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Emerging markets and trading costs: lessons from Casablanca

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Abstract

To enhance our understanding of emerging markets, we study a data set from the Casablanca stock exchange containing all the transaction records over a long span. The exchange was included in 1996 in the International Finance Corporation (IFC) data base roughly 3 years after important market reforms. Effective spreads as well as the price impact of large block trades are examined. We uncover prohibitively expensive trading costs which are temporary, yet last for over a year and coincide with the incorporation of the market into the IFC data base. This temporary effect is followed by transaction costs roughly equal to the pre-reforms era. The results we obtain do not support the conventional wisdom that market transparency and trading costs enhance, at least directly, the emergence of a market.

Keywords: Market; Stock; Trading cost

1. Introduction

In the world of today, isolationism is not a practical policy[1]

The city often associated with a movie classic, starring Humphrey Bogart as *Rick* and Ingrid Bergman as *Isla*, is also the site of an emerging financial market called the *Bourse*

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[1] There are many famous lines from the movie *Casablanca*. Each section in the paper starts with a quote related to the theme of the section. The line heading the introduction is a quote from Monsieur Ferrare who gives advice to Rick on how to run his Café Americain.

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de Casablanca.[2] It has been the scene of several structural changes affecting the market's microstructure as well as the role the stock exchange plays as an engine of the Kingdom of Morocco's economy. The *Bourse de Casablanca* was introduced into the International Finance Corporation (henceforth IFC) Emerging Market data base in 1996 together with stock exchanges from two other countries, Egypt and Russia.

We have collected transactions data from the Casablanca Stock Exchange, henceforth called the CSE, using the original historical records of the exchange which were handwritten registers of the daily trading activity. The data set contains all the transaction records over a span of 12 years from a dual market system consisting of an exchange and trading floor and an upstairs OTC large block trade market. The analysis of such data allows us to enhance our understanding of emerging markets as the long span of transactions data from a dual market system enables us to examine many issues so far mainly unaddressed due to lack of data.[3] The basic question we try to answer is: How much of the success or failure of an emerging market can be explained by the type of trading system adopted? Of course our paper examines this question from the perspective of one market—the CSE, and therefore, the answer from our analysis provided to the question should be thought of in a case study context.

Our results show that effective spreads were large, both by historical standards and in an absolute sense, after the reforms. These increases were not associated with the onset of new trading rules, instead they appear to coincide with the time the market gained international recognition as it was incorporated into the IFC database. The reforms, which took place roughly 3 years before the market was incorporated in the IFC data base, had minimal impact on the estimated spreads and other measures of transparency. The effect of increasing transactions costs, while temporary, lasted for over a year. Despite the very large trading costs, the market saw trading volume in the 3 years following the reforms quadruple, then double, and triple in the third year. The market index shows similar spectacular performances. It is also of interest to note that after the surge, estimated spreads appear to have settled at their pre-reform historical levels. Admittedly, our paper examines only a small set of stocks and focuses on one specific market. Moreover, we examine models that are not well suited to deal with a dual market system with thinly traded stocks. However, the type of data we examine is scarce. The results we obtain do not support the conventional wisdom that market transparency and trading costs enhance, at least directly, the emergence of a market.

While the changes in the microstructure are the main focus of our paper, we need first to paint a complete picture of the reforms which took place in Morocco. In Section 2, we discuss the institutional and historical context of the CSE and the various events which transformed the market from a submerged relatively inactive market in the mid-1980s to a fully operational specialist market towards the middle of 1995. We conclude Section 2 with a preliminary analysis of the transactions data and report several

[2] Until recently, the stock exchange was in fact called *Bourse des Valeurs de Casablanca.* In this paper, we will use its present official French name and the English translation Casablanca Stock Exchange.

[3] The emerging market literature has focused almost exclusively its attention on asset pricing issues using the IFC data base, due mainly to the lack of transactions data. Moreover, relatively little attention is paid to the transition dynamics of the process, see, however, Bekaert and Harvey (1995, 1997, 2000).

summary statistics of market activity throughout the different phases of reform. In the remaining of the paper, we pay exclusively attention to microstructure issues. Typically, one thinks of quality, efficiency and transparency using measures such as bid-ask spreads, market depth, liquidity, etc. Unfortunately, we cannot rely on such measures as they simply were neither recorded nor even available for the submerged stages of the market.

In Section 3, we follow statistical approaches which rely exclusively on transactions data. We start with the Roll (1984) model and extend the work of Hasbrouck (1993) who proposed to decompose security transaction prices into a random walk and a stationary component. The former is assumed to represent the efficient market price. We propose two extensions which make the decomposition more appropriate for the relatively infrequent trading, so typical for emerging markets. We also take advantage of the fact that we have observations from two simultaneously operating markets with a different microstructure and the same underlying fundamental price process. In Section 4, we examine the price impact of large block trades taking advantage of the data set which separates block trades from trading floor transactions.[4] Section 5 concludes the paper.

2. From a sleepy place to the wake-up call

> As one customer plays, upon *Rick's* advice, "22" on the roulette twice in a row and wins each time, another customer asks: *Are you sure this place is honest, Monsieur Rick?* Rick's answer: *Sure. . .He's just a lucky guy.*

Rick's *Café Americain* was a place where exit visas to the United States were actively traded, where gambling was tolerated although it was officially banned, and where special discounts were offered to Rick's friends. Of course all of this is the fiction of a movie and as is often said at the beginning of a novel, any resemblance with actual persons or places is purely coincidental. Yet, perhaps some of the features apply to the activity of a pre-emerged market. The emergence of the CSE was not simply a matter of changing a financial market. The purpose of this section is to describe the Moroccan structural adjustment program, the financial sector reforms and the revamping of the CSE. The first subsection describes the reform programs that fundamentally changed Morocco's economy. The next subsection deals with market microstructure of the CSE and discusses the changes that took place. A third subsection describes the details of the data we collected. The fourth subsection covers some preliminary empirical snapshots of the CSE while a final subsection deals with the selection of stocks we consider.

[4] It is rather unusual to have explicit data on large block trades for submerged, emerging or emerged markets. Typically such trades are filtered from transactions data, usually with the consequence of data errors. Some exceptions exist, notably Keim and Madhavan (1996).

2.1. Changing the fundamentals

The reforms in Morocco started in 1989 with the announcement of an ambitious privatization and economic liberalization program. The main scope of the adjustment program was to make Morocco's economy more competitive through the overhaul of the financial sector and the privatization of many state-owned firms. Morocco liberalized its foreign trade, achieved current account convertibility for residents and capital account convertibility for foreign investors, relaxed price controls and undertook important fiscal and monetary reforms.[5]

The reforms of the financial sector focused on (1) the liberalization of interest rates, (2) changes in monetary policy, (3) a decrease in the government access to credit, (4) major regulatory changes of the banking sector, and of particular interest for our analysis, (5) a fundamental change in the operations of the stock market.

The privatization program had many objectives which included easing the strain the state enterprises were putting on the state budget and the Moroccan economy. This program, while not directly linked to the development of the financial sector, affected it in many ways. The privatization law was voted in December 1989. It authorized the transfer from the public to the private sector of 75 companies and 37 hotels. After some delays, the privatization really took off in 1993.[6] A total of 22 companies and 17 hotels were transferred to the private sector between 1993 and 1996 generating 8.9 billion dirhams (DH) with 32.5% of that amount raised through public offerings on the CSE.[7] In January 1996, the government issued convertible bonds which proved extremely successful as they gave priority in buying stocks of privatization SEO or IPO offerings. It should also be noted that a concerted effort was made to sell shares to domestic small investors. Indeed most privatizations were preceded by intense ad campaigns. Many of the IPOs were oversubscribed by the general public. During the 5 years following the stock market reform, Moroccan nationals also had a 50% tax break on equity returns. There were never specific restrictions to the participation of foreigners in the market. However, the small number of shares offered has restricted their participation. At the same time in the privatization process, a ceiling was sometimes set for the number of shares that each individual could buy and some groups were sometimes given priority. For example, some of the early small privatizations, were only available for Moroccans working abroad.

2.2. Financial market reforms

A reform program of the financial sector was undertaken in the summer of 1993 almost simultaneously with the onset of the ambitious privatization program. On September 21, 1993, three laws came into effect regarding: the Casablanca stock exchange, the securities

[5] A useful reference on Morocco's economic reform program is a 1995 report of the World Bank referenced at the end of the paper.

[6] A comprehensive discussion of the privatization program can be found in a document produced by the Ministry of Privatization and State Entreprise (1996). In addition, the Ministry maintains a website with information regarding the privatization program: http://www.minpriv.gov.ma/index.html.

[7] One US dollar is roughly equal to 10 dirhams, the Moroccan currency, henceforth denoted DH.

commission (Conseil Déontologique des Valeurs Mobilières or CDVM) and the creation of mutual funds. The new laws included changes in the management and organization of the stock exchange and the way mutual funds operate, as well as fiscal advantages for shareholders and new regulations for shareholder protection. The reforms were to a large extent anticipated since they were part of the reform program announced in 1989.

2.2.1. The CSE prior to the 1993 reforms

The Casablanca Stock Exchange was, prior to the 1993 reforms, a state institution under the authority of the Ministry of Finance. The CSE was managed by a governing board and a manager nominated by decree. The CSE was a broker/dealer market with the banking sector holding a monopoly on stock exchange transactions. The CSE is comprised of two markets, a trading floor and an upstairs market, the former having trading hours Monday through Friday from 10 AM until noon. Transactions take place either on the trading floor (called Marché Officiel) or the upstairs OTC market (called Cession Directe) where large transactions are accomplished through a search-brokerage mechanism (see, e.g. Burdette and O'Hara, 1987l Grossman, 1992; Seppi, 1990; Keim and Madhavan (1996) for a more elaborate discussion). Besides the large block trading, another element distinguished the trading floor from the upstairs market. The CSE did not have exchange-traded derivative contract. Occasionally, some transactions on the upstairs market reflect OTC derivatives trading, such as CD trades that are executed at a pre-arranged price as part of an option contract agreement. In such rare cases, the recorded transaction prices appear out of line, as they reflect pre-arranged trades.

Absence of public disclosure laws combined with privileged client relationships between banks and the firms listed on the exchange implied that the market was not transparent. Bid and ask quotes were not often posted.[8] Whenever a trade took place on the trading floor, the Casablanca Stock Exchange personnel would record with chalk the latest transaction prices on a large blackboard. The quantities of any trading floor transaction were only announced at the end of the session. The role of the CSE was essentially to insure that the settlement was done according to norms (essentially that the buyer paid for the transaction), to debit the account of the buyer (buying bank) and credit the account of the seller. A report of these debit and credit operations was then sent to Bank Al Maghrib (the Moroccan Central Bank).

Individual investors were very rare and the institutional investors acted essentially on the upstairs large block trade market. Indeed, not all trades passed through the trading floor as large blocks typically traded on the upstairs market. The upstairs trade market was a market where trades were based on mutual agreements and where transactions were established under circumstances that were neither transparent nor standardized. The market operated for a small circle of investors, exchanging their stocks outside the trading floor. The number of private Moroccan shareholders was probably smaller than 10,000 during this period (see Manien and Chmanti, 1997). The individual and institutional

[8] On occasion, a bid and ask were quoted for a stock in the monthly CSE bulletin which summarized market activity. There was no systematic record keeping of bid and ask quotes, however, and the data would most likely reflect stale quotes.

investors or banks could settle a transaction at a price freely agreed upon. The transactions were essentially carried out over the phone and clearing was carried out in a bilateral manner between the intermediaries without public disclosure until the next day.[9]

The exchange was extremely illiquid, as most stocks did not trade for several weeks. The most actively traded stocks were banks and holding companies as well as a few agricultural sector firms. Hence, the domestic banks were mostly trading their own stocks. Banks played also a dominant role in the supply of credit (at pegged interest rates) to corporations. Moreover, they typically had privileged access to the financial statements of their clients. Lack of public disclosure laws implied that some corporations did not publish financial statements.

2.2.2. The CSE since the 1993 reforms

The reforms of 1993 altered significantly the role and the conditions of financial market operations. Launched September 21, 1993, the restructuring was materialized by three laws which transformed the management and organization of the stock exchange. Under article 7 of law number 1-93-211, the CSE, like many other state owned institutions, was privatized. Capital was raised by selling seats on the exchange, its initial capital was set at 10 millions DH distributed equally between the approved market makers. The market reforms created a dealer/market maker structure. Initially, the institutions may have changed, but many of the main actors were basically the same. Yet, the legal framework was very different. For example, the new laws established a securities commission, to insure shareholders protection, to monitor market activity and to help the government in the regulation of the stock exchange. The market watchdog (CDVM) could impose disciplinary sanctions on market makers and de-listed several stocks that did not comply with the public disclosure laws (more on this later). Moreover, the market makers are legally and financially autonomous. Fifteen market makers were approved by the CDVM, most of them since 1995. Among these market makers, eight are subsidiary of large Moroccan banks, one is linked to a Dutch bank, and four are independent.

Market makers post bid and ask quotes. Given the small number of stocks, they compete for order flow for all listed stocks, none are assigned a specialist role for specific stocks. They operate on the trading floor as well as the upstairs market (the distinction between the two market segments disappeared late 1996, which is beyond our sample). The brokerage fees were fixed by law at 0.6% for stocks and at 0.3% for bonds. Hence, competition for order flow is only through price quotes, not brokerage fees.

Companies listed on the CSE are required to report financial statements twice a year. This reporting requirement was introduced by the 1993 law and includes the publication of sale revenues and a balance sheet.

It is also worth noting that the daily price fluctuations on the CSE are limited to plus or minus 3% for transactions taking place on the trading floor. The upstairs market trans-

[9] Consequently, there is an important difference between the CSE upstairs market and, for instance, the NYSE. As Hasbrouck (1993) and Keim and Madhavan (1996) note, under NYSE rule 76, it is generally illegal to pre-negotiate trades on the NYSE as the order must be exposed to the public in accordance with auction principles with time and price priority. This restriction does not apply on the CSE prior to the introduction of screen-driven trading. Large trades may occur without public exposure throughout the sample period of the study.

actions are not affected by such price limits. This will be relevant for the estimation of volatility and the microstructure models. Unfortunately, there are no historical records regarding the intervention of price limits on the daily trading floor activity during the sample period as the CSE did not keep any information on occurrences of price limits. Officials of the CSE confirmed to us, however, that the occurrence of price limits was a rare event. Some of our own data analysis (not reported but available upon request) supports this. We computed the maximum relative spread between MO and CD for days where transactions took place in both market segments. The most common pattern after the reforms is a permanent small liquidity premium that characterizes the spread between the two market segments. Hence, it appears that controls did not occur very frequently and we will proceed in our analysis without further attention to price limits.

The initial three laws constitute the skeleton around which all the subsequent changes were built. It took roughly 2 years before some major changes were implemented. In February 1995, a professional association of the market makers was created. Since May 15, 1995, a document called Protocole de Place organizes the procedures, payment, delivery and compensation for the CSE. This protocol describes the transactions procedures for both the trading floor and the OTC markets. The laws of September 1993 created a number of new institutions and significantly changed the incentive structures of trading, yet it took time to implement those changes. The new protocol of May 15, 1995 had a profound impact on the incentives for dealers to trade as it formally implemented into trading practice the laws of 1993. Yet, trading volume picked up long before May 1995 so that the new protocol was to a large extent confirming established practices.

The stock market reform program can be called a success. The CSE was included in the IFC Emerging Market data base in 1996 together with stock exchanges from two other countries, Egypt and Russia. The IFC attributed a weight of 0.4% to the Moroccan index in the computation of the global emerging market index. This weight exceeds that of Egypt (0.1%) and some of the previously incorporated emerging markets such as Jordan (0.2%). A daily index and quotes for some of the major stocks listed on the CSE were added to the elaborate data set collected by the IFC. The number of individual investors increases substantially, particularly since 1995. Data for 1996 shows this number had reached some 300,000 for shares and privatization bonds. The institutional investors are still composed mainly by the insurance companies, the (Moroccan) Caisse de dépôt et Gestion (CDG) and retirement funds. The mutual funds play an increasing role since their creation in November 1995. Initially, five mutual funds were active, with 5 million DH in market capitalization. By 1997, the total number of funds was 42, with 118 million in assets.

Before turning our attention to the transactions data, it is worth providing first a general appraisal of the CSE before and after the reform programs. Table 1 presents a selection of basic indicators regarding the CSE from 1989, the year the reform programs were announced, until 1996. Table 1 provides on an annual basis (1) the number of trading days, (2) the trading volume (millions of DH), (3) market capitalization, (4) the ratio of market capitalization to GNP, and (5) the value of a market index on the last day of the year. These basic statistics reveal how trading volume, liquidity and returns exploded (in relative terms) during this 7-year window covering the pre-reform and post-reform eras. We also note that in 1993, when the first CSE reforms were put into law, trading volume

Table 1
Casablanca stock exchange: basic indicators

Year	Number of trading sessions	Average daily trading volume	Total market capitalization	Ratio of market capitalization to GNP	Market index
1989	248	123	5.0	2.6	122.65
1990	244	510	7.8	3.5	158.68
1991	243	428	12.4	5.0	187.55
1992	248	626	17.0	6.6	207.88
1993	248	4611	25.7	10.0	259.78
1994	251	7235	39.0	13.1	342.33
1995	251	20,730	50.4	17.5	342.39
1996	247	19,510	75.6	23.0	447.13

The entries to the table provide annual summary statistics of basic indicators. They are arranged by column as follows: (1) year, (2) the number of days of trading in the year, (3) the average daily volume in million of Dirhams (DH), (4) the total market capitalization in billion DH, (5) the ratio of market capitalization to GNP and (6) the market index on the last day of the year.

quadrupled, then subsequently doubled and tripled. The market index shows similar spectacular performances. Obviously, in absolute terms, there is no comparison with any developed financial market, yet the relative turnaround is remarkable. Indeed, in relative terms, the market underwent something close to a big bang in a short amount of time.

Finally, it is worth noting that the CSE adopted the French screen-driven trading system of the Bourse de Paris (see Biais et al., 1995 for further description) on December 17, 1996. Our data does not cover the screen-driven market transactions, see, however, Derrabi (1998) and Derrabi et al. (1999) for a microstructure study of the CSE transition to screen-driven trading.

2.3. Description of the data

We collected a data set containing all the trades which took place on the trading floor, i.e. Marché Officiel, henceforth denoted MO, and the upstairs large block trade market, also called the Cession Directe, henceforth denoted CD. Each entry was obtained from the original CSE records containing the name of the stock, the price of the transaction, the number of shares, the market where the transaction was recorded and the day of the transaction. We do not have a time stamp other than the calendar date of the transaction. Lacking this intra-day information, we do not know at what time between 10 AM and noon a transaction took place on the trading floor, or at what time the parties agreed to transact on the upstairs market. However, we have some knowledge of the intra-day timing of trades since the order of the registration in the original records respects the chronological order of the execution.[10]

[10] The records on the timing may not be as accurate for the CD market. The majority of OTC trades do not occur before noon, however, the time when floor trading ends. It is very rare that OTC trades take place after 4 PM and are therefore reported on the next day. This allows us to compute, with some minor error, intra-day returns on a tick-by-tick basis either on each segment of the market or both markets together.

The data runs from January 1, 1984 until March 31, 1997. Roughly 50–65 stocks are typically traded on the CSE. They are divided into the following sectors: banking, financial services other than banking, energy and mining, agriculture, industrial and services. The reforms of September 21, 1993 were so important in terms of the organization of the market (the previous reforms date from 1967) that we decided to take this date as a sample split point. Hence, a first sample, denoted S1, covers the pre-reform period which runs from the beginning of the sample until September 20, 1993. The second sample, S2, runs from September 21, 1993 until March 31, 1997, i.e. the end of the sample. Many of the summary statistics will be calculated using this particular sample split with the reform laws as the benchmark. Obviously this may be criticized since many of the changes were anticipated following the widely publicized announcements of reforms and many legal changes affected only materialized in the daily practice of trading after September 21, 1993.

Our statistical analysis will therefore not be limited to a fixed break. Indeed, we will conduct tests for any "structural changes" in key measures of market quality, to be defined later, without presuming a priori a fixed breakpoint. Moreover, we will also examine several statistics on a month-by-month basis and assess the dynamic pattern of the market's trading costs.

We will also construct various samples, other than S1 and S2, to appraise the robustness of our results. In particular, for reasons that will become apparent later, we will also consider a sample denoted S3, which covers January 1, 1984 until December 31, 1995. Hence, in S3, all observations pertaining to 1996 and 1997 are deleted. Likewise we will also consider S4 which runs from September 21, 1993 until December 31, 1995 excluding the same observations from the sample S2. For the moment, it will be convenient to focus on S1 and S2, i.e. observations before and after the reforms, as a first examination of the data.

The two samples S1 and S2 are very uneven in terms of the time span they cover. Yet, as the focus of the empirical analysis will be microstructure models, it is more relevant to compare the two samples on the basis of the number of observations, i.e. transactions. In Table 3 (last line), we report the sample sizes for each of the samples and each of the market segments. While S1 covers almost a decade and S2 less than 4 years, we note from Table 2 that S1 counts roughly 11,000 transactions while S2 has more than 16,000. About two thirds of the transactions take place on the trading floor, respectively, 7433 for S1 and 11,378 for S2.

Table 2
Capitalization, number of shares on the Casablanca stock exchange

Dates	January 1984	September 1993	March 1997
Total number of stocks	62	63	48
Total number of shares	24,687,047	83,303,717	179,784,663
Capitalization	1.4 billion DH	22.4 billion DH	94.2 billion DH

Entries are number of stocks, shares, and capitalization on the CSE at pivotal dates of the sample split, i.e. the month of January 1984 (beginning of the sample), September 1993 (end of Sample S1), April 1997 (end of Sample S2). A more detailed list with each individual stock appears in the Appendix, Table A.1 of Ghysels and Cherkaoui (1999).

Table 3
Trading frequencies and the stages of reforms

Number of transactions	Frequency distribution of daily number of transactions					
	Trading floor (MO market)		Upstairs market (CD market)		Both markets	
	S1	S2	S1	S2	S1	S2
0	0.32	0.05	0.70	0.19	0.24	0.04
1	0.13	0.02	0.06	0.09	0.11	0.01
2	0.11	0.02	0.04	0.10	0.09	0.01
3	0.13	0.04	0.10	0.10	0.13	0.01
4	0.07	0.03	0.02	0.09	0.09	0.02
5	0.06	0.05	0.01	0.08	0.06	0.02
6	0.05	0.07	0.02	0.05	0.07	0.03
7	0.03	0.06	0.01	0.06	0.04	0.03
8	0.02	0.06	0.01	0.06	0.03	0.04
9	0.02	0.05	0.00	0.05	0.03	0.04
10	0.01	0.05	0.00	0.03	0.02	0.05
10+	0.04	0.53	0.02	0.11	0.09	0.72
Average number of transactions	2.93	12.38	1.37	5.06	4.30	17.44
Total number of transactions	7433	11,378	3481	4646	10,914	16,024

Entries to the table are the daily average, the relative frequencies and the total number of trades in all the stocks occurring on the trading floor, upstairs market separately as well as both markets together. The sample S1 runs from January 1984 until September 20, 1993, S2 from September 27, 1993 until March 31, 1997.

We report in Table 2 the capitalization, number of shares and the number of stocks on the CSE for three pivotal dates: the sample split, beginning and end.[11] We note that at the beginning of the sample, a total of 62 stocks were traded. The number of stocks gradually declined to 48, despite the introduction of new stocks through the privatization program. Indeed, some stocks were de-listed by the CSE's watchdog, namely the CDVM, because the companies did not comply with the newly installed regulations (in September 1993) regarding public disclosure of corporate financial statements according to an accepted accounting standard. It should also be noted that the market capitalization rose 41-fold from the end of S1 until the end of S2, while the number of shares traded quintupled.

2.4. A first look at market activity

In this section, we examine overall trading activity and focus on some individual stocks that will be the primary focus of our analysis in the subsequent two sections. In Table 3, we report how trading changed dramatically from samples S1 to S2. Prior to the reforms, an average of four trades took place on a daily basis, roughly three on the MO market and one on CD. Hence, the CSE was clearly a very inactive market. Note that the average

[11] In Table A.1 of Ghysels and Cherkaoui (1999), we provide a more detailed list of all individual stocks, their capitalization, number of shares, etc. Since market capitalizations are only changed at the end of the month, we list the months corresponding to the sample split date.

number of transactions are across all stocks. Such an illiquid market obviously calls into question a continuous trading mechanism as a call auction would have been more suitable. Table 3 also contains the frequency distributions. We note that for 32% of the trading days in S1, there were no trades registered on the trading floor (MO market) and 70% of the days were without any trade on the upstairs CD market. These figures dropped to 5% and 19%, respectively, in S2. Hence, activity picked up remarkably in S2, as trading frequencies more than quadrupled. Both segments of the market combined have 72% of the days more than 10 trades during S2, when 10 trades or more were registered in less than 10% of the days in S1.

As the main focus of our analysis will be on transaction-based data, let us examine trading activity in some individual stocks. A total of 28 stocks, which rank as the most actively traded, are listed in Table 4. For each stock, we have the daily average number of trades and average number of shares on both segments of the market in each sample. When we compare the average daily volume, we observe that the CD market takes the lion share of the volume, though there is one notable exception, ONA, the most actively traded stock. Trading floor activity for ONA takes a larger share of the volume after the reforms. The fact that the CD market takes the lion share of the volume should not be a surprise as it is a large block trading market.[12]

The MO market, in contrast, is more active in terms of trading frequency, with smaller volumes. As we noted before, prior to the reforms, the most actively traded stocks were financial services companies, with a few exceptions like Brasseries du Maroc, Ciments d'Agadir, Lessieur Afrique, and, to a certain extent, the most actively traded ONA stock which is a financial holding company. Most active stocks followed the market trend after the reforms in terms of increased trading frequencies, though some stocks regressed or stayed at the same frequencies. Examples include the agricultural sector stocks Brasseries du Maroc, Ciments d'Agadir and Lessieur Afrique. It should also be noted that the least actively traded stocks during S1 appearing in Table 4 remained relatively inactive.

A first examination of the transactions data suggests that changes took place in the trading patterns. The summary statistics reveal that the trading floor market became a more active market with relatively frequent but small volumes of trade. The upstairs market performed the role of large block trades (with a much more important part) of the daily volume channeled through this segment of the market, although it did not increase dramatically in terms of trading frequency. A handful of stocks benefited from this increased activity, while most other stocks trailed. Those that benefited are concentrated in the banking sector as well as holding companies and were the largest stocks before the reforms as well.

2.5. The selection of stocks

The trading activity statistics in Table 4 revealed that the least active stocks remained inactive after the reforms. Hence, the gains were primarily in the top tier of the market. It

[12] It is also worth noting that some of the less actively traded stocks transact primarily on the upstairs market (Cadem and Auto-Hall appearing in Table 4 being perfect examples).

Table 4
Trading activity of individual stocks

Stock	Trading floor (MO market)				Upstairs market (CD Market)			
	Average daily trading frequency		Average daily volume		Average daily trading frequency		Average daily volume	
	S1	S2	S1	S2	S1	S2	S1	S2
ONA	0.157	0.494	264	5423	0.058	0.261	1668	3555
Brasseries du Maroc	0.142	0.065	275	376	0.082	0.072	2001	1128
BMCE	0.116	0.342	375	1748	0.048	0.186	114	3417
Lessieur Afrique	0.102	0.118	164	238	0.066	0.059	3957	7813
Cosumar	0.099	0.063	78	195	0.033	0.019	8309	9423
Ciments d'Agadir	0.087	0.065	150	240	0.061	0.036	4072	1283
SNI	0.083	0.021	299	1051	0.021	0.022	4871	2831
CMCB	0.082	0.311	1472	1800	0.019	0.150	872	4277
BMCI	0.073	0.171	862	814	0.047	0.050	1468	4610
Centrale Laitière	0.071	0.053	144	127	0.029	0.047	948	7097
Cherifienne d'engrais	0.065	0.036	242	180	0.036	0.028	2033	3594
Zellidja	0.065	0.051	260	289	0.022	0.035	1302	4806
BCM	0.062	0.201	415	37	0.039	0.156	5022	5831
Berliet-Maroc	0.061	0.033	100	154	0.013	0.007	9521	47
Longometal	0.056	0.045	167	222	0.019	0.017	8688	5168
Cema	0.053	0.016	41	71	0.016	0.023	123	394
Branoma	0.050	0.055	76	37	0.033	0.033	528	6679
Crédit Eqdom	0.049	0.202	911	4898	0.051	0.033	1355	2545
BNDE	0.047	0.068	744	591	0.027	0.053	1788	4515
Somafic	0.042	0.013	1060	484	0.028	0.014	4090	1294
ACRED	0.038	0.029	96	362	0.019	0.013	2402	2844
Sofac-Maroc	0.036	0.188	125	280	0.008	0.057	1471	6153
Cadem	0.033	0.041	117	40	0.019	0.030	4460	9810
Auto-Hall	0.031	0.047	136	93	0.011	0.030	1792	1588
Caranaud	0.031	0.026	117	77	0.008	0.005	406	682
Cherifienne Textiles	0.028	0.013	60	95	0.007	0.016	415	2008
Uniban	0.027	0.030	673	227	0.056	0.027	1064	8548
CTM-LN	0.019	0.300	2526	148	0.014	0.092	5208	5134
Oulmes	0.019	0.016	37	47	0.009	0.025	3116	2965
CDM	0.078	0.121	176	650	0.021	0.063	1303	1028

For the stocks listed in the left column, the following is reported: (1) average daily trading frequency for sample S1 (January 1984–September 20, 1993) and S2 (September 27, 1993–March 31, 1997); (2) the average daily volume for the trading floor market (left panel) and upstairs market (right panel). Volume is measured by number of shares traded. Description of the stocks appears in Table A.1 of Ghysels and Cherkaoui (1999). Stocks are ranked according to their average daily trading frequency on the MO market during sample S1.

will therefore be of interest to see whether the market reforms made any dent in the cost of trading for stocks in the top tier. We will focus on three groups each containing four stocks making a total of 12 active stocks. We have chosen the three groups to disentangle several effects pertaining to reforms and privatizations. Market microstructure models suggest that spreads have three components: (1) order processing, (2) adverse information selection, and (3) inventory holding costs. A detailed list of privatizations appears in the Appendix to Ghysels and Cherkaoui (1999).

There are certainly several features of Morocco's reforms that affected one or several components of the bid-ask spread. In Table 1, we noted that market volume improved dramatically. The influx of new shares had a positive impact on liquidity particularly in the case of seasoned equity offerings involving shares already listed on the exchange prior to the reform programs. Several of the firms appearing in Table 4 were the subject of privatizations.[13] For instance, BMCE, a commercial bank which was among the first major privatization operations, saw its number of shares quadruple roughly a year after the September 1993 CSE reforms. The transportation firm CTM which was privatized right before the market reforms took place saw its number of shares in circulation triple. The number of shares traded on the CSE quintupled for the financial holding firm SNI which was privatized roughly a year after the market was reformed. Its privatization was roughly at the same time as BMCE and involved a slightly larger amount of capital.[14]

These are a few examples illustrating how the privatization program injected liquidity. The reforms also brought more transparency. Financial statement reporting requirements were introduced in the summer of 1993. These disclosure laws brought more information in the public domain and therefore may have diminished the adverse selection component. The fact that market makers operated on their own account since the reforms and the increased trading volume should probably have made a dent in the order processing costs as well.

The first group consists of four stocks in the banking sector: CMCB, BMCI, BCM and BMCE. These four stocks share many common features, namely they are in the same sector and they also figured among the actively traded stocks before and after the reforms. There is one stock, namely BMCE, which was the subject of a major privatization that took place in December 1994, i.e. over a year after the microstructure reforms of September 1993. Hence, unlike the three other banks, we have a combination of a seasoned equity offering and changes in the trading/dealer incentives for BMCE.

The second batch of four stocks is also a group of equities belonging to the same sector, namely that of financial holding companies. It also contains a combination of firms which were privatized and others which were not. The group contains the most actively traded stock throughout the period, namely ONA. The three other stocks are as follows: Crédit Eqdom and two firms which were subject of privatizations, namely Sofac Crédit and SNI. Here the privatizations took place in May 1994 and October 1994, respectively.

The final group of four stocks does not contain banks or holding companies nor does it contain privatized firms. It also includes some firms which dropped in the ranking in terms of average trading frequencies according to the results listed in Table 4. The group consists of Brasseries du Maroc, Lessieur Afrique, Cosumar and Centrale Laitière. All these stocks belong to Morocco's most important sector in the economy, namely the agricultural sector. This rather diverse selection of 12 stocks exhibits different features and allows us to make comparisons, and to a certain extent, control for sectorial and privatization effects. This selection of stocks will figure prominently in all of our empirical analysis.

[13] See Table A.2 in Appendix A of Ghysels and Cherkaoui (1999) for details regarding the privatization of firms.

[14] A total of 1781.6 million DH for BMCE versus 2030 million DH for SNI. The former involved a larger fraction of shares sold to the public as opposed to a consortium of large institutional share holders.

2.6. Volatility

As a prelude to the formal model-based estimates and tests, we examine several plots which appear in Fig. 1. They portray a picture of market activity for some individual stocks, covering a set of four stocks and show the annualized monthly volatility estimates. All the calculations appearing in the plots are based on trading floor data. It was noted that the nature of our data does not really allow us to investigate explicitly the tick-by-tick process since we do not have the intra-day time stamp of the transactions on the trading floor and OTC markets. Fortunately, we know the sequence of transactions as they occurred throughout a day on the different segments of the market (CD versus MO). This allows us to compute intra-day and end-of-day returns from trading in a particular stock. The volatilities appearing in the plots are computed based on daily observations using the closing price defined as: (1) the last MO trade of the day or (2) last MO trade prior to that day when no trade occurred. Squared daily returns are centered and averaged on a monthly basis to obtain monthly volatility estimates. The plots display the sequence of monthly volatilities.

The use of transactions data from the MO segment of the market has two potential sources of serious biases, and therefore, the plots can only be viewed as indicative. Genuine parametric volatility estimates will be covered in the next section. The two sources of bias are the following. First, one should note that volatility is extremely low, often close to zero, before the reforms. This is in part due to the construction of the data. With daily observations covering a period with very few transactions, one has many zero

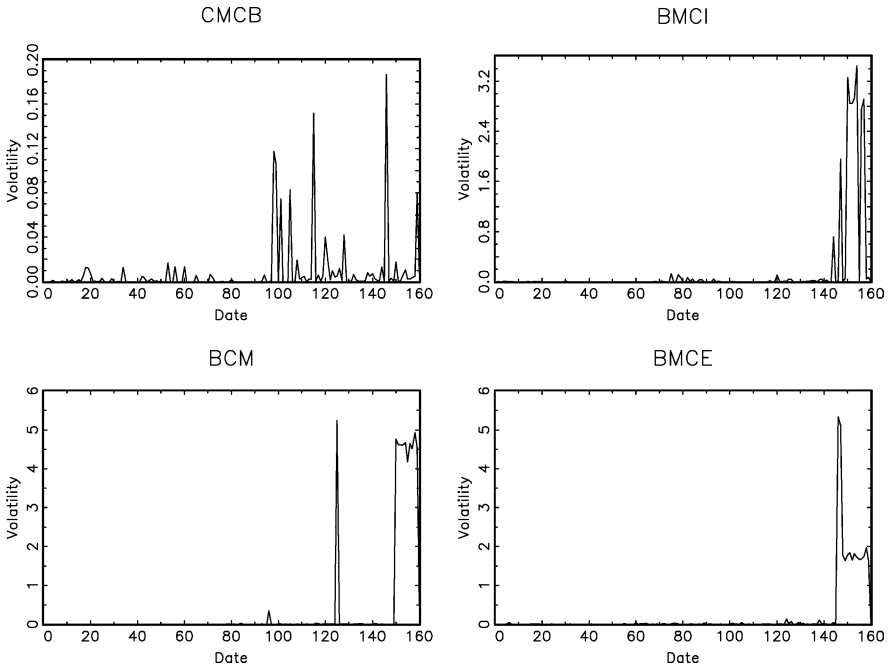

Fig. 1. Monthly estimates of volatility, high-low spreads and roll spreads for CMCB, BMCI, BCM and BMCE.

returns in the computation of volatility. Hence, there is a serious downward bias in the estimates before trading volume picked up. It also suggests that using transactions data rather than daily observations would be a better approach, a strategy pursued in the next section. Second, the estimates are based on the last MO transaction, ignoring the transactions on the upstairs market. Hence, several days may pass with transactions on the CD segment without the last MO transactions price moving. This may result in a serious upward bias in the volatility estimates. In the next section, we will eliminate such biases, examining models that apply to both segments of the market.

For the moment, we will examine the plots while keeping in mind that they are only indicative. It should be noted that computing data-driven volatility estimates when trading takes place on two market segments with different microstructures is a matter of independent interest beyond the scope of the present paper. Moreover, the first microstructure model we examine applies exclusively to trading floor activity and is very closely related to volatility measures.

Fig. 1 covers CMCB, BMCI, BCM and BMCE. Three of the four stocks show very much the same pattern. Volatility increased dramatically, but long after the reforms were put into place (the sample split between S1 and S2 is $t=117$). Quite surprisingly, the sharp increases all occur January/February 1996 ($t=145$), the time when the Casablanca Stock Exchange drew a lot of international attention.[15] Among the four financial institutions, we observe very similar patterns for BCM, BMCE and BMCI. They show a very quiet market with a burst in volatility. Another noteworthy point to make is that the BMCE stock does not show any sign of increased volatility around January 1995 ($t=133$), the time of its privatization. Despite the fact it was the first major privatization roughly a year after the market reform, nothing seems to have happened with the transaction prices.

The fact that volatility increased should not be surprising, in light of the findings in Bekaert and Harvey (1997, 2000) who examined 20 emerging markets (not including Morocco). They show a significant increase in volatility using a first indicator of liberalization (see, in particular, Bekaert and Harvey, 2000, Table VII).

The patterns appearing in Fig. 1 are mostly representative for the 12 stocks considered. The purpose of the plots was to give a first impression of the historical patterns. At this point, we need to replace descriptive statistics by more formal tests, which is the subject of the next section.

3. The quality of the market through the stages of reform

> *Captain Renault* to *Rick*: What brought you to Casablanca? *Rick*: My health. . .I came to Casablanca for the waters. *Captain Renault*: Waters?. . .what waters?. . .it is the desert here! *Rick*: I was misinformed. . .

This is the first of two sections dealing with the core question of our paper: How much did microstructure reforms contribute to the emergence of the *Bourse de*

[15] Recall that 1996 was the year the CSE was incorporated into the IFC data base. It is also worth noting that there does not seem to be any announcement effect late 1995 regarding the incorporation of the CSE into the IFC.

Casablanca? The purpose of this section is to assess the quality of the market, as microstructure finance theorists view it, throughout the different stages of reforms. Obviously we need first to explain what is meant by quality. Typically one thinks of measures such as bid-ask spreads, market depth and liquidity to discuss microstructure features of a stock market.[16] Unfortunately, we cannot rely on such measures as they simply were not systematically recorded during the pre-reform period of the CSE. Indeed, despite the unique attributes of our data set, it should be noted that the transaction-based data are the only common thread through the different market structures. Bid and ask quotes, for instance, are generated in financial market environments which are more mature and driven by actively participating specialists or market makers. For the CSE, such a market structure was gradually established and completed by May 1995. The time series properties of the transaction prices will therefore be our only guidance to appraise the evolution of the market through its various stages of reform. We will consider several approaches as we do not want our conclusions to depend on the implicit assumptions embedded in one specific class of models or statistical methods.

3.1. Microstructure models

We have identified several potential effects the market reforms and the emergence of the CSE may have had on the components of the bid-ask spread. So far most of these effects are only speculations. The microstructure models introduced here are meant to appraise the empirical significance and importance of these changes. Econometric methods for uncovering effective spreads and their components from transactions data rest on certain assumptions regarding the behavior and/or presence of each to the three components of the bid-ask spread.

We will start with an implementation of Roll's model and then move to a second and complementary approach inspired by Hasbrouck (1993).[17] We will also exploit some of its features to deal more explicitly with the noncooperative emerging market data context, in particular the difficulties associated with highly inactive markets, an issue which we ignored to a large extent so far. Moreover, the estimates of the Roll model rely exclusively on the trading floor market data whereas the extended Hasbrouck model will take advantage of the separate registration of trades which are executed upstairs and on the trading floor.

Inferences about the bid-ask spread in the model pioneered by Roll (1984) are made from the autocovariance properties of observed transactions prices. The Roll (1984) model

[16] There are numerous examples of studies assessing market performance, market structure and regulatory impact via bid-ask spreads, liquidity ratios, daily high–low midpoints and other measures. Some examples are Cooper et al. (1985), Hasbrouck and Schwartz (1988), Grossman and Miller (1988), Neal (1989), Commodities Futures Trading Commission (1989) and Tanner and Prichett (1992). Such studies were applied to various OTC and specialist markets in equities and derivative securities.

[17] We could not implement models which infer the spread via trade indicator regressions, as suggested by Glosten and Harris (1988). Since we do not have bid and ask quotes, we cannot sign trades, relying on bid-ask midpoints or an algorithm such as that described by Lee and Ready (1991).

assumes only the existence of the order processing cost, and hence the absence of inventory costs, while the trade flow is i.i.d. without any adverse information effects. Under these assumptions, the effective spread, denoted S^{MO} as it will be applied to the trading floor data, can be recovered from transactions prices as follows:

$$S^{\mathrm{MO}} = 2\sqrt{-\mathrm{Cov}(\Delta p_\tau, \Delta p_{\tau-1})}, \tag{1}$$

where $\Delta p_\tau \equiv p_\tau - p_{\tau-1}$, where p_τ denotes the logarithm of the transactions price.

Besides the restrictive microstructure assumptions underlying the Roll model, we should also note that it is assumed that the covariance appearing in Eq. (1) is assumed to remain invariant. The plots appearing in Fig. 1 cast doubt on the fact that the covariance of returns was constant throughout the sample period. We will therefore explicitly examine the hypothesis of constant spreads through tests for structural change. We estimate S^{MO} via the moment condition:

$$\sum_{t=2}^{T} \left[-(\Delta p_t^j \Delta p_{t-1}^j)/T - (S^{\mathrm{MO}})^2/4 \right] = 0 \tag{2}$$

which can be viewed as a just identified GMM estimator applied to the transactions data recorded on the trading floor. Hence, T in Eq. (2) is the number of transactions, not the number of trading days. We can estimate Eq. (2) over samples S_i for $i=1$, 2, 3 and 4 separately. We denote such estimates $\hat{S}_i^{\mathrm{MO}}$ for $i=1$, 2, 3 and 4. Alternatively, we could estimate S^{MO} over the full sample which we will denote $\hat{S}_{\mathrm{F}}^{\mathrm{MO}}$. A first test consists of comparing, say $\hat{S}_1^{\mathrm{MO}}$ and $\hat{S}_2^{\mathrm{MO}}$, and see whether they are statistically significantly different. Hence, we test formally whether there have been any changes in the effective spreads with the market reform as a given breakpoint. The use of a fixed breakpoint can easily be criticized. Moreover, the plots of monthly volatility also revealed that the reform date may not be such an obvious breakpoint. We therefore conduct various other tests. Some still consist of picking a breakpoint, like comparing S1 with a sample of S4 deleting all observations pertaining to 1996–1997. This comparison allows us to investigate changes due to reforms without contaminating our results by the sudden surge of volatility which started in 1996. The same argument applies to comparisons involving S3, i.e. the entire sample stripped from all observations pertaining to 1996–1997. Furthermore, we will also consider tests which operate on the premise of an *unknown* breakpoint. We can formulate this hypothesis as follows:

$$H_{\mathrm{o}}: \; S_t^{\mathrm{MO}} = S^{\mathrm{MO}} \quad \forall t = 1, \ldots, T \tag{3}$$

Hence, we assume that the effective spread for any point in time is constant. A great variety of tests for structural change for models estimated by GMM exists.[18] The majority of tests assume as an alternative that at some point in the sample, there is a single structural break, like, for instance: $S_t^{\mathrm{MO}} = S_{\mathrm{a}}^{\mathrm{MO}}$, $t=1,\ldots,\pi\mathrm{T}$ and $S_{\mathrm{b}}^{\mathrm{MO}}$, $t=(\pi\mathrm{T})+1,\ldots,T$, where π

[18] Relevant references include Andrews (1993), Andrews and Ploberger (1994) and Ghysels et al. (1997), among others.

determines the fraction of the sample before and after the assumed break point. The idea of a single breakpoint of unknown date is appealing as it may be that events other than the September 1993 reforms are relevant. Moreover, a single breakpoint is only an explicit alternative, the tests have indeed power against more complex alternatives as well.[19] We conduct these tests on the entire sample as well as the sample not including 1996–1997 data, i.e. the S3 sample.

Hasbrouck (1993) suggested to identify the random walk component of security transaction prices as the efficient price of a stock.[20] The residual stationary component is taken as the implicit transaction cost and is therefore termed the *pricing error*. Hence, it is assumed that the logarithm of the transactions price, which is denoted as p_τ, can be decomposed as:

$$p_\tau = m_\tau + s_\tau, \tag{4}$$

where m_τ is the efficient price, specified as follows:

$$m_\tau = m_{\tau-1} + \omega_\tau, \tag{5}$$

with ω_τ a serially uncorrelated process with $E\omega_\tau = 0$ and $E\omega_\tau^2 = \sigma_\omega^2$. The process s_τ represents the pricing error and is related to the transaction cost as the buyer incurs a cost equal to s_τ while a seller faces a cost which amounts to $-s_\tau$.

Hasbrouck (1993) does not allow for heteroskedasticity in ω_τ nor in s_τ and relies on the assumption that events arrive at a reasonably uniform rate in transactions time, after accounting for an intra-day seasonal, to justify the assumption of homoskedasticity. While for an active market like the NYSE such an assumption may be appropriate, it is clear that for a stock market with infrequent trading, it would probably be difficult to maintain the homoskedastic specification adopted by Hasbrouck regardless whether transactions time or calendar time is used. Henceforth, we will use τ for transactions time and denote calendar time by t. To accommodate infrequent trading, we start from a random walk model in transactions time similar to Hasbrouck and augment it with a drift term μ, to obtain in calendar time t:

$$m_t = \mu\Delta_t + m_{t-1} + (\Delta_t)^{1/2}\omega_t, \tag{6}$$

where Δ_t represents the duration in calendar time between two consecutive trades. Hence, the time-deformed random walk becomes a random walk in t with an innovation variance

[19] We use the SupLM, or supremum LM, test proposed by Andrews (1993) and used, for instance, in Ghysels (1998) to assess structural change in conditional CAPM models. One computes the supremum of all LM tests, or score tests, over all possible break points πT. Andrews (1993) tabulated the asymptotic null distribution for the supremum. The SupLM test has the great advantage that it only uses the parameter estimates $\hat{S}_F^{MO}$obtained from the full sample. This saves enormously on computations, avoiding all the GMM parameter estimations over the various samples.

[20] The random walk hypothesis for stock prices has been called into question, see, e.g. Fama and French (1988), Lo and MacKinlay (1988) and Poterba and Summers (1988), among others. Hasbrouck correctly points out that violation of this hypothesis entails a misspecification that is important for the analysis of long-term trends but is of lesser importance for the high frequency study of microstructures.

and drift proportional to the duration between trades.[21] We set Δ_t equal to 1 plus the number of trading days between two consecutive trades. For the cases where more than one trade occurs for the same stock on a given day, we set Δ_t equal to 1. As noted before, fortunately we know the sequence of transactions as they occurred throughout a day, even if they took place on different segments of the market (CD versus MO). This allows us to compute intra-day returns from trading in a particular stock, keeping Δ_t always equal to 1 for intra-daily returns.

Using Eqs. (4) and (6), we can write the returns (in calendar time) as:

$$\Delta p_t = \mu\Delta_t + (\Delta_t)^{1/2}\omega_t + (\Delta_t)^{1/2}(s_t - s_{t-1}) \tag{7}$$

where the normalization with respect to Δ_t is also applied to s_τ to obtain the calendar time representation. Unlike the Roll model, we observe from Eq. (7) that returns feature conditional heteroskedasticity directly related to the intensity of trading. Since trading picked up dramatically (recall Table 3), we expect this model to capture the changes in volatility patterns observed in Fig. 1.

In principle, we have to rely on identification assumptions to disentangle the unobserved components ω_t and $s_t - s_{t-1}$, keeping in mind that both components may be correlated. Several univariate time series decompositions have been suggested, most notably by Beveridge and Nelson (1981) and Watson (1986). One can cast some microstructure models in the framework of the Beveridge and Nelson (1981) and Watson (1986) decompositions. For instance, in the Roll (1984) bid-ask model, the pricing error $s_t - s_{t-1}$ is uncorrelated with ω_t and therefore completely information-uncorrelated. The other extreme is where the pricing error is entirely information correlated, as in Glosten (1987).

We recorded data separately from the MO and CD market segments, i.e. two simultaneously operating markets with the same underlying fundamental price process m_t but different transaction costs and microstructures. Since trading floor and OTC markets are not necessarily occurring simultaneously, we write the expressions in terms of expectations. Moreover, we are interested in the second moments, namely:

$$E\left(\left(p_t^{\mathrm{MO}} - p_{t-1}^{\mathrm{MO}}\right) - \mu\Delta_t\right)^2 = E\left(\left(\Delta_t\right)^{1/2}\left(\omega_t + s_t^{\mathrm{MO}} - s_{t-1}^{\mathrm{MO}}\right)\right)^2 \tag{8}$$

for the upstairs OTC market and for the CD market, we have:

$$E\left(\left(p_t^{\mathrm{CD}} - p_{t-1}^{\mathrm{CD}}\right) - \mu\Delta_t\right)^2 = E\left(\left(\Delta_t\right)^{1/2}\left(\omega_t + s_t^{\mathrm{CD}} - s_{t-1}^{\mathrm{CD}}\right)\right)^2. \tag{9}$$

Please note that both equations share the common variance of the fundamental price process. This will be exploited in the next section to test whether market reforms affected

[21] For further details, see Ghysels et al. (1996) who provide an elaborate description of the time-deformed random walk and other processes. It should be noted that Hasbrouck (1993) did not include a drift. He relied on Merton (1980) who noted that for data samples that are brief in calendar time the standard error of the return is better estimated with a zero drift specification. We added a drift term as we no longer have the situation of sampling high frequency data.

the pricing errors. Before addressing this, we will add one final aspect to the sophistication of the model.

So far, we treated the Δ_t process as if there was only one market and we treated the return series as if there were two separate markets. Since the same stocks are traded on both markets and they only differ according to their transaction cost structure, agency costs, etc., we need to take this into account. To do this, the Δ_t process will measure the time from the last transaction whatever market it took place and denote the process as Δ_t^{L}. Similarly, for the return process of the MO market, we examine $p_t^{\mathrm{MO}} - p_{t-1}^{\mathrm{L}}$ where the index L indicates that the price is taken from the last transaction.[22] The same approach was also taken for the CD market. The model can then be written as:

$$E\left(\left(p_t^j - p_{t-1}^{\mathrm{L}}\right) - \mu\Delta_t^{\mathrm{L}}\right)^2 = E\left(\left(\Delta_t^{\mathrm{L}}\right)^{1/2}\left(\omega_t + s_t^j - s_{t-1}^{\mathrm{L}}\right)\right)^2 \tag{10}$$

for $j = \mathrm{MO}$ and CD. Since the process Δ_t^{L} is observable, we can estimate parameters not involving unobserved components via a set of moment conditions using transactions data from the two markets. Note that we will not extract σ_ω^2 from the data, rather we will take advantage of having observations from MO and CD sharing the same underlying ω_t to formulate certain hypotheses.

We conclude with the details regarding the estimation of the model, beginning with the following moment condition:

$$\sum_{t=1}^{T}\left[\left(p_t^j - p_{t-1}^{\mathrm{L}}\right) - \left(\Delta_t^{\mathrm{L}}\right)\mu\right]/T = 0 \tag{11}$$

for $j = \mathrm{MO}$ and CD. These two moment conditions (over)identify the drift ì. Since we are interested in measuring the component σ_ω relative to the total variance of returns, we will have to estimate the latter. We denote the right-hand side of Eq. (10) as the variances σ_j where $j = \mathrm{CD}$ and MO when normalized by Δ^{L}. We want to obtain these estimates via a GMM setup to apply the same structural change tests discussed in the context of the Roll model. In order to obtain estimators, we formulate the following moment conditions (including those for the Δ_t process):

$$\left[\sum_{t=1}^{T}\left(\left(p_t^j - p_{t-1}^{\mathrm{L}}\right) - \left(\Delta_t^{\mathrm{L}}\right)\mu\right)^2 - \left(\left(\Delta_t^{\mathrm{L}}\right)\sigma_j^2\right)/T\right] = 0 \tag{12}$$

[22] As a control, we will also compute the estimates with L replaced by MO. They will not be reported in the paper, as they yielded the same key results.

$$\left[\sum_{t=1}^{T}\Delta_t^{\mathrm{L}}\Big/T\right]-\mu_\Delta=0 \tag{13}$$

$$\left[\sum_{t=1}^{T}\left(\Delta_t^{\mathrm{L}}-\mu_\Delta\right)^2\right]\Big/\,T-\sigma_\Delta^2=0 \tag{14}$$

where $T=\mathrm{Max}(T^{\mathrm{MO}},T^{\mathrm{CD}})$ in the last two expressions. Eqs. (11)–(14) yield six moment conditions in five parameters, estimated via the GMM estimator defined by these moments. All the sample sizes are based on transactions data.

In contrast to the analysis in Hasbrouck, we have not yet decomposed the variances σ^2_{MO} and σ^2_{CD} into their common fundamental component σ^2_ω and market specific noise variance and covariance between fundamental and market component if the assumed decomposition is not orthogonal. Yet by estimating both σ^2_{MO} and σ^2_{CD} we can, without any further identification assumptions, infer some interesting hypotheses. To express these hypotheses, let us define: σ^2_{ji} for $i=1$, 2 and $j=\mathrm{CD}$, MO as well as $\sigma^2_{j\mathrm{F}}$. The former two correspond to estimates for each market segment and sample split separately, while the index F stands for the full sample.

We also apply the same structural change tests for the extended Hasbrouck model. These tests allow us to address the following question: did either the quality of the market change or did the fundamental price component ω_t, which we do not explicitly identify, change its structure (including its relationship with the pricing error–something which we do not identify explicitly). The advantage of the two market segments is that we also can test whether $\sigma^2_{\mathrm{MO}}=\sigma^2_{\mathrm{CD}}$ despite the differences in market structure. If they are not equal, we can simply infer from the relative magnitude of σ_{MO} versus σ_{CD} which market is higher quality, i.e. more transparent.

3.2. Empirical results: effective spreads

In Table 5, we report the estimates of the effective spreads of the Roll model obtained from Eq. (2) using transactions data for the 12 stocks we selected. We report five estimates of the spread, namely S_i^{MO} for i = 1, 2, 3, 4, and F. Besides the estimates, we also report the standard errors.

The first batch of four stocks pertain to the banking sector and correspond to the set of four appearing in Fig. 1. Except for CMCB, the spreads *increased* from the first sample, S1, to the second sample, S2. All the estimates are also very imprecise when we examine standard errors. We find nevertheless that the spreads are statistically significantly different for all stocks except CMCB, which shows a decrease in its spread. The SupLM statistics confirm the results for the χ^2 statistic for two out of the three stocks featuring structural change with a fixed break. These first results are surely not very encouraging as they indicate that if anything happened, it was a worsening of trading costs.

The spreads estimated via the Roll model for the entire sample range from roughly 2 DH to almost 55 DH (see the column labeled to $S_{\mathrm{F}}^{\mathrm{MO}}$ in Table 5), obviously suggesting

Table 5
Effective spreads roll model

Stocks	Sample S1			Sample S2			Entire sample			
	S_1^{MO}	St. Er.	Rel. Spr.	S_2^{MO}	St. Er.	Rel. Spr.	S_F^{MO}	St. Er.	$\chi^2(1)$	Sup LM
MO market										
CMCB	12.49	46.72	8.00	1.37	60.04	0.20	1.80	111.54	1.09	0.76
BMCI	1.65	102.61	0.70	60.93	25.70	12.60	21.53	39.86	7.02**	1.08
BCM	47.73	4.49	12.60	128.84	13.22	17.60	52.56	20.94	9.27***	7.20*
BMCE	5.45	19.30	2.40	114.58	5.14	18.80	52.37	8.99	42.82***	51.56***
ONA	32.12	2.86	8.70	4.24	17.28	0.60	4.41	17.50	2.04	22.64***
Crédit Eqdom	10.05	48.30	4.40	57.10	13.05	6.20	18.55	25.43	11.81***	0.02
Sofac Crédit	3.89	195.21	1.10	3.16	25.53	0.60	3.11	26.98	0.18	0.10
SNI										11.22***
Bras. du Maroc	5.01	23.65	1.30	69.26	51.01	3.80	10.49	64.88	0.92	1.32
Lessieur Afrique	6.24	24.94	1.30	91.74	21.01	5.10	6.98	415.77	6.15**	0.07
Cosumar	7.67	38.13	1.70	45.30	49.66	5.30	8.92	90.15	0.94	0.06
Centrale Laitière	3.11	43.14	1.00	11.37	52.68	0.40	3.29	51.37	0.76	0.18

Entries to the table are estimates of effective spread based on the Roll (1984) model. The column S_i^{MO} reports the point estimates of the effective spreads on the MO market (measured in Dirhams), while St. Er. is the standard error. The Rel. Spr. column is the effective spread divided by the stock price on the last day of the sample. Samples: S1 (January 1, 1984–September 20, 1993), S2 (September 21, 1993–March 31, 1997). The $\chi^2(1)$ statistic tests the hypothesis that the effective spread is equal across S1 and S2. The Sup LM statistic tests whether at any point in the sample there was a structural break in the effective spread.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

extremely large bid-ask spreads. The spreads over 50 DH are for BCM and BMCE, stocks that are in the 300–550 DH per share price range throughout the sample. Because of the upward movement in prices, we also report in Table 5 spreads relative to the price at the end of the samples. Prior to the reforms, the spreads were below 3.5%; during the S2 sample, they skyrocketed to almost 20%. First, it should be noted that such large spreads are neither totally unreasonable nor unusual, indeed Easley et al. (1996) report similar figures for infrequently traded stocks listed on the London Stock Exchange. Nevertheless, these estimates must be taken with extreme caution as we know that Roll estimates are based on a misspecified model. Besides the usual microstructure model specification assumptions, it should also be noted that the estimates are affected by the direction in the market. During the period after liberalization, the market heads sharply higher (a phenomenon called the return to integration discussed and documented extensively by Bekaert and Harvey, 1997, 2000). In effect, the Roll spreads are highly correlated with volatility, and the large spread estimates are simply a reflection of this.[23] Moreover, one of

[23] We have computed, but do not report, the cross-correlations of the three series appearing in Fig. 1. The cross-correlations are computed for all 12 stocks separately over samples S1 and S2. We also computed the cross-correlations for other samples, like S3 and S4. We found, not surprisingly, high cross-correlations. We also found that excluding 1996–1997 yielded estimates roughly equal across S1, S3 and S4.

the two biases affecting the volatility estimates appearing in Fig. 1 also affects the Roll spreads. Using transactions data has eliminated the daily use of stale transactions prices, one source of bias in volatility estimates, but has not eliminated the fact that intermediate upstairs market transactions are ignored. The second source of bias will be eliminated with the estimation of the Hasbrouck model.

The next four stocks are drawn from a different sector, grouping financial holding companies and includes the most actively traded stock, ONA. We notice again the pattern of increasing spreads, except for ONA. Evidence of a structural break in spreads appears to be present in spreads for ONA and SNI if we judge the evidence on the SupLM test, and to a lesser extend for spreads of Crédit Eqdom where the χ^2 statistic strongly suggests a break. These four stocks therefore reveal many features similar to the first group of four stocks. Among the eight stocks discussed so far, we have four firms which were the subject of privatizations, namely BMCE, Crédit Eqdom, Sofac Crédit and SNI. There is no clear pattern that shows any difference between these four and the other firms.

The final set of stocks are drawn from the important agricultural sector. We know from the results in Table 4 that they did not pick up so much in trading activity. Not surprisingly, we see no evidence of any break in the spreads (except for Lessieur Afrique). The main conclusions we can draw from these first estimates are the following: (1) if anything, spreads tended to increase rather than decrease, and (2) stocks subject to privatization programs do not show any distinguished features.

3.3. Empirical results: pricing errors

The pricing errors of the Hasbrouck model are a more sophisticated and arguably better way of estimating the costs of trading. We report the empirical estimates for this second model in Table 6, focusing only the parameters directly related to the pricing errors. We refrain from reporting μ, μ_Δ and σ_Δ here to reduce the size of the table. For the same reason, we also omit the parameter estimates for the full sample as well as S3 and S4. Besides the parameter estimates σ_{CD} and σ_{MO} for S1 and S2, we also report an estimate of the pricing error denoted σ which is obtained from imposing the restriction $\sigma_{CD}=\sigma_{MO}$. Besides the parameter estimates, we also report three SupLM statistics: one pertaining to σ_{CD}, a second statistic tests the stability of σ_{MO}, while the third corresponds to σ. We examine again the same 12 stocks grouped in three sets along the lines of their industry classification.

The results in Table 6 are fairly easy to summarize; indeed, we find strong evidence of structural change in pricing errors. Yet, the point estimates show that in almost all cases, pricing errors *increased* rather than decreased. This result is not surprising as we reported similar findings with the effective spreads obtained for Roll's model. It should also be noted that the point estimates for the samples S3 and S4 (not reported in Table 6) are close to those of S1. Moreover, one rejects the hypothesis that $\sigma_{CD}=\sigma_{MO}$ with the latter always yielding lower point estimates. Finally, SupLM tests using S3 data for σ_{CD}, σ_{MO} and σ do not reject the null hypothesis of stability of the spreads, regardless of whether the firms were privatized or not.

The main conclusions that we can draw again from this model are the same as before, namely: (1) if anything, spreads tended to increase rather than decrease, and (2) stocks subject to privatization programs do not show any distinguished features. Finally, when we

Table 6
Measures of market quality for the Casablanca stock exchange

Stocks	σ_{CD}		σ_{MO}		σ		Sup LM		
	S1	S2	S1	S2	S1	S2	σ_{MO}	σ_{CD}	σ
CMCB	0.021	0.046	0.008	0.013	0.025	0.028	34.43***	15.08***	19.92***
	(0.014)	(0.011)	(0.023)	(0.006)	(0.006)	(0.007)			
BMCI	0.027	0.232	0.010	0.294	0.017	0.250	35.64***	45.54***	52.87***
	(0.005)	(0.042)	(0.003)	(0.064)	(0.004)	(0.030)			
BCM	0.018	0.200	0.012	0.675	0.015	0.318	107.25***	8.58**	31.46***
	(0.003)	(0.065)	(0.004)	(0.050)	(0.002)	(0.038)			
BMCE	0.024	0.202	0.014	0.825	0.016	0.443	65.18***	14.72***	143.28***
	(0.004)	(0.049)	(0.002)	(0.018)	(0.003)	(0.015)			
ONA	0.031	0.031	0.033	0.093	0.032	0.062	3.84	24.17***	25.16***
	(0.008)	(0.005)	(0.005)	(0.037)	(0.003)	(0.013)			
Crédit Eqdom	0.032	0.441	0.022	0.696	0.022	0.606	18.56***	13.01***	17.32***
	(0.010)	(0.194)	(0.003)	(0.066)	(0.003)	(0.073)			
Sofac Credit	0.023	0.014	0.026	0.008	0.024	0.010	27.11***	13.25***	96.02***
	(0.006)	(0.002)	(0.010)	(0.010)	(0.005)	(0.001)			
Lessieur Afrique	0.041	0.135	0.023	0.336	0.029	0.187	41.44***	12.06***	15.92***
	(0.008)	(0.039)	(0.009)	(0.047)	(0.005)	(0.026)			
Cosumar	0.040	0.014	0.016	0.026	0.031	0.014	12.26***	29.94***	46.32***
	(0.013)	(0.002)	(0.003)	(0.006)	(0.005)	(0.002)			
Centrale Laitière	0.037	0.018	0.023	0.009	0.032	0.010	101.46***	29.37***	54.66***
	(0.011)	(0.006)	(0.007)	(0.001)	(0.006)	(0.004)			

Entries to the table are parameter estimates representing pricing errors on the MO market (σ_{MO}) and the CD market (σ_{CD}). The column labeled σ represents an estimate of the pricing error assuming $\sigma_{MO}=\sigma_{CD}$. The Sup LM statistic tests whether at any point in the sample there was a structural break in the pricing error. Samples: S1 (January 1, 1984–September 20, 1993) and S2 (September 21, 1993–March 31, 1997).

** Significant at 5%.

*** Significant at 1%.

compare the pricing errors for the MO market with those for CD, we observe, as should be expected, that the trading floor has a smaller pricing error compared to the OTC section of the market. The hypothesis that $\sigma_{CD}=\sigma_{MO}$ is typically, though not always, rejected.

4. The price impact of large block trades

> You will not find a treasure like this in whole Morocco...and it is only 700 Francs. Oooooh but the Lady is a friend of *Rick*...did I say 700? You can have it for 200 Francs!

The fact that we have separate data for large block trades provides us with a unique opportunity to examine the capacity to absorb large trades. These trades account for a substantial fraction of the volume, roughly 40% as indicated in Table 2.[24] It was noted that

[24] Keim and Madhavan (1996) note that for the NYSE it is estimated that large block trades represent about 54% of trading volume when a large block trade is defined as 10,000 shares or more.

Table 7
Price impact of large block trades on Casablanca stock exchange-buyer initiated (positive)

Stocks		Temporary impact	Permanent impact measured over the period				
			$t-22$ to $t+1$	$t-6$ to $t+1$	$t-1$ to $t+1$	$t-1$ to $t+6$	$t-1$ to $t+22$
CMCB	S1	38.95	2.06	2.22	1.24	1.53	2.75
	S2	1.84	3.23	1.68	1.45	3.14	7.13
BCM	S1	4.34	5.88	1.52	2.03	2.39	5.25
	S2	65.93	82.69	47.52	61.34	34.57	35.80
BMCE	S1	1.84	3.77	3.24	3.13	6.08	5.29
	S2	55.92	44.69	36.28	38.24	34.44	33.39
ONA	S1	6.49	6.79	7.01	3.75	3.68	7.76
	S2	4.73	4.04	2.75	3.86	3.30	7.55
Crédit Eqdom	S1	3.50	–	–	5.26	3.58	–
	S2	14.53	58.24	15.10	8.05	13.35	20.09
SNI	S1	10.49	5.81	4.76	3.41	3.99	4.90
	S2	30.42	30.21	11.94	6.63	11.14	19.79
Bras. du Maroc	S1	3.40	3.92	3.15	2.07	2.76	5.30
	S2	1.28	2.74	3.07	24.90	13.82	18.77
ALL	S1	10.39	5.73	4.71	3.39	3.89	4.85
	S2	30.36	29.47	19.87	20.38	14.38	19.31

Entries are summary information on upstairs-negotiated CD market block trades. The temporary price impact is defined as $\ln p^{CD}_{t+1}/p^{CD}_{trade}$ where p^{CD}_{t+1} is the closing price on the day after the trade on the CD market. p^{CD}_{trade} is the price registered on the block trade. The permanent price impact is defined as $\ln(p^{CD}_{t+1}/p^{CD}_{t-j})$ and $\ln(p^{CD}_{t+j}/p^{CD}_{t-j})$ where p^{CD}_{t+j} and p^{CD}_{t-j} are closing prices. All entries are sample averages. The samples are S1 (January 1, 1984–September 20, 1993) and S2 (September 21, 1993–March 31, 1997).

large transactions are accomplished through a search-brokerage mechanism where an intermediary or broker locates counterparties to a trade. Several theoretical models have been proposed to study such markets, including Burdette and O'Hara (1987), Grossman (1992), Seppi (1990) and Keim and Madhavan (1996).

We focus here exclusively on CD transactions and measure the price impact of large block trades as reported in Tables 7 and 8. The statistics we report are the same as those in Tables 1 and 2 in Keim and Madhavan (1996). The comparison with their results is of interest for two reasons. First, they consider small stocks on the AMEX, NASDAQ and NYSE. In this regard, our data shares features with theirs as some of the stocks in their sample have one single trade, the large block trade, on a given day. Second, their data also consists exclusively of large block trades, i.e. it is not based on regular transactions data with a cut-off for the size of the trade. Unlike Keim and Madhaven, we do not have information which trades were seller-initiated and which were buyer-initiated. Therefore, we separated the data on the bases of the sign of the temporary price impact. The latter is being defined as $\log p^{CD}_{trade}/\log p^{CD}_{t+1}$, where $t+1$ is the day following the large block trade on the CD segment of the market. If the temporary impact was positive, we classified the trade as buyer-initiated while negative ones are considered seller-initiated. Besides the temporary impact, we also report permanent price impacts. These are measured as the sample averages of $\log p^{CD}_{t-j}/\log p^{CD}_{t+1}$ for $j=1$, 6 and 22. We computed the same sample

Table 8
Price impact of large block trades on Casablanca stock exchange-seller initiated (negative)

Stocks		Temporary impact	Permanent impact measured over the period				
			$t-22$ to $t+1$	$t-6$ to $t+1$	$t-1$ to $t+1$	$t-1$ to $t+6$	$t-1$ to $t+22$
CMCB	S1	− 12.26	− 2.98	− 2.16	–	− 2.66	− 3.46
	S2	− 3.67	− 7.13	− 3.27	− 1.81	− 1.68	− 3.24
BMCI	S1	− 5.81	− 5.76	− 3.08	− 0.01	− 2.03	–
	S2	− 9.90	− 32.43	− 21.13	− 26.35	− 34.16	− 33.35
BCM	S1	− 2.34	− 4.56	− 2.64	− 7.84	− 1.52	− 3.70
	S2	− 2.53	− 35.80	− 34.45	− 43.75	− 50.01	− 82.69
BMCE	S1	− 1.44	− 7.17	− 6.08	− 2.66	− 3.24	− 1.60
	S2	− 6.98	− 33.39	− 35.43	− 30.88	− 35.88	− 44.69
ONA	S1	− 11.64	− 5.22	− 3.76	− 5.00	− 7.52	− 5.69
	S2	− 3.35	− 7.55	− 3.37	− 3.02	− 2.75	− 4.04
SNI	S1	− 12.06	− 4.85	− 3.99	− 4.23	− 4.64	− 5.88
	S2	− 4.96	− 19.79	− 10.91	− 6.12	− 11.98	− 30.21
Bras. du Maroc	S1	− 5.94	− 4.01	− 2.45	− 2.86	− 3.45	− 3.33
	S2	− 1.92	− 18.77	− 12.56	− 2.53	− 1.54	− 2.21
Lessieur Afrique	S1	− 30.22	− 3.30	− 7.25	− 4.90	− 7.00	− 8.34
	S2	− 3.06	− 24.63	− 8.88	− 14.94	− 42.03	− 93.00
ALL	S1	− 12.01	− 4.85	− 3.86	− 3.30	− 4.63	− 5.73
	S2	− 4.67	− 19.75	− 15.18	− 14.91	− 14.13	− 16.78

Entries are summary information on upstairs-negotiated CD market block trades. The temporary price impact is defined as $\ln p^{CD}_{t+1}/p^{CD}_{trade}$ where p^{CD}_{t+1} is the closing price on the day after the trade on the CD market. p^{CD}_{trade} is the price registered on the block trade. The permanent price impact is defined as $\ln(p^{CD}_{t+1}/p^{CD}_{t-j})$ and $\ln(p^{CD}_{t+j}/p^{CD}_{t-j})$ where p^{CD}_{t+j} and p^{CD}_{t-j} are closing prices. All entries are sample averages. The samples are S1 (January 1, 1994–September 20, 1993) and S2 (September 21, 1993–March 31, 1997).

averages. The results in Table 7 are reported for the same selection of 12 stocks. We report the aggregate results only and suppressed those for the individual stocks because the latter were based on small samples.

Let us consider first the buyer-initiated trades. Comparing the temporary impact of large block trades from S1 to S2, we notice that the impact almost quadrupled. For the seller-initiated large block trades, we observe the same order of magnitude. The other two samples show increases, but they are substantially smaller. As for the permanent price impacts, it is interesting to note that the results for S1, S3 and S4 are quite similar to those reported by Keim and Madhavan (1996), particularly those pertaining to the NASDAQ firms in their sample (they report smaller price impacts for large block trades on the NYSE/AMEX). For instance, from $t-22$ until $t+1$, the price impact on the NASDAQ is reported as 6.76 (buyer-initiated) while it is 5.73 and 6.01 for S1 and S3, respectively. Similarly, comparable figures for seller-initiated block are reported for the NASDAQ, namely -7.05, and between roughly -5.0 and -7.0 for the usual triplet of samples. In all cases, the inclusion of the 1996 era increases dramatically the price impact statistics. For buyer-initiated trades, the mean increases to 9.47 and decreases to -9.10 for seller-initiated trades. Both figures are much higher than those reported for the NASDAQ and the NYSE/AMEX, as well as those found for the CSE for all, except

the S2 sample. The same pattern emerges for the price impacts at horizons $t-6$ and $t-1$, which are also reported in Tables 7 and 8.

5. Conclusions

> Go ahead and shoot me...you will be doing me a favor.

These feelings expressed by Rick to Isla towards the end of the movie (and hence the story) sometimes coincide with those of somebody who tries to do empirical research with recalcitrant data series. It is indeed a very difficult task to measure the progress that was made with the various reforms of the market, the financial sector and the economy in general. The process of emergence of a market, in particular what makes it happen, is still poorly understood. The results suggest that the cost of trading and the quality of the market if anything became worse, despite the improved liquidity and the increase of overall trading activity and volume. There are several interpretations of our results that we can offer.

First, the models used are inadequate to model the transactions behavior of thin markets prior to reforms and after the reforms the market may not have been immediately a competitive dealer market stylized in the standard microstructure models. Hence, we are dealing with potentially seriously misspecified models. Moreover, the simultaneous operation of floor and upstairs trading certainly do not make the analysis easier. Our extension of the Hasbrouck model is an attempt at capturing some of these issues. Nevertheless, *if* misspecification is a constant factor throughout the various samples, we should still be able to draw conclusions from our analysis despite the shortcomings of our simple model specifications.

Second, provided that trading costs did increase substantially, it should be noted that the period of transition is a long one, stretched over several years with lots of uncertainties. Not a single event caused the change, which is why it is difficult to obtain the predictions emerging from comparing simple equilibrium outcomes. More recent work has shown that the market eventually improved and the introduction of screen-driven trading ultimately improved trading costs and market transparency.

The results are surprising as the liquidity of the market improved dramatically and barriers to trading were brought down. The changes in liquidity and transparency were impressive on a relative basis. However, in absolute terms, the CSE is still a very thin market with few trades, when compared to the standard of developed financial markets. One interpretation is that foreign investors (particularly new arrivals) are presumably among the least informed of market participants. It may be that CSE dealers possessed a tremendous amount of market power relative to the foreign traders. This would imply that the high spreads were not a competitive equilibrium phenomenon, but simply indicated a fleecing opportunity.

Microstructure reforms may be important to signal foreign investors that the stock exchange embarks on a genuine integration with the world financial markets. However, they do not seem to contribute to the effective costs of trading, at least not during the post-reform period. Presumably, with the adoption of the screen-driven trading system

of the *Bourse de Paris*, one would expect further improvements in the trading environment. However, these improvements came very much after the market emerged. Recent work by Derrabi et al. (1999) examines the transition of the CSE to screen-driven trading. They find that volatility decreased subsequent to the introduction of screen-driven trading. These effects are similar to the traditional findings in the microstructure literature.

Another element we should take into account is that during the transition period, there was a *learning by doing* effect which may explain some of the phenomena such as the large spreads during some of the transition phases. Initially, the CSE was faced with a serious shortage of skilled labor, people who understood the operations of international financial markets. In this regard, we may conclude this paper with an anecdote that suits so well as it almost suggests a very nice definition of an emerging market and also describes very well the early stages of the reforms. The event took place during one of our (the authors) first visits to the CSE. We had an appointment with the Chairman of the CSE. His secretary had inadvertently scheduled our appointment at exactly the same time that was arranged for a delegation of eight investment bankers from the US and the UK. Consequently, 10 people showed up at the same time to see the Chairman. When the secretary found out we were academics, she gave us priority. The moral of the story, and at the same time a rather interesting definition, is that an emerging market is a market where academics still have priority over investment bankers.

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