggregate supply and demand curves. The transaction price is the price that maximizes trading

[2] The West-African Bourse is also called the *Bourse Régionale des Valeurs Mobilières* or BRVM. It succeeded to the Abidjan Stock market which was created in 1979.
[3] In 2002, a new broker-dealer has been authorized by the Bourse.
[4] Since the end of 2001, the Bourse is open daily.

volume. [5] Buying (selling) orders with a limit price greater (smaller) than or equal to the market clearing price are executed. Rationing occurs when there is an order imbalance at the market clearing price. Orders are executed proportionally to their proposed quantity. There is no time priority. If supply and demand do not cross, another trading session is organized on the same day which is similar to the previous one. A preopening period occurs from 11:00 to 11:30 (the orders present in the book at 10:30 are still valid for this new session). The orders are potentially filled at 11:30 using the same procedure as before.

2.2. The Data

Our data set includes all the orders submitted to the market from January 3rd, 2000 to December 13th, 2000. This corresponds to 141 trading sessions. We have all the characteristics of the orders including their time of placement, their limit price, the quantity proposed, and the identity of the broker-dealers who placed the orders. However, we do not know whether broker-dealers act as principals or as agents. For each session, we computed the indicative prices, the market clearing price, and the quantities allocated to each broker-dealer.

Among the 40 stocks listed on the Bourse, we focus on the stocks that were included in the index of the Bourse. The index included 10 stocks at the end of 2000. Among these 10 stocks, only three remained in the index throughout the year. We complemented our data set by choosing five additional stocks that remained in the index at least 2 quarters during the year 2000.

[5] If there are several volume maximizing prices, other criteria are applied until only one price remains. These criteria consist in choosing the price that i) minimizes excess demand, and ii) minimizes variation between successive prices. If several prices still satisfy these constraints, the transaction price is the highest of these prices.

2.3. Summary Statistics

Market Activity - For each stock, Table 1 reports several descriptive statistics for the year 2000 including the average and standard deviation of the volume per trading session, the average number of orders per trading sessions, and the turnover defined as the total number of shares traded over the number of outstanding shares.

The volume per trading session, and the number of orders submitted to the market are on average quite low. These phenomena are reflected in a very low turnover. The market thus appears rather inactive. This is confirmed by the large number of trading sessions without trades. Interestingly, despite the apparent low liquidity, the transaction volume is quite volatile. This suggests that, from time to time, the market experiences shocks on the demand and/or on the supply of shares. This high trading volume volatility despite the low average volume suggests that the West-African Bourse is punctually able to accommodate large transactions. The extent of orders cancellations and modifications appears limited: overall, only 2% of the orders are cancelled, and only 7% are modified.

Broker-dealers' Activity - Table 1 indicates that the number of broker-dealers active on the market is low. Between two and seven broker-dealers (out of sixteen) intervene on the market. This means that all the broker-dealers are not providing liquidity at every trading session. Following Ellis, Michaely, and O'Hara (2000), to assess the competitiveness of the Bourse, we computed for each stock the average Herfindahl index across the sessions with a non-null trading volume. For a given trading session, the index is equal to the sum of the squares of the market share of each broker-dealer. The market share of a broker-dealer is computed as the ratio of the number of shares traded by the broker-dealer over the transaction volume. An index of one corresponds to a monopolistic situation while an index of 1/n, n being the number of active broker-dealers, corresponds to a situation where every broker-dealer handles the same volume. Table 1 shows that the Bourse is an oligopoly market. This result echoes the findings of Ellis, Michaely, and O'Hara (2000) who draw similar conclusions for the NASDAQ market, and in particular for low volume stocks. Table 2 complements these results. It presents the broker-dealers' activity in terms of order placement and shares traded averaged across stocks and trading sessions. Table 2 shows that 8 broker-dealers account for 99% of the transaction volume and that the 4 largest broker-dealers alone account for 89% of this volume. The Bourse thus appears as a concentrated trading venue where a few agents are making the market.

Transaction Costs - Table 3 presents a measure of transaction costs for the various stocks under study. This measure was constructed following Kehr, Krahnen, and Theissen (1998). For each trading session, we added one buying market order in the order book, and computed the new transaction price (P_b). After canceling this buying order, we added one selling market order, and computed another transaction price (P_s). Transaction costs were measured by the following formula: $\frac{P_b - P_s}{P^*}$ where P^* was the actual transaction price. We computed this measure by adding orders of various sizes: one, ten, a hundred, two hundred, five hundred, and one thousand. For each stock, we computed the average transaction cost across trading sessions where the additional buy or sell orders could find a counterpart. The number of trading sessions in which the order book was not thick enough to allow execution of the additional orders is also provided. These trading sessions may be viewed as infinitely illiquid.

Table 3 suggests that average transaction costs are high on the West African Bourse. They represent from 2.6% to 16.4% of the transaction price for a one hundred-share order with an average equal to 6.8% for the 8 stocks we consider. Compared to the findings of Kehr, Krahnen, and Theissen (1998) concerning the opening call in Frankfurt, these transaction cost appear rather large. Moreover, there is a lot of trading sessions, from 26 up to 130 sessions depending on the stock considered, in which it was not even possible to add one-share orders and still find counterparts. This might again be a sign of extremely poor liquidity on the

Bourse. However, such a low liquidity is in some sense at odds with the fact that high volumes are observed on particular days. In fact, we shall argue that this measure consistently overestimates transaction cost since it only considers submitted orders and not latent orders. In the context of an emerging market, the bias can be important because of the cost associated with market participation.

3. Liquidity formation

This section studies the liquidity formation process in the West-African Bourse. The summary statistics presented above suggest that the trading activity is on average quite low and volatile. The volatility of the returns is also low. To complement these points, Figure 3 shows the number of shares traded on the market along with the transaction price over the 141 trading days in our sample. Panels A trough H correspond to the 8 stocks under study sorted alphabetically. For all the stocks, the trading volume appears highly volatile while the prices are surprisingly stable. These features indicate that the market is punctually able to accommodate huge transactions without major price adjustments.

Building on these graphical impressions, we perform the following regressions. For each stock, we regress the absolute returns from the last trading sessions (a measure of the price volatility) onto the contemporaneous trading volume. The estimated equation is:

$$\frac{|P_t - P_{t-1}|}{P_{t-1}} = a + b \times Q_t + e_t$$

t represents the time expressed in terms of trading sessions with a non-null trading volume. P_t is the transaction price in CFA francs, and Q_t is the trading volume in shares at time *t*. The results are in Table 4.

For the 8 stocks, the coefficient *b* appears not significantly different from zero. Further, the regression R^2s are extremely low. For the 8 stocks, we cannot reject the hypothesis that trading volume has no impact on prices, and in particular that high volumes does not destabilize prices. This may appear counterintuitive as one would expect a thin market to generate high execution costs. This is however consistent with Dia and Pouget (2004)'s model where liquidity flows to the market only when it is needed thanks to sunshine trading going on during the preopening period. Our subsequent empirical investigations aim at capturing the extent to which traders implement sunshine trading on the West-African Bourse.

To preannounce their liquidity needs, investors should place orders early during the preopening period. In particular, to the extent that large liquidity needs primarily require preannouncement, large orders should be observed early during the preopening. Then, in order to constitute credible announcements, these orders should not be cancelled before the call. Finally, if sunshine trading is successful on the Bourse, a significant part of the orders placed early should be eventually executed. Tables 5 and 6 address these issues. [6] To construct these tables, we classify the orders according to two dimensions: their size and their time of placement during the preopening period. Each dimension is divided in four quartiles. This creates a 16-cell table. The upper-left cell includes the orders pertaining to the fourth quartile in terms of size, and to the first quartile in terms of placement time. This cell thus includes the (relatively) large orders that are placed (relatively) early during the preopening period. Table 5 presents the average proportion of orders of various sizes placed during the four intervals of the preopening period.[7] The first quartile of placement time is on average 9:16 am. The second quartile of placement time is on average 9:39 am. The third quartile of placement time is on average 10:07 am. The first quartile of order size is on average 9 shares.

[6] We have not analyzed order cancellations and modifications since only a fairly small fraction (overall 9%) of the orders is affected by such operations (see the summary statistics). We rather study the order book after cancellations and modifications occurred.

The second quartile of order size is on average 32 shares. The third quartile of order size is on average 92 shares. Since sunshine trading is more likely to occur when large quantities have to be traded, our analysis will focus on large orders, i.e. orders pertaining to the 4th and 3rd size quartiles.

From Table 5, we can compute the proportion of large orders placed in the first part of the preopening period (before the median placement time). These proportions are 50% and 56% for the 4th and 3rd size quartiles respectively. This means that large orders are quite often placed early during the preopening period. To verify that such large orders do not only reflect market manipulation, Table 6 reports the proportion of orders executed in each category. It indicates for each order size and each placement time the proportion of orders that have been (partially) filled at the time of the call. From Table 6, we observe that 28% of the large orders placed early (4th and 3rd size quartiles, and 1st and 2nd time quartiles) are on average executed. This indicates that a substantial part of these orders is "in the market". Figure 4 illustrates these findings. It shows that large orders are uniformly distributed over time and that a substantial part of the orders placed in the first part of the preopening period end up executed.

These results may appear surprising if one believes that traders have an incentive to refrain from placing orders as long as these orders cannot be executed. Indeed, insiders may be willing to conceal their information as long as possible. Uninformed traders may be willing to wait to gather as much information as possible. On the contrary, the theoretical results on sunshine trading suggest that traders may have an interest to preannounce their liquidity needs in order to attract potential liquidity providers. This is consistent with our empirical results. These results complement the empirical findings of Biais, Hillion and Spatt (1999) concerning the Paris Bourse. Note that, in the West-African Bourse, an intense activity occurs well before the time of the call. On average, the median placement time is 9:39 am meaning that half of

[7] Columns and rows do not always add up to 25% of the total number of orders. This happens when several observations fall on the limit between two quartiles. In this case, they were classified in the lower quartile.

the orders are already placed more than 50 minutes before transactions occur. In contrast, the major part of the order placement in the Paris Bourse occurs during the last 30 minutes of the preopening period.

As a robustness check and to give an idea of the number of shares attached to the large orders we focus on, Tables 7 and 8 reproduce the analysis displayed in Tables 5 and 7 respectively.[8] It appears that the large orders (4th and 3rd size quartiles) represent 97% of the quantities that are proposed on the market. These orders are thus of high economic importance in the context of the West-African Bourse. From Table 7, we obtain that 38% and 57% (for the 4th and 3rd size quartiles respectively) of the total quantity proposed via large orders are offered in the first part of the preopening period (before the median placement time). Furthermore, Table 8 indicates that on average 28% of the quantity proposed via large orders placed early (4th and 3rd size quartiles, and 1st and 2nd time quartiles) is eventually exchanged at the time of the call. These results confirm the previous results obtained with orders. They indicate that when broker-dealers want to exchange large quantities of shares, they place large orders early during the preopening period, orders that are often executed during the call. At the beginning of this section, we showed that large traded quantities seem not to incur high execution costs. Our interpretation is that broker-dealers engage in sunshine trading to attract potential liquidity providers. The very low average trading volume in the West-African Bourse suggests that, without sunshine trading, it would be very difficult to trade such large quantities of shares.

Admati and Pfleiderer (1991) suggest that, for the sunshine trading to be effective, the preannouncement should be credible in the sense that agents engaging in sunshine trading should eventually trade the quantities they preannounced. The fairly low number of order cancellations or modifications indicates that offers made during the preopening period can indeed be considered as firm.

4. Price Formation

This section studies the price formation process in the West-African Bourse. When they place orders, broker-dealers have to post limit prices.[9] Over the course of the preopening period, these orders are crossed and their limit prices translate into indicative prices. These indicative prices are publicly available. If traders engage in sunshine trading, we expect indicative prices during the preopening period to be related to call prices. It is clear that toward the end of the preopening period, tentative prices converge toward the call price: the call price per construction equals the last indicative price. However, Dia and Pouget (2004)'s model suggests that, when traders implement sunshine trading, indicative prices computed early during the preopening period should also be related to the actual call price. Admati and Pfleiderer (1991) state that agents have to trade the quantities they preannounced. Extending this argument, their theoretical analysis shows that, when implementing sunshine trading with limit orders, agents should choose to preannounce prices at which they stand ready to trade. This implies a link between the early tentative prices and the transaction price.

To study this issue, we compute the average indicative price before and after the median placement time. We then regress the return from the previous trading session to the call onto the return from the previous trading session to the preopening period. For each stock, we use OLS regressions to estimate the following equation:

$$\frac{P_t - P_{t-1}}{P_{t-1}} = A^1 + B^1 \times \frac{IP_t^1 - P_{t-1}}{P_{t-1}} + E_t^1$$

where IP_t^1 represents the average indicative price during the first part of the preopening period. The results are in Table 9.

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[8] Table 8 does not take into account potential rationing.

[9] Market orders are prohibited on the Bourse.

Indicative prices computed and announced during the first part of the preopening period are indeed related to the call price for 7 out of 8 stocks. This means that, by looking at early indicative prices, broker-dealers can have a pretty good idea of the price that will prevail on the market. This is consistent with our model where the limit price quoted by the insider during the preopening period equals the price he quotes at the trading stage.

Given that no transaction occurs during the preopening period, the informational content of indicative prices in terms of fundamental valuation could be questioned. In the context of sunshine trading, this issue becomes crucial since preannouncers are big participants and may try to manipulate market prices. On the other hand, the model cited above shows that information revelation during the preopening period might be beneficial to the traders since it relaxes the participation constraint of the outsider.

To address this issue, we follow Biais, Hillion, and Spatt (1999) and study whether the return between the previous trading session and the next trading session can be predicted by the return between the previous trading session and the preopening period. For each stock, we use OLS regressions to estimate the following equation:

$$\frac{P_{t+1} - P_{t-1}}{P_{t-1}} = \alpha^1 + \beta^1 \times \frac{IP_t^1 - P_{t-1}}{P_{t-1}} + \varepsilon_t^1$$

To obtain a measure of the total information that could have been revealed during the preopening period, we also ran these regressions with the call price P_t instead of the mean early indicative price IP_t^1. The estimated equation was:

$$\frac{P_{t+1} - P_{t-1}}{P_{t-1}} = \alpha + \beta \times \frac{P_t - P_{t-1}}{P_{t-1}} + \varepsilon_t$$

The results are in Tables 10 and 11. Table 10 indicates that, for some stocks, early indicative prices incorporate information. This is supported by the fact that β^1 is statistically significant 5 times out of 8 at the 10% error level (4 times out of 8 at the 5% error level).

Using data from Tables 10 and 11, the amount of information revealed in the first part of the preopening period can be measure by the ratio between the R^2 of the regression using the average indicative price during the first part of the preopening period and the R^2 of the regression using the call price. Across the 8 stock, 44% of the information is on average revealed during the first part of the preopening period, i.e. long before trading takes place. However indicative prices during the preopening period do not reflect all the information that is incorporated in the call price. This can be seen from the fact that β^1 is overall smaller than 1, or from the fact that the R^2 in Table 10 are in general smaller than the R^2 in Table 11. This could leave room to insiders' profit. In the context of sunshine trading, the agents cannot afford to profit from insiders' profits without suffering from future denial of liquidity provision. Large broker-dealers who implement sunshine trading are thus less likely to be identified as insiders. This is contrary to what one would expect if the large broker-dealers were colluding to manipulate prices.

To examine this issue, we looked at whether broker-dealers' positions could predict the future evolution of securities' prices. For each stock and each broker-dealer, we regressed the future returns (from the current trading session to the next) onto the signed quantity traded by the broker-dealer. The estimated equations were:

$$\frac{P_{t+1} - P_t}{P_t} = x + y \times q_t + z_t$$

where q_t is the signed quantity (positive for a purchase, and negative for a sale) traded by the broker-dealer. A broker-dealer is identified as insider as soon as the regression coefficient is positive and statistically significant at the 10% error level. Table 12 reports the number of times each broker-dealer has been identified as insider across the 8 stocks in our sample.

Overall, very few broker-dealers have been identified as insiders. This indicates that the adverse selection risk on the market is fairly low. This may appear surprising in an emerging market but can be explained by the fact that information is revealed during the preopening period. Furthermore, the broker-dealers identified as insiders are not the major broker-dealers of the marketplace. This finding reinforces the conclusions of the previous section. These major broker-dealers are indeed the ones susceptible to engage in sunshine trading, and are thus the ones who may suffer from future liquidity denials. If they engage in sunshine trading, it seems reasonable to think that they do not attempt to mislead their trading partners. On the other hand, the small broker-dealers that do not receive liquidity shocks because they do not deal much with outside investors can afford to profit from private information if they have some. Altogether, these results suggest that broker-dealers in the West-African Bourse did not manipulated prices in their advantage.

5. Conclusion

This paper empirically studies sunshine trading in financial markets. Using data from the West-African Bourse, we show that: i) part of the large orders are placed early during the preopening period and are not cancelled, ii) for some stocks, tentative prices reveal information long before trading actually occurs, and iii) large volumes are transacted without significant price movements. Consistently with Admati and Pfleiderer (1991) and with Dia and Pouget (2004), market participants appear to implement sunshine trading strategies in order to enhance market liquidity.

This paper has implications for global portfolio management. It suggests that the liquidity on the West African Bourse is higher than what is indicated by the average state of the order book. Indeed the practice of sunshine trading appears to enable traders with high liquidity needs to attract liquidity providers only when these liquidity needs are realized. There is a latent liquidity that is not reflected in the order book because of the cost of market participation, and that appears only when traders engage in sunshine trading.

This paper also shows that the preopening period may play an important informational role and enhance welfare. Market organizers may thus have an interest in providing traders with pre-trade communication platforms such as preopening periods as a way mean to disseminate information regarding both liquidity needs and asset valuation.

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Table 1 – Trading activity

This table presents various measures of trading activity for the 8 stocks under study. The average and the standard deviation of the trading volume, and the average number of orders are computed over the 141 trading sessions in 2000. The turnover is defined as the total number of shares traded over the number of outstanding shares for the year 2000. The average and the standard deviation of the number of active broker-dealers are computed across the trading sessions with a non-null order placement. The average Herfindahl index and the average 1/number of broker-dealers are computed across the trading sessions with a non-null trading volume. BICC stands for Banque Internationale pour le Commerce et l'Industrie de Côte d'Ivoire. BLHC stands for Blohorn – Côte d'Ivoire. CIEC stands for Compagnie Ivoirienne d'Electricité. PALC stands for Palm – Côte d'Ivoire. SGBC stands for Société Générale de Banques en Côte d'Ivoire. SHEC stands for Shell – Côte d'Ivoire. SNTS stands for Société Nationale de Télécommunication. NA stands for "Not Available".

	BICC	BLHC	CIEC	PALC	SGBC	SHEC	SNTS	STBC
Average Volume	246	88	100	141	116	71	1719	73
Standard Deviation of the Volume	772	253	168	378	494	170	7211	295
Turnover	0.0231	NA	0.0050	0.0050	0.0053	0.0139	0.0242	NA
Number of Trading Sessions without Trades	54	38	24	73	105	33	3	57
Average Number of Orders	10	9	16	13	8	8	31	11
Proportion of Cancelled Orders (in %)	1.41	2.86	3.27	1.00	1.25	3.19	2.95	1.08
Proportion of Modified Orders (in %)	4.44	11.45	9.95	5.79	4.83	8.38	5.55	9.32
Average Number of Active Broker-Dealers	2.21	3.49	4.52	4.67	2.76	3.72	7.35	3.48
Standard Deviation of the Number of Active Broker-Dealers	0.98	1.44	1.44	1.54	1.05	1.47	0.26	1.77
Average Herfindahl Index	0.81	0.54	0.49	0.57	0.81	0.49	0.52	0.58
Average 1/number of broker-dealers	0.56	0.35	0.25	0.25	0.44	0.32	0.20	0.41

Table 2 – Broker-dealers' activity

This table presents the number of orders placed and the number of shares traded by each broker-dealer, averaged across stocks and trading sessions.

	Average Number of Orders	Average Number of Shares Traded
BD1	3.1	33
BD2	6.8	70
BD3	2.6	151
BD4	3.1	101
BD5	35.9	3117
BD6	5.7	334
BD7	0.4	8
BD8	2.4	20
BD9	0.0	0
BD10	1.1	126
BD11	0.2	3877
BD12	1.3	27
BD13	0.3	2
BD14	0.2	1
BD15	10.1	494
BD16	32.3	4779

Table 3 – Transaction costs

The measure of transaction costs we used is inspired by Kehr, Krahnen, and Theissen (1998). For each trading session, we added one buying market order in the orderbook, and computed the new transaction price (P_b). After canceling this buying order, we added one selling market order, and computed another transaction price (P_s).

Transaction costs were measured by the following formula: $\frac{P_b - P_s}{P^*}$ where P^* was the actual transaction price.

We computed this measure with orders of various sizes: one, ten, hundred, two hundred, five hundred, one thousand. For each stock, we computed the average transaction cost across trading sessions where the additional buy and sell orders could find a counterpart. The number of trading sessions (out of 141) in which the orderbook was not thick enough to allow execution of the additional orders is also provided.

	BICC	BLHC	CIEC	PALC	SGBC	SHEC	SNTS	STBC
Transaction cost for the trading of 1 additional share	5.0	3.8	2.5	9.2	3.3	1.9	1.7	3.3
Number of trading sessions without liquidity	99	84	66	84	130	65	26	92
Transaction cost for the trading of 10 additional shares	5.3	12.5	5.3	9.7	4.3	2.4	1.9	3.9
Number of trading sessions without liquidity	104	114	106	90	132	80	29	100
Transaction cost for the trading of 100 additional shares	6.2	16.4	5.2	10.9	3.9	3.6	2.6	5.6
Number of trading sessions without liquidity	122	121	134	96	135	108	64	129
Transaction cost for the trading of 200 additional shares	6.7	26.0	3.73	14.6	3.3	2.6	3.0	3.1
Number of trading sessions without liquidity	127	133	140	102	138	120	77	133
Transaction cost for the trading of 500 additional shares	10.0	59.5	*	16.7	3.3	4.5	4.0	3.9
Number of trading sessions without liquidity	134	139	141	113	138	130	95	138
Transaction cost for the trading of 1000 additional shares	16.4	*	*	22.7	5	4.8	5.6	*
Number of trading sessions without liquidity	138	141	141	126	139	135	105	141

Table 4 – Regression of the instantaneous price volatility onto the trading volume

This table presents the results of OLS regressions of the absolute returns onto the trading volume. The return at date *t* is computed as the difference between the price at date *t* and the price at date *t-1*, divided by the price at date *t-1*. Only the days with a non-null trading volume are considered. The number of observations is consequently not the same for all the stocks. P-values are reported in parenthesis.

	Intercept *a*	**Coefficient *b***	**R²**	**Number of Observations**
BICC	0.0041	-0.0000	0.00	87
	(0.15)	(0.78)		
BLHC	0.0027	0.0000	0.02	103
	(0.00)	(0.21)		
CIEC	0.0143	0.0000	0.00	117
	(0.00)	(0.74)		
PALC	0.0131	-0.0000	0.00	68
	(0.00)	(0.79)		
SGBC	0.0346	-0.0000	0.06	36
	(0.00)	(0.16)		
SHEC	0.0052	-0.0000	0.00	108
	(0.00)	(0.64)		
SNTS	0.0064	-0.0000	0.00	138
	(0.00)	(0.87)		
STBC	0.0076	0.0000	0.02	84
	(0.00)	(0.23)		

Table 5 – Distribution of orders according to their size and their time of placement during the preopening period

For each of the 8 stocks, orders are classified in sixteen categories according to the placement time quartile and the size quartile they belong to. Table 5 averages these data. The upper-left cell of the table represents the large orders placed early. The first quartile of placement time is on average 9:16 am. The second quartile of placement time is on average 9:39 am. The third quartile of placement time is on average 10:07 am. The first quartile of order size is on average 9 shares. The second quartile of order size is on average 32 shares. The third quartile of order size is on average 92 shares.

		Time of Placement				
		1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	sum
Order Size	4th Quartile	6%	7%	6%	6%	25%
	3rd Quartile	7%	7%	5%	5%	24%
	2nd Quartile	7%	7%	6%	5%	25%
	1st Quartile	6%	5%	7%	8%	26%
	sum	25%	25%	25%	25%	100%

Table 6 – Proportion of orders executed at the call as a function of their size and placement time during the preopening period

For each size and time category, this table reports the proportion of orders (partially) filled at the time of the call, averaged across the 8 stocks.

		Time of Placement				
		1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	average
Order Size	4th Quartile	25%	24%	35%	58%	36%
	3rd Quartile	32%	32%	36%	58%	39%
	2nd Quartile	37%	37%	41%	58%	43%
	1st Quartile	34%	34%	43%	53%	41%
	average	32%	32%	39%	57%	40%

Table 7 – Distribution of proposed quantities over the sixteen categories of orders

This table reports the proportion of the total quantity that has been proposed by each type of orders, averaged over the 8 stocks.

		Time of Placement				
		1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	sum
Order Size	4th Quartile	17%	18%	23%	33%	91%
	3rd Quartile	2%	2%	1%	2%	6%
	2nd Quartile	1%	1%	1%	0%	2%
	1st Quartile	0%	0%	0%	0%	1%
	sum	19%	21%	25%	35%	100%

Table 8 – Proportion of the executed quantities proposed by each type of orders that are eventually executed

For each category, this table reports the proportion of quantities that have been exchanged at the time of the call, averaged across the 8 stocks. Potential rationing is not taken into account.

		Time of Placement				
		1st Quartile	2nd Quartile	3rd Quartile	4th Quartile	average
Order Size	4th Quartile	25%	24%	35%	58%	36%
	3rd Quartile	32%	32%	36%	58%	39%
	2nd Quartile	37%	37%	41%	58%	43%
	1st Quartile	34%	34%	43%	53%	41%
	average	32%	32%	39%	57%	40%

Table 9 – Price discovery regressions

This table presents the result of OLS regression of the returns from the previous trading session to the call onto the returns from the previous trading session to the first part of the preopening period. The return at date *t* is computed as the difference between the price at date *t* and the price at date *t-1*, divided by the price at date *t-1*. Only the days with a non-null trading volume are considered. The number of observations is consequently not the same for all the stocks. The data is conditional on the existence of indicative prices in the first part of the preopening period. This further reduces the number of observations. P-values are reported in parenthesis.

	Intercept *A* [1]	**Coefficient *B*** [1]	**R^2**	**Number of Observations**
BICC	0	1	1.00	20
BLHC	-0,0011	0.0148	0.00	45
	(0.18)	(0.74)		
CIEC	-0.0019	0.2395	0.12	62
	(0.55)	(0.00)		
PALC	-0.0049	0.7353	0.71	10
	(0.62)	(0.00)		
SGBC	-0.0608	0.3233	0.41	8
	(0.04)	(0.08)		
SHEC	-0.0013	0.5451	0.25	54
	(0.23)	(0.00)		
SNTS	0.0001	0.4446	0.44	69
	(0.91)	(0.00)		
STBC	-0.0012	0.8993	0.41	26
	(0.47)	(0.00)		

Table 10 – Information revealed by indicative prices

This table presents the result of OLS regression of the returns from the previous trading session to the next trading session onto the returns from the previous trading session to the first part of the preopening period. The return at date t is computed as the difference between the price at date t and the price at date t-1, divided by the price at date t-1. Only the days with a non-null trading volume are considered. The number of observations is consequently not the same for all the stocks. The data is conditional on the existence of indicative prices in the first part of the preopening period. This further reduces the number of observations. P-values are reported in parenthesis.

	Intercept *alpha* [1]	**Coefficient *beta*** [1]	**R^2**	**Number of Observations**
BICC	0.0052	0.9736	0.79	20
	(0.33)	(0.00)		
BLHC	-0.0021	0.0234	0.00	45
	(0.09)	(0.73)		
CIEC	-0.0036	0.1362	0.01	62
	(0.53)	(0.36)		
PALC	-0.0175	0.4496	0.45	10
	(0.13)	(0.03)		
SGBC	-0.0680	0.5485	0.44	8
	(0.10)	(0.07)		
SHEC	-0.0026	-0.0154	0.00	54
	(0.07)	(0.93)		
SNTS	0.0001	0.4871	0.33	69
	(0.97)	(0.00)		
STBC	-0.0012	0.8795	0.27	26
	(0.59)	(0.01)		

Table 11 – Information incorporated in transaction prices

This table presents the result of OLS regression of the returns from the previous trading session to the next trading session onto the returns from the previous trading session to the current trading session. The return at date t is computed as the difference between the price at date t and the price at date t-1, divided by the price at date t-1. Only the days with a non-null trading volume are considered. The number of observations is consequently not the same for all the stocks. The data is conditional on the existence of indicative prices in the first part of the preopening period. This further reduces the number of observations. P-values are reported in parenthesis.

	Intercept *alpha*	Coefficient *beta*	R^2	Number of Observations
BICC	-0.0052	0.9736	0.79	20
	(0.33)	(0.00)		
BLHC	-0.0011	0.8329	0.31	45
	(0.28)	(0.00)		
CIEC	-0.0029	1.2653	0.56	62
	(0.44)	(0.00)		
PALC	-0.0141	0.5556	0.52	10
	(0.17)	(0.01)		
SGBC	0.0297	1.4906	0.83	8
	(0.10)	(0.00)		
SHEC	-0.0026	0.3374	0.09	54
	(0.05)	(0.03)		
SNTS	-0.0008	0.8296	0.42	69
	(0.60)	(0.00)		
STBC	-0.0001	1.1069	0.85	26
	(0.95)	(0.00)		

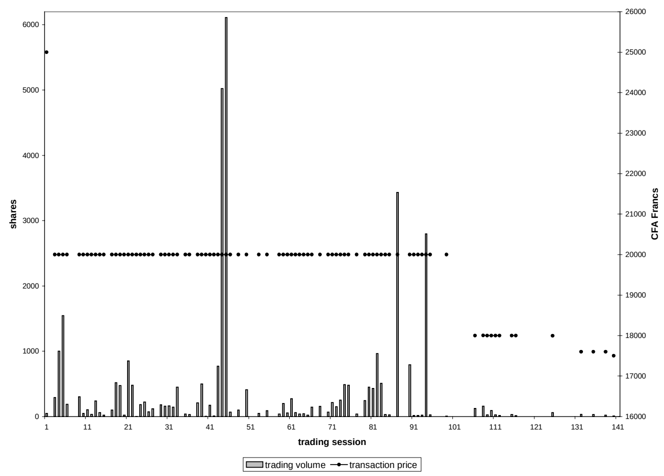
Table 12 – Identification of insiders

This table reports the number stocks out of the 8 stocks in our sample for which a broker-dealer has been identified as insider. To identify insiders, for each stock and each broker-dealer, we regressed the future return at date t onto the signed position taken by the broker-dealer at date t. A broker-dealer will be considered as an insider if it has a positive coefficient with a p-value smaller than or equal to 10%. The future return at date t is computed as the difference between the price at date t+1 and the price at date t, divided by the price at date t. Only the days with a non-null trading volume are considered.
BD stands for broker-dealer.

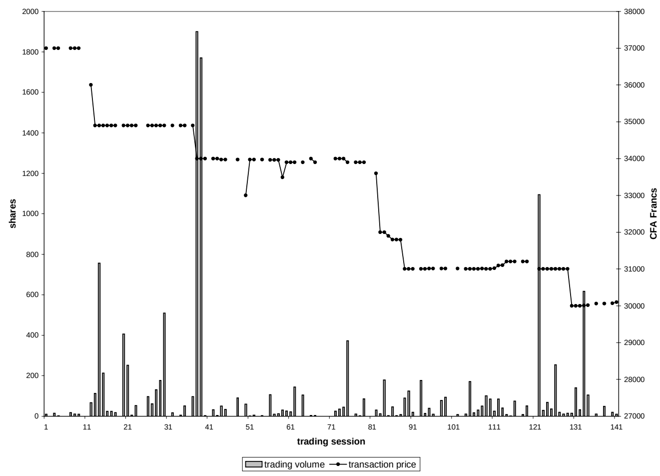
	Number of identifications as insiders
BD1	1
BD2	0
BD3	1
BD4	2
BD5	0
BD6	0
BD7	0
BD8	0
BD9	0
BD10	1
BD11	0
BD12	0
BD13	0
BD14	0
BD15	0
BD16	0

Figure 1 – Volume and Price over the 141 trading sessions in our sample

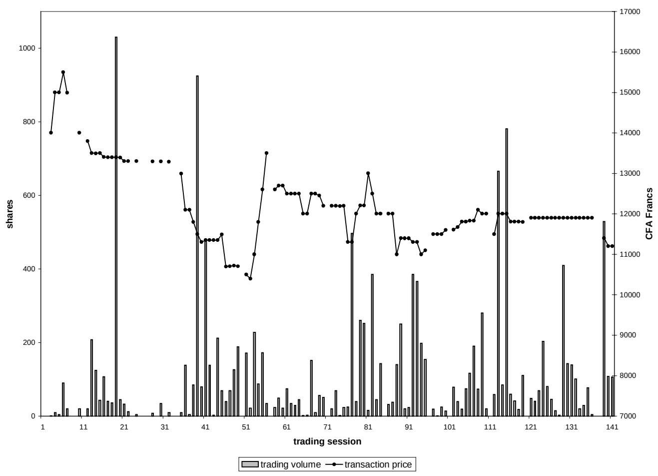
Panel A – BICC



Panel B – BLHC



Panel C – CIEC



Panel D – PALM

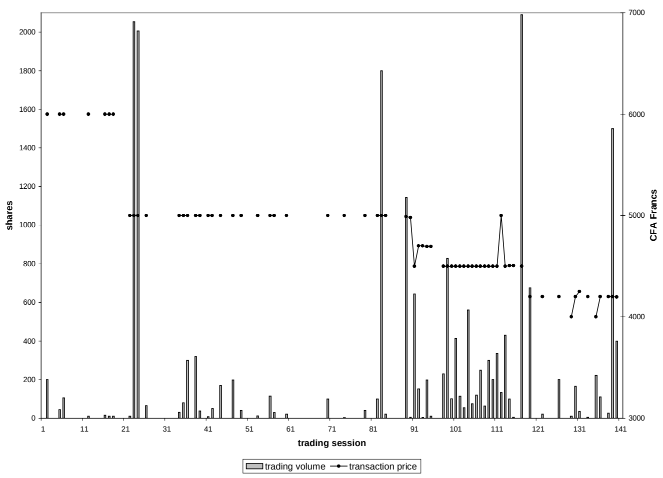
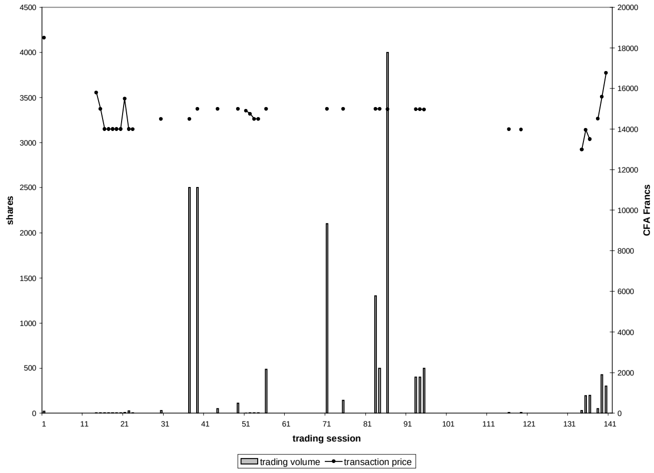
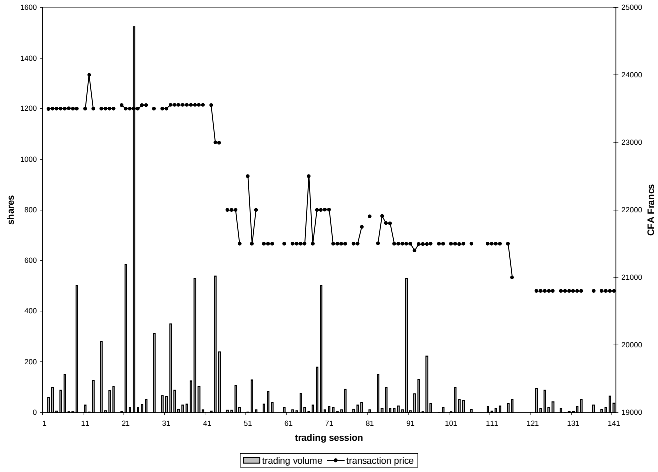


Figure 3 (continued) – Volume and Price over the 141 trading sessions in our sample

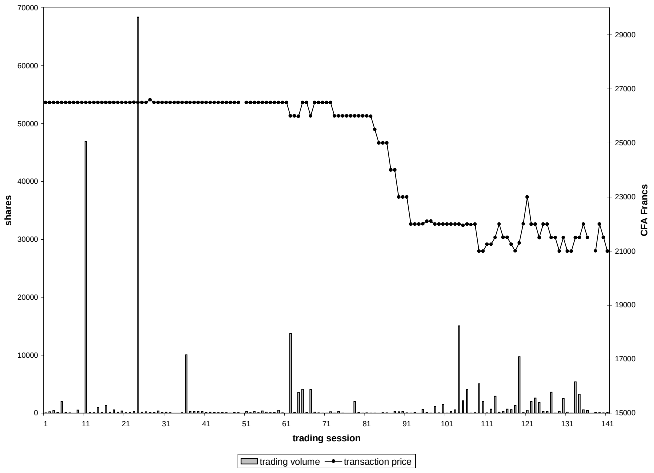
Panel E – SGBC



Panel F – SHEC



Panel G – SNTC



Panel H – STBC

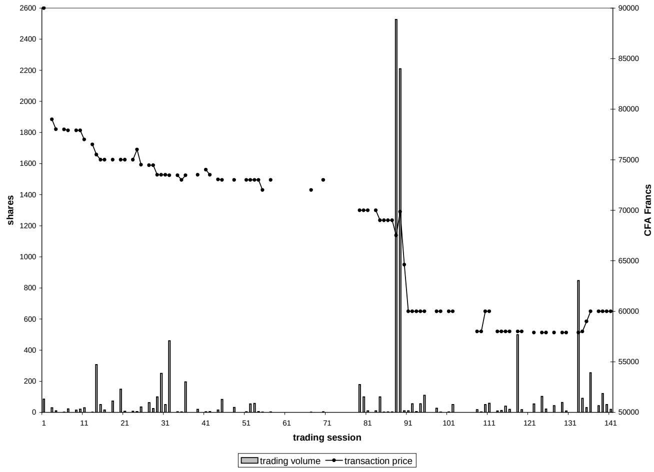


Figure 2 – Large orders during the preopening period

This figure represents the distribution of large orders (i.e. orders pertaining to the 4th and 3rd size quartiles) over the four time quartiles of the preopening period. It also indicates the amount of orders executed in each time quartile. The numbers are averages across stocks, and across the 2 size quartiles.