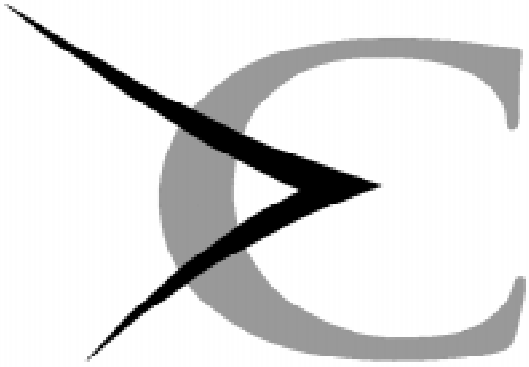

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Emerging Markets and Trading Costs

Eric Ghysels, Mouna Cherkaoui

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Emerging Markets and Trading Costs*

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Résumé / Abstract

Afin d'accroître notre compréhension des marchés émergents nous analysons une base de données incluant toutes les transactions effectuées sur une longue période. Le marché, qui, trois années après avoir connu d'importantes réformes, a été introduit en 1996 dans la base de données de la Société Financière Internationale (SFI), fonctionne selon un système d'échange dual qui consiste en un marché pour les transactions de bloc et un marché central. Les transactions ont été enregistrées séparément pour chacun des segments du marché. Les fourchettes effectives ainsi que l'impact des transactions de bloc sur les prix sont examinés. Nous vérifions si les coûts de transaction ont changé de manière significative depuis les réformes de microstructures. Nous trouvons des coûts de transaction élevés et prohibitifs qui sont temporaires mais durent néanmoins plus d'une année et coïncident avec l'incorporation du marché à la base de données de la SFI. Cet impact temporaire est suivi de coûts de transaction à peu prés égaux à ceux de la période précédant la réforme. Les résultats que nous obtenons n'appuient pas l'idée conventionnelle selon laquelle la transparence des marchés et les coûts de transaction rehaussent, au moins directement, l'émergence du marché.

To enhance our understanding of emerging markets we study a data set containing all the transaction records over a long span. The market, which was included in 1996 in the International Finance Corporation (IFC) data base roughly three years after important market reforms, operated under a dual trading system, consisting of an upstairs market for large block trades and a trading floor exchange. Transactions were recorded separately for both segments of the market. Effective spreads as well as the price impact of large block trades are examined. We test whether the costs of trading have significantly changed since the stock market microstructure reforms. We uncover prohibitively expensive trading costs which are temporary, yet last for over a year and coincide with the incoporation 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

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not support the conventional wisdom that market transparency and trading costs enhance, at least directly, the emergence of a market.

Mots Clés : Structures de marchés, marchés émergents

Keywords : Market structures, emerging markets

1 Introduction

In the world of today isolationism is not a practical policy

The city often associated with a movie classic, staring Humphrey Bogart as *Rick* and Ingrid Bergman as *Isla*, is also the site of an emerging financial market called the *Bourse de Casablanca.*[1] 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.[2]

This paper focuses on the financial market reforms which led to the process of emergence and examines how these changes affected the market transparency, the quality of the market and the cost of trading. 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 *twelve 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 the dual market system enables us to examine many issues hitherto mainly unaddressed, in particular what role microstructure reforms played in the emergence of the market.[3]

Our results are rather surprising with regard to the role played by trading costs. It appears that effective spreads became very large, both by historical standards and in an absolute sense. 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 three years before the market was incorporated in the IFC data

[1] There are many famous lines from the movie *Casablanca*. Every section in this paper starts with a quote which relates 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.

[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).

base, made hardly any dent in the spreads and other measures of transparencies. The effect of increasing transactions costs, while temporary, lasted for over a year. Despite the very large trading costs, the market saw trading volume quadruple, then double the year after, then triple again once the reforms were put into place. The market index shows similar spectacular performances. It is also of interest to note that after the surge, 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. The type of data we examine is scarce, however. 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 *Bourse de Casablanca* and the various events which transformed the market from a submerged relatively inactive market in the mid-eighties 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 summary statistics of market activity throughout 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 not recorded nor even available for the submerged stages of the market. In section 3 we follow statistical approaches which rely exclusively on transactions data such as the Roll (1984) model of effective spreads, the spread between the large block trade and floor trading market as well as various measures of liquidity and effective spreads. In addition we extend the work of Hasbrouck (1993) who proposed to decompose security transaction prices into random walk and stationary components. 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 which is so typical for submerged and 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

[4]It is rather unusual to have explicit data on large block trades for submerged,

concludes the paper.

2 From a Sleepy Place to the Wake-up Call

As one costumer 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 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 pure coincidental. Yet, perhaps some of the features apply to the activity of a pre-emerged or submerged market. The emergence of the CSE was not simply a matter of changing its microstructure. Many developments took place, fortunately not all simultaneously. The purpose of this section is to briefly describe how the CSE originally functioned and changed over time. We look at several dimensions, including the structural adjustment program, the financial sector reforms and the microstructure of the CSE. A first subsection describes the microstructure of the market and the changes which took place. The next subsection describes the details of the data we collected. The third subsection covers some preliminary empirical snapshots of the CSE while a final subsection deals with the selection of stocks we consider. Appendix A to the paper also provides details about Morocco's reform and privatization programs.

2.1 The market's microstructure

A stock market reform program was undertaken in the summer of 1993 almost simultaneously with the onset of an ambitious privatization program. On September 21 1993 three laws (so called *Dahir*) came into effect regarding: (1) the Casablanca Stock Exchange, (2) the securities commission (*Conseil Déontologique des Valeurs Mobilières*) and (3) the creation of mutual funds. The new laws included changes in the management and organization of the stock exchange. In addition, changes were made to the way mutual funds operate, fiscal advantages were established

emerging or emerged markets. Typically such trades are filtered from transactions data, usually with the consequence of data errors. Some exceptions exist, notably Kiem and Madhavan (1996).

for shareholders and new regulations for shareholder protection were installed. The reforms were to a large extent anticipated. Indeed, since 1989 the country embarked on several reform programs which affected many dimensions of the economy (see Appendix A for more details). The actors operating on the CSE prior to the reforms of 1993 were the major domestic banks. Trades were executed by employees from these institutions, none of the traders were acting on their own account. The exchange was extremely illiquid, as most stocks did not trade for several weeks. In the next subsection we will provide more details regarding trading activity. The exchange personnel recorded with chalk the latest transaction prices on a large blackboard. Not all trades passed through the trading floor as large blocks typically traded OTC. Such trades were also handled by the same banks which operated floor trading but the OTC trades were not directly exposed to the trading floor (more on this later). 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.

The CSE was privatized with the reforms of September 1993 and the new owners were an association of dealers. Permits to operate were given to 14 market makers who act as specialists in roughly the 50 stocks traded on the exchange. The CSE trading hours are Monday to Friday from 10 AM until noon and transactions take either place on the trading floor (called *Marché Officiel*) or the upstairs OTC market (called *Cession Directe*). The differences between the two are similar to for instance the NYSE. Namely, in the upstairs market, large transactions are accomplished through a search-brokerage mechanism where an intermediary or broker locates counter-parties to a trade (see e.g. Burdett and O'Hara (1987), Grossman (1992), Seppi (1990) and Kiem and Madhavan (1996) for a more elaborate and theoretical discussion). In contrast, the downstairs market relies on market makers who provide liquidity on demand.[5]

Since May 15 1995 a document called *Protocole de Place* organizes

[5]There is an important difference between the CSE and the NYSE, however. As Hasbrouck, Sofianos and Sosebee (1993) and Kiem and Madhaven (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. Large trades may occur without public exposure, at least until the next trading day.

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. Finally, it is worth noting that the CSE adopted the French screen-driven trading system of the Bourse de Paris (see Biais, Hillion and Spatt (1995) for further description) on December 17th 1996. So far we have not collected enough recent data to cover this episode but plan to do so in future work.

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 2.1 presents a selection of basic indicators regarding the CSE from 1989, the year the reform programs were announced, until 1996. Table 2.1 provides on an annual basis (1) the number of trading days, (2) the trading volume (million of *Dirhams*, the Moroccan currency denoted DH, one US dollar is roughly 9 DH), (3) market capitalization, (4) a measure of liquidity (trading volume/market capitalization), (5) dividend yields, and (6) 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 seven year window covering the pre-reform and post-reform eras. The liquidity index, perhaps the most important basic indicator for what will be discussed in the next sections, went from a meager 2.4 % to 25.8 %. We also note that in 1993, when the first CSE reforms were put into law, trading volume quadrupled, then doubled the year after, then tripled again. 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.

2.2 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 which contains 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 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.[6] The data set runs from January 1st 1984 until March 31 1997. Roughly between 50 to 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 which came into effect on 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. Hence, a first subsample, 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 on the one hand many of the changes were anticipated following the widely publicized announcements of reforms and on the other hand many of the legal changes 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 subsample, 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 which excludes the same observations from the sample *S2*. For the moment, it will be convenient to focus on *S1* and *S2*, i.e. obesrvations before and after the reforms, as

[6] The records on the timing may not be as accurate for the *CD* market. It is very rare that OTC trades take place after 4 PM and are therefore reported on the next day. The majority of OTC trades are not reported before noon, however, the time when floor trading ends. With the same caveat we also know the sequence of transactions which they took place on different segments of the market (CD versus MO) on the same day. This allows us to compute intra-day returns on a tick-by-tick basis either on each segment of the market or both markets together.

a first cut of the data.

The two subsamples *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 2.2 we report the sample sizes for each of the subsamples and each of the market segments. While *S1* covers almost a decade and *S2* less than four years we note from Table 2.2 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 11378 for *S2*.

We report in Table 2.3 the capitalization, number of shares and the number of stocks on the CSE. In Table A.1 (appearing in Appendix A) we provide a more detailed list of all individual stocks, their capitalization, number of shares, etc. In both tables we report only three pivotal dates which are related to the sample split, beginning and end.[7] 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 *Conseil Déontologique des Valeurs Mobilières*, 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. The detailed summary in Table A.1 provides the names of each of the stocks, including the de-listed ones. It also provides the number of shares and the stock price at three pivotal dates in our sample (beginning, end of *S1* and *S2*). The market capitalization rose 41-fold from the end of *S1* until the end of *S2*, while the number of shares traded quintupled.

2.3 A First Look at Market Activity

In this section we examine overall trading activity and focus on some individual stocks which will be the primary focus of our analysis in the subsequent two sections. In Table 2.4 we report how trading changed dramatically from subsample *S1* to *S2*. Before the reforms took place there were an average of four trades on a daily basis, roughly three on the MO market and one on CD. Hence, the CSE was clearly a very inactive market. Table 2.4 also contains the frequency distributions. We note that for 32 % of the trading days in *S1* there were no trades registered

[7] Since market capitalizations are only changed at the end of the month we list the months corresponding to the sample split date.

on the trading floor (MO market) and 70 % of the days were without 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 and hardly any day goes by without trading. Both segments of the market combined have 72 % of the days more than 10 trades during *S2*, more than three times the 24 % of days which showed not a single trade in *S1*.

As the main focus of our analysis will be on transaction-based data let us examine now trading activity in some individual stocks. A total of 28 stocks, which rank as the most actively and continuously traded, are listed in Table 2.5. For each stock we have the daily average number of trades and average number of shares on both segments of the market in each subsample. 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 which is ONA, the most actively traded stock, where the trading floor 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.[8]. 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 in fact 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 2.5 remained relatively inactive.

This first examination of the transactions data reveals that the reforms had a strong impact on trading patterns and seem to suggest that the trading floor market became rapidly an active market with relatively 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 activity in terms of trading frequency. A handful of stocks benefited from this increased activity, while most other stocks trailed. Those which benefited are concentrated in the banking sector as

[8] It is also worth noting that for some of the less actively traded stocks transact primarily on the upstairs market (*Cadem* and $Auto - Hall$ appearing in Table 2.5 being perfect examples)

well as holding companies and were the largest stocks before the reforms as well.

2.4 The selection of stocks

Before we discuss modeling and estimation issues, we briefly list the stocks we will focus on and explain why they were selected. We noted from the trading statistics in Table 2.5 that the least active stocks remained inactive after the reforms. Hence, the gains were primarily in the top tier of the market. It 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 of four stocks making a total of twelve active stocks. We have chosen the three groups to disentangle several effects, particularly pertaining to microstructure reforms and privatizations. Before introducing any specific stocks let us recall that the bid-ask spread is assumed to have different components. Indeed, theoretical models about the marketmaking process suggest that spreads have three components: (1) order processing, (2) adverse information and (3) inventory holding costs. There are certainly several features of Morocco's reform package which had potentially an impact on one or several components of the bid-ask spread. It was noted before that the privatization program brought liquidity to the market. Among the basic indicators which appeared in Table 2.1 we noted that market liquidity improved dramatically. In Appendix A it is also observed that roughly 9 billion DH, or 1 billion US dollars, worth of new equity through IPO's and seasoned equity offerings was created. The influx of new shares probably 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 2.5 were the subject of privatizations.[9] 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 SCE quintupled for the financial holding *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.[10] These

[9] See Table A.2 in Appendix A for details regarding the privatization of firms.

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

are a few examples illostrating how the privatization program injected liquidity. The reforms also brought more transparency through the financial statement reporting requirements which 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 marketmakers 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, they figured also among the actively traded stocks before and after the reforms. There is one stock, namely *BMCE*, which was the subject of a major privatization which 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 for *BMCE* a combination of a seasoned equity offering and changes in the trading/dealer incentives. 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 firms and others which were not. The group contains the most actively traded stock throughout the period, namely *ONA*. The three other stocks are : *Crédit Eqdom* and two firms which were subject of privatizations, namely *Sofac Crédit* and *SNI*. Here the privatizations took place in May 1994 for the first, while *SNI* was in October 1994. 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 rankings in terms of average trading frequencies according to the results listed in Table 2.5. 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 divers selection of twelve stocks exhibits different features and allows us to make comparisons and to a certain extent control for sectoral and privatization effects. This selection of stocks will figure from now on prominently in all of our empirical analysis.

To conclude this section we report some first regression results involving the selection of twelve stocks. Namely the following regressions are reported in Table 2.6:

$$\begin{aligned} r_\tau &= \alpha_{01} + \alpha_{11} r_{\tau-1} + \varepsilon_\tau \\ r_\tau^2 &= \alpha_{02} + \alpha_{12} r_{\tau-1}^2 + \varepsilon_\tau \\ v_\tau &= \alpha_{0v} + \alpha_{1v} v_{\tau-1} + \varepsilon_\tau \end{aligned}$$

where r_τ represents the transaction-based return series and v_τ is the volume. Only the slope estimates of α_{1i} for $i = 1, 2$ and v are reported in the table for the two subsamples $S1$ and $S2$. The regressions are estimated via OLS whereas the standard errors are computed using the Newey and West (1987) procedure. The results of the first regression show that the first autoregressive coefficient is more negative in $S2$ compared to the estimates obtained with $S1$ data. There are a few exceptions, namely *SNI*, *Cosumar* and *Centrale Laitière*. In those cases the coefficients became smaller in magnitude, although the standard error increased as well suggesting less precision of the S2 estimates. The OLS estimates converges to $cov(r_\tau, r_{\tau-1})/var(r_{\tau-1})$ where the covariance is negative due to the bid-ask bounce. Therefore, as α_{11} becomes more negative we find evidence that the covariance is more important relative to the variance of r_τ during $S2$. This is a first indication that spreads may have increased substantially during $S2$. This issue will be further explored in the next section. The next set of columns considers autoregression in volatility. Volatility became clearly more persistent. For some stocks during $S1$ we observe even negative coefficients. All autoregressive coefficients have the expected positive sign during $S2$, except for *Cosumar* which shows statistically insignificant autocorrelation in both samples. Finally, the last two columns in Table 2.6 pertain to trading volume. The results feature the same pattern as volatility, namely with some exceptions we note that trading volume became more positively autocorrelated.

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, namely: How much did microstructure reforms contribute to the emergence of the *Bourse de Casablanca*? The purpose of this section is an attempt 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, etc. to discuss microstructure features of a stock market.[11] Unfortunately,

[11] There are numerous examples of studies assessing market performance, market

we cannot rely on such measures as they simply were not systematically recorded for a submerged market like 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.[12] 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. Various statistical approaches exist to do this. We will consider several approaches as we want our conclusions not to depend on the implicit assumptions embedded in one specific class of models.

3.1 Plots and Descriptive Statistics

As a prelude to the formal model-based estimates and tests we examine several plots which appear in Figures 1 through 3. They portray a picture of market activity and quality for individual stocks. Each figure has twelve plots, namely three graphs for a set of four stocks. Figure 1 displays monthly estimates of volatility, monthly high-low spreads and monthly Roll (1984) model spreads.[13] All the calculations appearing in the figures are based on trading floor data.[14] The top row of plots in Figure 1 show the monthly volatility estimates of *CMCB*, *BMCI*, *BCM* and *BMCE*. The next row shows the monthly high-low spreads whereas the lower panel displays the Roll spreads. The monthly high-low spreads could be viewed as a "model-free" upperbound on the actual spreads which, as noted before, we do not have whereas the Roll spreads are based

structure and regulatory impact via bid-ask spreads, liquidity ratios, daily high-low midpoints and other measures. Some examples are Cooper, Groth and Avera (1985), Hasbrouck and Schwarz (1988), Grossman and Miller (1988), Neal (1989), Commodities and Futures Trading Commission (1989) and Tanner and Pritchett (1992). Such studies were applied to various OTC and specialist markets in equities and derivative securities.

[12] On occasion a bid and ask was 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.

[13] Details regarding the calculations of the Roll model spreads are deferred to the next section.

[14] 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 returns from trading in a particular stock.

on a very explicit set of assumptions (more on this later). The vertical lines on each graph are the sample splits between $S1$ and $S2$. Three of the four stocks show very much the same pattern. Volatility, high-low and Roll spreads increased dramatically, but long after the reforms were put into place. Table 3.1, which complements Figure 1, contains the cross-correlations of the three series appearing in the set of two figures.[15] The cross-correlations are computed for all twelve stocks separately over samples $S1$ and $S2$. We also computed, but do not report, the cross-correlations for other samples, like *S3* and *S4*. We found, perhaps not surprisingly, that excluding 1996-1997 yielded estimates roughly equal across *S1*, *S3* and *S4*. The eight stocks in Table 3.1 not appearing in Figure 1 are covered in the subsequent two figures, Figure 2 for *ONA*, *Crédit Eqdom*, *Sofac Crédit* and *SNI* and Figure 3 for *Brasseries du Maroc*, *Lessieur Afrique*, *Cosumar* and *Centrale Laitière*.

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, monthly averages of daily high-lows (on the trading floor market) and Roll spreads. Quite suprisingly this sudden increase does not coincide with any of the reform dates, i.e. neither the September 21 1993 nor May 15 1995. The sharp increases all occur January/February 1996, the time when the Casablanca Stock Exchange drew a lot of international attention.[16] The spreads estimated via the Roll model for the entire sample range from roughly 4 % to 19 % (see the column labeled to S_F^{MO} in Table 3.2), obviously suggesting extremely large bid-ask spreads. It should be noted, however, that such large spreads are not totally unreasonable nor unusual, indeed Easley et al. (1996) report similar figures for infrequently traded stocks listed on the London Stock Exchange.[17] Prior to the reforms the spreads were below 3.5 %, during the $S2$ sample they sky-rocketed to 40 %. The pattern for *CMCB* is very different, but so is the scale of magnitude. The Roll spreads are roughly 4 % throughout the sample.[18] Another noteworthy point to make is that the *BMCE* stock does not show any sign of increased volatility around December 1994, 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.

[15] Table 3.1 also contains cross-correlations of series which will be discussed later in Section 4.

[16] 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.

[17] We quote percentage figures in the text while the plots are on a decimal scale.

[18] Descriptive statistics regarding the spreads and the other series appearing in Figure 1 will be provided in Table 3.2 which will be discussed later.

Figure 2 displays the volatility, high-low and Roll spreads for *ONA* and three other stocks, namely *Crédit Eqdom* and two firms which, as noted before, were also the subject of privatizations, namely *Sofac Crédit* and *SNI*. These privatizations took place before that of *BMCE*, namely the former took place in May 1994 while the *SNI* privatization was in October 1994. The four stocks in Figure 2 show more heterogeneous patterns, though the spikes in volatility starting in 1996 re-occur for all stocks except *Sofac Crédit*. The first stock in Figure 2, *ONA* has low spreads, and only a few volatility spikes towards the end of the sample. As *ONA* is the most frequently traded stock throughout the sample this is obviously an interesting case. Among the other stocks *Sofac Crédit* does not show the upsurge in volatility starting in 1996, instead it has a sharp peak in December 1992. The high-low spreads, however, climb around the time of the privatization in May 1994. The Roll spreads show a downward trend *before* the reforms and peak around the privatization as well as in 1996. *SNI* was another pilot privatization involving 2030 million *Dirhams* (see Table A.2) as opposed to only 130.8 million *Dirhams* for *Sofac Crédit*. Both the high-low and Roll spreads show large increases right before the market reforms as well as at the time of the privatization roughly one year thereafter. The two privatized firms appearing in Figure 2 therefore display a pattern very different from *BMCE* which showed hardly any movement of volatility nor spreads around the time its shares went public. The spreads *increased* rather than decreased however. *Crédit Eqdom* in Figure 2 shows a fairly flat spread pattern unaffected by the reforms and features also a strong uprise in volatility and spreads at the very end of the sample.

The four remaining stocks are covered in Figure 3. This group does not contain banks or holding companies nor does it contain privatized firms. It also includes firms which dropped in the rankings in terms of trading frequencies. Three stocks, namely *Brasseries du Maroc*, *Lessieur Afrique* and *Cosumar* show the by now familiar pattern of flat volatility and spread pattern until 1996. The only exception is *Centrale Laitière* which showed some activity around the time of the reforms. However, as the scale is minor this is probably like *BMCE* and *ONA* no significant event. The huge increases in spreads are economically very important and probably also statistically significant. Obviously, we don't need very much statistics for assessing the changes after January 1996. But the issue of significant changes if we only look up to 1996 (which is a serious window of more than two years after the reforms) is more subtle and requires a more sophisticated approach.

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 remainder of this section. Before we leave the subject of descriptive statistics, let us examine the results appearing in Table 3.1 which complement the plots. In Table 3.1 we investigate the cross-correlations between volatility, Roll spreads and the high-low spreads to see how much they are interrelated. The first observation is that volatility and high-low spreads are, not surprisingly, positively correlated. The correlation between Roll spreads and volatility is usually positive, i.e. spreads again go up as expected as volatility increases, but there are also quite a few cases of negative correlations between Roll spreads and volatility (and high-low spreads as well). For most of the twelve stocks the correlation between Roll spreads and volatility grew stronger from sample $S1$ to $S2$. The stocks are *BCM*, *ONA* and *Brasseries du Maroc*. For some stocks there was a negative correlation before the reforms which turned positive. Those stocks are *BMCI*, *BMCE*, *Sofac Crédit* and *Lessieur Afrique*. Three stocks show positive correlation during $S1$ which turns into negative correlations after the reforms. Those three are *CMCB*, *SNI* and *Cosumar*. Finally, *Crédit Eqdom* and *Centrale Laitière* show only weak positive correlation between Roll spreads and volatility as well as monthly high-low spreads. Hence, the picture is mixed when we consider the comovements between spreads and volatility. One conclusion one must draw from the cross-correlations in Table 3.1 is that the increase in spreads is not purely a reflection of increased volatility.

3.2 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 graphs which appeared in the previous section gave us a first indication on how the market responded to the reforms. The plots were based on "noisy" statistics involving monthly averages of data. 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. The plots in the previous section displayed monthly estimates of spreads based on the model pioneered by Roll (1984). Inferences about the bid-ask spread in Roll's model are made from the autocovariance properties of observed transactions

prices.[19] We will start from this simple model and then proceed to more complex ones. The Roll (1984) model 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:

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

where $\Delta p_\tau \equiv p_\tau - p_{\tau-1}$. where p_τ denotes the logarithm of the transactions price. We will start with an implementation of Roll's model which is more elaborate than the graphical display discussed in the previous section and then move to a second and complementary approach inspired by Hasbrouck (1993).[20] We will also exploit some of its features to deal more explicitly with the non-cooperative 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 excecuted upstairs and on the trading floor.

Hasbrouck (1993) suggested to identify the random walk component of security transaction prices as the efficient price of a stock.[21] 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:

$$p_\tau = m_\tau + s_\tau, \tag{2}$$

where m_τ is the efficient price, specified as follows:

$$m_\tau = m_{\tau-1} + \omega_\tau, \tag{3}$$

[19] See also Choi, Salandro and Shastri (1988), Stoll (1989) and George, Kaul and Nimalendran (1991) for related work.

[20] 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).

[21] 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 which is important for the analysis of long term trends but is of lesser importance for the high frequency study of microstructures.

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 th 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:

$$m_t = \mu\Delta_t + m_{t-1} + (\Delta_t)^{1/2}\omega_t, \tag{4}$$

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 and drift proportional to the duration between trades.[22] We defer all the technical details to Appendix B where we show that the model can be written as:

$$E\big((p_t^j - p_{t-1}^L) - \mu\Delta_t^L\big)^2 = E\big((\Delta_t^L)^{1/2}(\omega_t + s_t^j - s_{t-1}^L)\big)^2 \tag{5}$$

for $j = MO$ and CD. Since the process Δ_t^L, which is defined in Appendix B and relates to the Δ_t process, is observable we can estimate parameters not involving unobserved components via a set of moment conditions using transactions data from the two markets. We can denote the right hand side of (5) as the variances σ_{CD}^2 and σ_{MO}^2 when normalized by Δ^L. From the left hand side of (5) we note that the two equations share the common component σ_ω^2 which is of interest to us. 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.

[22] For further details see Ghysels, Gouriéroux and Jasiak (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.

3.3 Estimation and Testing

The models discussed in the previous section provide estimates of the (effective) spread or pricing error. We are interested in testing whether the effective spreads have fundamentally changed over the course of the transitions and emergence of the market. In this section we will present the estimators for the parameters of interest and also present the statistics which we will use to test the hypothesis of structural change. We will first focus on hypothesis testing and use the Roll model as a leading example, since it is relatively simple. Next we will elaborate on the estimation and testing of the pricing error models presented in the previous section.

Recall that the spread in the Roll model is denoted S and is obtained from (1). We will estimate S^{MO} via a GMM procedure which exploits this equation. Namely, let us consider the moment conditions:

$$\sum_{t=1}^{T} \left[-\left(\Delta p_t^j \Delta p_{t-1}^j\right) - \left(S^{MO}\right)^2/4 \right]/T = 0 \tag{6}$$

We can estimate (6) over samples *Si* for $i = 1, 2, 3$ and 4 separately. We denote such estimates $\hat{S}_i^{MO}$ for $i = 1, 2, 3$ and 4. Alternatively, we could estimate S^{MO} over the full sample which we will denote $\hat{S}_F^{MO}$. It is important to note that the estimation strategy is slightly different from the results reported in Figures 1 through 3 where estimates were plotted using one month of data. A first test consists of comparing, say $\hat{S}_1^{MO}$ and $\hat{S}_2^{MO}$, 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. Obviously, the use of a fixed breakpoint can easily be criticized. Moreover, the plots of monthly spreads 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 subsample 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:

$$H_o : S_t^{MO} = S^{MO} \qquad \forall t = 1, \ldots, T \tag{7}$$

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.[23] The majority of tests assume as an alternative that at some point in the sample there is a single structural break, like for instance: $S_t^R = S_a^R \quad t = 1, ..., \pi T$ and $S_b^R \quad t = \pi T^j + 1, ..., T$, where π 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.[24] We conduct these tests on the entire sample as well as the sample not including 1996-1997 data, i.e. the *S3* sample.

We can also entertain the same 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 $\sigma_{MO}^2 = \sigma_{CD}^2$ 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.

3.4 Effective spreads

In Table 3.2 we report the estimates of the effective spreads of the Roll model obtained from (6) using transactions data for the twelve stocks we selected.[25] 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 Figure 1. Except for *CMCB* the spreads *increased* from the first $S1$ to the second subsample $S2$. All the estimates are also very imprecise when we examine standard errors.

[23] Relevant references include Andrews (1993), Andrews and Ploberger (1994), Ghysels, Guay and Hall (1996), among others.

[24] 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 subsamples.

[25] We noted that the strong assumptions of the Roll model are not applicable for a search brokerage market. We nevertheless did compute the estimates for the *CD* segment. While the spreads bear little resemblance with their *MO* counterparts they yielded the same type of results for the χ^2 and SupLM tests reported in Table 3.2.

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 was a worsening of trading costs. However, the columns reporting the resulting for the samples $S3$ and $S4$ paint a different picture. It is worth first recalling that these subsamples cover January 1, 1984 until December 31, 1996 *S3* and September 21, 1993 until December 31, 1996 *S4*. It appears from the results for $S3$ and $S4$ that the outrageous spreads are a temporary phenomenon unrelated to the fundamental changes in the market structure. Moreover, despite the reforms which took place one also observes no particular decrease in the spreads either when the sample is cleansed of the turbulent era observations of 1996 and 1997. In particular the point estimates for the spreads are roughly the same for Si for $i = 1, 3$ and 4. We verified this further by computing SupLM statistics for the truncated sample $S3$.

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. This finding is reinforced by the fact that SupLM tests performed on the $S3$ sample, which excludes 1996-1997 data, reveals no breaks for the firms which were privatized prior to 1996.

The final set of stocks are drawn from the important agricultural sector. We know from the results in Table 2.5 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.

The assumptions underlying the Roll model are fairly unrealistic to make for the trading activity on the CSE, certainly before and also after the reforms. However, as far as "misspecification" is a constant factor throughout the two samples we may find these first results giving little

support for the view that trading costs were significantly affected by the reforms of the CSE.

3.5 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 3.3, focusing only the parameters directly related to the pricing errors.[26] 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 tests stability of σ_{MO} while the third corresponds to σ. We examine again the same twelve stocks grouped in three sets along the lines of their industry classification.

The results in Table 3.3 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 3.3) 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 of stability of the spreads, notably regardless whether the firms were privatized or not.

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

[26] 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 $S4$.

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 percent as indicated in Table 2.2.[27] It was noted in section 2.2 that 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 Burdett and O'Hara (1987), Grossman (1992), Seppi (1990) and Kiem and Madhavan (1996).

We start with Table 4.1 where we report the monthly maximum spread between transaction prices recorded on the MO and CD segments of the Casablanca Stock Exchange. It allows us to appraise the relationship between transactions on the trading floor versus the upstairs market. The spreads between MO and CD are measured as $log(p_t^{MO}/p_t^{CD})$ using the last transaction recorded whenever transactions on both segments took place on a given trading day. The spreads are mostly negative and relatively small during *S1*, ranging from 0.009 (which is one of the two positive spreads corresponding to *Centrale Laitière*, the other is *Sofac Crédit*) to -0.020 (for *SNI*) with most of the spreads in the range of -0.003 to -0.006. These spreads became large (and all negative) by historical standards, reaching -0.882 (with large standard errors). When we examine the $S3$ and $S4$ subsamples we recover again the phenomenon of relative stability, i.e. we obtain figures for spreads which are comparable with those obtained from the $S1$ subsample.

One possible interpretation of the figures in Table 4.1 regarding the evolution of spreads is that the trading floor segment of the market went astray with large (Roll) spreads causing large price differences between trading floor prices and upstairs transactions. An alternative interpretation is that both markets became volatile and less synchonous. The latter interpretation is more plausible. To verify this we focus exclusively on CD transactions and measure the price impact of large block trades as reported in Table 4.2. The statistics we report are the same as those

[27] Kiem and Madhavan (1996) note that for the NYSE it is estimated that large block trades represent about 54 percent of trading volume when a large block trade is defined as 10000 shares or more.

in Tables 1 and 2 in Kiem 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 Kiem and Madhaven we do not have information which trades were seller and 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 $logp^{CD}_{trade}/logp^{CD}_{t+1}$ 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 $logp^{CD}_{t-j}/logp^{CD}_{t+1}$ for $j = 1, 6$ and 22. We computed the same sample averages. The results in Table 4.2 are reported for the same selection of twelve stocks. We report the aggregate results only and suppressed those for the individual stocks bacause 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 Kiem 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 respectively 5.73 and 6.01 for $S1$ and $S3$. 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 subsamples. In all cases the inclusion of the 1996 era increases dramatically the price impact statistics. For buyer initiated the mean increases to 9.47 and 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 but the $S2$ subsample. The same pattern emerges for the price impacts at horizons $t-6$ and $t-1$, which are also reported in Table 4.2.

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 in this paper suggests 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. Obviously, we used some yardsticks to assess the quality of the market. These yardsticks were models of effective spreads and pricing errors. One could equally well conclude that none of the models are adequate and appropriate to handle emerging market conditions. However, we also noted that 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. Moreover, our analysis did rely quite extensively on descriptive statistics which allowed us to by-pass some of the criticism one could level against too tightly parameterized models. The main conclusions we can draw 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. Moreover, the increase in spreads is not purely a reflection of increased overall volatility in the market. The price impact of large block trades, if anything, also increased. All these results are driven not by the pre- versus post-reform sample split. They are the result of a period in the history of the Casablanca stock exchange where the market drew a lot of international attention due to the admission of some of its stocks to the IFC data base. If one deletes this episode from the data, a period which was temporary but nevertheless lasted long over a year, one finds very little evidence in real fundamental changes. This finding is very robust and transpires through all the different measures we studied.

These results are clearly 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. Clearly, as far as emerging markets goes, we are still looking for good ex-

planations to characterize the phenomenon. 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. But these improvements came very much after the market emerged.

Table 2.1: Casablanca Stock Exchange: Basic Indicators

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, (4) the total market capitalization (5) the ratio of market capitalization to GNP, (6) a measure of liquidity computed as the ratio of trading volume divided by the market capitalization, (7) the yield expressed as the ratio of share dividends and market equilibrium and (8) the market index on the last day of the year.

Year	Number of Trading Sessions	Average Daily Trading Volume	Total Market Capitalization	Ratio Market Cap/GNP	Liquidity	Yield	Market Index
1989	248	123	5.0	2.6	2.4	9.0	122.65
1990	244	510	7.8	3.5	6.6	12.3	158.68
1991	243	428	12.4	5.0	3.4	11.2	187.55
1992	248	626	17.0	6.6	3.7	9.3	207.88
1993	248	4611	25.7	10.0	17.9	13.4	259.78
1994	251	7235	39.0	13.1	18.6	11.7	342.33
1995	251	20730	50.4	17.5*	41.1	2.7	342.39
1996	247	19510	75.6	23.0*	25.8	4.2	447.13

Table 2.2: Transactions Data of the Casablanca Stock Exchange

Entries to the table are the number of observations, i.e. transactions, for each of the two sample sizes. The subsamples are benchmarked on the microstructure market reforms of September 21, 1993. Sample S1 runs from Jan 1, 1984 until Sept 20, 1993 whereas Sample S2 runs from Sept 21, 1993 until April 30, 1997. The MO market is the floor trading market, while the CD market is the OTC segment of the CSE.

Sample	Trading Floor MO (Marché Officiel)	Upstairs Market CD (Cession Directe)	Total Both Markets
S1 (Jan 1, 1984-Sept 20, 1993)	7433	3481	10914
S2 (Sept 21, 1993-April 30, 1996)	11378	4646	16024

Table 2.3: Capitalization, Number of Shares on the Casablanca Stock Exchange

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.

Dates	84.01	93.09	97.03
Total Number of Stocks	62	63	48
Total Number of Shares	24687047	83303717	179784663
Capitalization	1.4 billion DH	22.4 billion DH	94.2 billion DH

Table 2.4: Trading Frequencies and the Stages of Reforms

Entries to the table are relative frequencies of the 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.

	Trading Floor (MO Market)		Upstairs Market (CD Market)		Both Markets	
	S1	S2	S1	S2	S1	S2
AVG # Trans.	2.93	12.38	1.37	5.06	4.30	17.44
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

Table 2.5: Trading Activity of Individual Stocks

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. Stocks are ranked according to their average daily trading frequency on the MO market during sample S1.

	Trading Floor (MO Market)				Upstairs Market (CD Market)			
	Average Daily Trading Freq.		Average Daily Volume		Average Daily Trading Freq.		Average Daily Volume	
Stock	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

Table 2.5 -- cont'd

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
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-Crédit	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

Table 2.6: Persistence in Trading and Volatility

Using the transactions data of twelve stocks we consider the regressions

$$r_t = \alpha_0 + \alpha_1 r_{t-1} + \varepsilon_t \qquad r_t^2 = \alpha_0 + \alpha_1 r_{t-1}^2 + \varepsilon_t \qquad v_t = \alpha_0 + \alpha_1 v_{t-1} + \varepsilon_t$$

where r_t is the transaction-based return series and v_t is the volume. Only the slope estimates are reported in the table for the two subsamples S1 (Jan 1984-Sept 1993) and S2 (Sept 1993-April 1997). The regressions are estimated via OLS whereas the standard errors are robustified via the Newey and West (1987) procedure.

	r		r^2		v	
Stock	S1	S2	S1	S2	S1	S2
CMCB	-0.4154 (0.1297)	-0.4797 (0.0828)	0.4336 (0.1506)	0.4915 (0.2033)	0.6607 (0.2470)	0.0179 (0.0170)
BMCI	-0.3830 (0.1418)	-0.5856 (0.0588)	0.3856 (0.2077)	0.5647 (0.0611)	0.3434 (0.1661)	0.0280 (0.0225)
BCM	-0.4399 (0.1826)	-0.4882 (0.2609)	-0.5552 (0.0451)	0.5015 (0.0455)	0.2170 (0.1862)	0.0207 (0.0137)
BMCE	-0.2403 (0.0541)	-0.5431 (0.0233)	0.0901 (0.0798)	0.3822 (0.0316)	0.4105 (0.1451)	0.0607 (0.0477)
ONA	-0.3587 (0.0760)	-0.4681 (0.1352)	0.2904 (0.1247)	0.5003 (0.1999)	1.3091 (0.0869)	0.0245 (0.0133)

Table 2.6 -- cont'd

Credit Eqdom	-0.3266 (0.1043)	-0.5194 (0.0723)	0.4185 (0.2058)	0.4930 (0.1634)	0.2906 (0.0865)	0.1258 (0.0928)
Sofac-Maroc	-0.0471 (0.0703)	-0.3579 (0.0810)	-0.0229 (0.0194)	0.2575 (0.1119)	0.4858 (0.2551)	0.2171 (0.1599)
SNI	-0.4436 (0.1881)	-0.3251 (0.2021)	-0.3075 (0.1755)	0.1026 (0.0982)	0.4795 (0.1833)	0.5770 (0.1604)
Brasseries du Maroc	-0.2916 (0.0757)	-0.4934 (0.2377)	0.3212 (0.1810)	0.4969 (0.2446)	0.1459 (0.0913)	0.3326 (0.1674)
Lessieur Afrique	-0.3715 (0.0923)	-0.5036 (0.0926)	0.4046 (0.1873)	0.4685 (0.0944)	0.0389 (0.0329)	0.2164 (0.1452)
Consumar	-0.3601 (0.1250)	-0.3371 (0.1336)	-0.0157 (0.0098)	-0.0106 (0.0076)	0.2211 (0.1266)	0.1331 (0.1453)
Centrale Laitière	-0.2848 (0.1302)	-0.2382 (0.1671)	-0.4506 (0.0913)	0.4201 (0.1498)	0.6157 (0.2100)	0.4745 (0.1758)

Table 3.1: Cross-Correlations Monthly Volatility, Max High/Low, Roll Spreads, MO-CD Spreads and Price/Volume

Entries to the table are cross-correlations between monthly averages computed from transactions data of the trading floor market segment of volatility, maximum high/low spreads, roll spreads, spreads trading floor and upstairs trades (MO-CD spreads) and price/volume ratios. The cross-correlations are computed for twelve major stocks (appearing in left column) over samples S1 (Jan 1984-Sept 1993) and S2 (Sept 1993-April 1997).

		Volatility		Max Hi/Lo		Roll Spreads		MO-CD Spreads		Price/Volume	
		S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
CMCB	Volatility	1.00	1.00	0.80	0.86	0.26	-0.16	-0.58	-0.50	0.45	-0.02
	Max Hi/Lo	0.80	0.86	1.00	1.00	0.33	-0.07	-0.51	-0.37	0.62	0.17
	Roll Spreads	0.26	-0.16	0.33	-0.07	1.00	1.00	-0.13	0.02	0.04	0.09
	MO-CD Spreads	-0.58	-0.50	-0.51	-0.37	-0.13	0.02	1.00	1.00	0.04	0.00
	Price/Volume	0.45	-0.02	0.62	0.17	0.04	0.09	0.04	0.00	1.00	1.00
BMCI	Volatility	1.00	1.00	0.87	0.98	-0.15	0.75	-0.62	-0.73	0.19	0.90
	Max Hi/Lo	0.88	0.98	1.00	1.00	-0.09	0.75	-0.63	-0.72	0.39	0.86
	Roll Spreads	-0.15	0.75	-0.09	0.75	1.00	1.00	0.15	-0.61	-0.10	0.77
	MO-CD Spreads	-0.62	-0.73	-0.63	-0.72	0.15	-0.61	1.00	1.00	-0.21	-0.67
	Price/Volume	0.19	0.90	0.39	0.86	-0.10	0.77	-0.21	-0.67	1.00	1.00
BCM	Volatility	1.00	1.00	0.88	1.00	0.03	0.74	-0.17	-0.87	0.09	0.82
	Max Hi/Lo	0.88	1.00	1.00	1.00	0.26	0.74	-0.45	-0.87	0.37	0.83
	Roll Spreads	0.03	0.74	0.26	0.74	1.00	1.00	-0.23	-0.67	0.46	0.70
	MO-CD Spreads	-0.17	-0.87	-0.45	-0.87	-0.23	-0.67	1.00	1.00	-0.32	-0.57
	Price/Volume	0.09	0.82	0.37	0.83	0.46	0.70	-0.32	-0.57	1.00	1.00

Table3.1 -- cont'd

BMCE	Volatility	1.00	1.00	0.65	0.95	-0.11	0.42	-0.27	-0.78	0.34	0.53
	Max Hi/Lo	0.65	0.95	1.00	1.00	0.05	0.60	-0.44	-0.82	0.42	0.66
	Roll Spreads	-0.11	0.42	0.05	0.60	1.00	1.00	-0.05	-0.56	-0.03	0.67
	MO-CD Spreads	-0.27	-0.78	-0.44	-0.82	-0.05	-0.56	1.00	1.00	-0.16	-0.60
	Price/Volume	0.34	0.53	0.42	0.66	-0.03	0.67	-0.16	-0.60	1.00	1.00
ONA	Volatility	1.00	1.00	0.79	0.95	0.14	0.55	0.48	-0.35	0.18	0.87
	Max Hi/Lo	0.79	0.95	1.00	1.00	0.25	0.44	0.43	-0.48	0.38	0.72
	Roll Spreads	0.14	0.55	0.25	0.44	1.00	1.00	0.07	0.08	0.24	0.62
	MO-CD Spreads	0.48	-0.35	0.43	-0.48	0.07	0.08	1.00	1.00	0.10	0.04
	Price/Volume	0.18	0.87	0.38	0.72	0.24	0.62	0.10	0.04	1.00	1.00
Crédit Eqdom	Volatility	1.00	1.00	0.78	0.93	0.21	0.09	-0.01	-0.95	0.31	0.18
	Max Hi/Lo	0.78	0.93	1.00	1.00	0.34	0.29	-0.03	-0.79	0.52	0.39
	Roll Spreads	0.21	0.09	0.34	0.29	1.00	1.00	-0.08	-0.01	0.18	0.85
	MO-CD Spreads	-0.01	-0.95	-0.03	-0.79	-0.08	-0.01	1.00	1.00	0.04	-0.08
	Price/Volume	0.31	0.18	0.52	0.39	0.18	0.85	0.04	-0.08	1.00	1.00
Sofac Crédit	Volatility	1.00	1.00	0.25	0.81	-0.07	0.51	--	-0.61	0.08	0.19
	Max Hi/Lo	0.25	0.81	1.00	1.00	-0.04	0.38	--	-0.55	0.67	0.50
	Roll Spreads	-0.07	0.51	-0.04	0.38	1.00	1.00	--	-0.35	0.10	-0.21
	MO-CD Spreads	--	-0.61	--	-0.55	--	-0.35	--	1.00	--	0.07
	Price/Volume	0.08	0.19	0.67	0.50	0.10	-0.21	--	0.07	1.00	1.00

Table 3.1 -- cont'd

SNI	Volatility	1.00	1.00	0.84	0.94	0.59	-0.07	-0.85	-1.00	0.10	-0.07
	Max Hi/Lo	0.84	0.94	1.00	1.00	0.67	-0.07	-0.88	-0.91	0.20	0.01
	Roll Spreads	0.59	-0.07	0.67	-0.07	1.00	1.00	-0.67	0.09	0.55	-0.40
	MO-CD Spreads	-0.85	-1.00	-0.88	-0.91	-0.68	0.09	1.00	1.00	-0.11	0.08
	Price/Volume	0.10	-0.07	0.20	0.01	0.55	-0.40	-0.11	0.08	1.00	1.00
Brasseries du Maroc	Volatility	1.00	1.00	0.68	0.99	0.15	0.61	-0.61	0.01	0.09	1.00
	Max Hi/Lo	0.68	0.99	1.00	1.00	0.21	0.67	-0.50	-0.06	0.27	0.99
	Roll Spreads	0.15	0.61	0.21	0.67	1.00	1.00	-0.20	-0.31	0.24	0.63
	MO-CD Spreads	-0.61	0.01	-0.50	-0.06	-0.20	-0.31	1.00	1.00	-0.08	-0.00
	Price/Volume	0.09	1.00	0.27	0.99	0.24	0.63	-0.08	-0.00	1.00	1.00
Lessieur Afrique	Volatility	1.00	1.00	0.83	0.93	-0.09	0.76	-0.28	-0.49	0.46	0.64
	Max Hi/Lo	0.83	0.93	1.00	1.00	-0.00	0.70	-0.28	0.53	0.60	0.66
	Roll Spreads	-0.09	0.76	-0.00	0.70	1.00	1.00	0.08	-0.34	0.00	0.45
	MO-CD Spreads	-0.28	-0.49	-0.28	-0.53	0.08	-0.34	1.00	1.00	-0.39	-0.39
	Price/Volume	0.46	0.64	0.60	0.66	0.00	0.45	-0.40	-0.39	1.00	1.00
Cosumar	Volatility	1.00	1.00	0.78	1.00	0.20	0.09	0.08	-1.00	0.12	-0.00
	Max Hi/Lo	0.78	1.00	1.00	1.00	0.21	-0.08	0.28	-1.00	0.35	0.05
	Roll Spreads	0.20	-0.09	0.21	-0.08	1.00	1.00	0.19	0.09	-0.08	0.45
	MO-CD Spreads	0.08	-1.00	0.28	-1.00	0.19	0.09	1.00	1.00	-0.34	0.01
	Price/Volume	0.12	-0.00	0.35	0.05	-0.08	0.45	-0.34	0.01	1.00	1.00

Table 3.1 -- cont'd

Centrale Laitière	Volatility	1.00	1.00	0.62	0.84	0.05	0.08	0.60	0.34	0.41	0.39
	Max Hi/Lo	0.62	0.84	1.00	1.00	0.16	0.11	0.90	0.18	0.74	0.61
	Roll Spreads	0.05	0.08	0.16	0.11	1.00	1.00	0.10	-0.16	0.13	0.03
	MO-CD Spreads	0.60	0.34	0.90	0.18	0.10	-0.16	1.00	1.00	0.60	-0.11
	Price/Volume	0.41	0.39	0.74	0.61	0.13	0.03	0.60	-0.11	1.00	1.00

Table 3.2: Effective Spreads Roll Model

Entries to the table are estimates of effective spread based on the Roll (1984) model. The column Si,M^O reports the point estimates of the effective spreads on the MO market, while St. Er. is its standard error. S_i^{MO} is estimated over the full sample i=F (Jan 1, 1984-March 31, 1997) and subsamples S_i for i=1,...,4 where S1 (Jan 1, 1984-Sept 20, 1993), S2 (Sept 21, 1993-March 31, 1997), S3 (Jan 1, 1984-Dec 31,1995) and S4 (Sept 21, 1993-Dec 31, 1995). The column S1/S2 reports a $\chi^2(1)$ statistic which 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%, ** at 5% and *** at 1%.

Stocks	Sample S1		Sample S2		S1/S2	Sample S3		Sample S4		Entire Sample		
	S_1^{MO}	St. Er.	S_2^{MO}	St. Er.	$\chi^2(1)$	S_3^{MO}	St. Er.	S_4^{MO}	St. Er.	S_F^{MO}	St. Er.	Sup LM
CMCB	3.70	2.72	4.10	2.92	1.09	4.17	2.69	6.17	1.33	3.81	2.77	0.76
BMCI	2.56	0.63	26.88	36.90	7.02***	2.86	1.13	4.19	1.75	9.09	21.84	13.98***
BCM	2.74	4.60	40.14	62.80	9.27***	3.73	4.69	8.03	1.70	12.79	36.52	17.28***
BMCE	3.11	0.79	35.47	48.28	42.82***	3.22	0.76	3.69	3.80	11.81	28.70	51.56***
ONA	7.09	3.07	11.69	7.17	2.04	7.24	2.89	7.88	1.87	8.33	4.96	22.64***
Crédit Eqdom	5.57	3.65	8.69	1.05	11.81***	5.92	3.38	7.48	0.67	6.41	6.40	7.81*
Sofac Crédit	5.47	2.54	3.89	1.46	0.18	5.27	2.39	4.45	1.37	5.05	2.40	0.10
SNI	1.17	1.83	10.04	4.76	13.08***	3.23	4.98	12.13	4.48	3.56	4.90	11.22***

Table 3.2 -- cont'd

Bras. du Maroc	3.76	1.60	7.88	11.67	0.92	4.00	1.53	5.08	0.09	4.87	6.42	1.32
Lessieur Afrique	7.93	1.94	39.90	47.82	6.15**	7.61	1.87	6.27	0.23	16.52	28.44	20.38***
Cosumar	2.79	2.00	9.54	9.25	0.94	3.04	2.88	4.14	5.14	4.60	5.88	0.06
Centrale Laitière	1.26	6.04	5.36	2.66	0.76	2.37	2.43	7.20	1.10	2.36	2.40	0.18

Table 3.3: Measures of Market Quality for the Casablanca Stock Exchange

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 (Jan 1, 84-Sept 20, 1993), S2 (Sept 21, 1993-March 31, 1997). * Significant at 10%, ** at 5% and *** at 1%.

Stocks	σ_{CD}		σ_{MO}		σ		Sup LM	Sup LM	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	0.032	0.441	0.022	0.696	0.022	0.606	18.56***	13.01***	17.32***
Eqdom	(0.010)	(0.194)	(0.003)	(0.066)	(0.003)	(0.073)			
Sofac	0.023	0.014	0.026	0.008	0.024	0.010	27.11***	13.25***	96.02***
Credit	(0.006)	(0.002)	(0.010)	(0.010)	(0.005)	(0.001)			

Table 3.3 -- cont'd

SNI	0.041	0.211	0.058	0.183	0.049	0.199	19.19***	24.25***	83.01***
	(0.028)	(0.078)	(0.013)	(0.068)	(0.051)	(0.083)			
Bras. du Maroc	0.048	0.122	0.029	0.113	0.032	0.017	11.12**	9.36**	12.78***
	(0.011)	(0.048)	(0.004)	(0.058)	(0.005)	(0.062)			
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)			

Table 4.1: Spreads Between MO and CD Transaction Prices

Entries to the tables are averages of maximum monthly spreads $\ell n(p_t^{MO} / p_t^{CD})$ using the last transaction of the day recorded whenever transactions in a stock occurred on both segments of the market. The averages (and their standard error reported between parentheses) are computed for samples S1 (Jan 1, 1984-Sept 20, 1993), S2 (Sept 21, 1993-March 31, 1997), S3 (Jan 1, 1984-Dec 31, 1995) and S4 (Sept 21, 1993-Dec 31, 1995).

	S1	S2	S3	S4
CMCB	-0.003	-0.017	-0.003	-0.005
	(0.045)	(0.115)	(0.053)	(0.078)
BMCI	-0.006	-0.470	-0.007	-0.013
	(0.042)	(1.274)	(0.080)	(0.165)
BCM	-0.006	-0.581	-0.077	-0.383
	(0.031)	(3.104)	(0.791)	(1.822)
BMCE	-0.006	-0.376	-0.004	0.005
	(0.038)	(1.756)	(0.052)	(0.092)
ONA	0.004	-0.066	-0.019	-0.012
	(0.058)	(0.356)	(0.196)	(0.429)
Crédit Eqdom	-0.001	-0.882	-0.599	-0.191
	(0.028)	(3.261)	(7.224)	(6.688)
Sofac Crédit	0.002	-0.013	-0.003	-0.016
	(0.041)	(0.037)	(0.019)	(0.042)
SNI	-0.020	-0.752	-0.470	-0.421
	(0.221)	(8.864)	(4.860)	(6.172)
Brasseries du Maroc	-0.007	-0.021	-0.010	-0.020
	(0.125)	(0.055)	(0.114)	(0.047)
Lessieur Afrique	-0.003	-0.276	-0.001	0.014
	(0.072)	(1.046)	(0.073)	(0.075)
Cosumar	-0.001	-0.527	-0.971	-0.804
	(0.055)	(3.347)	(6.583)	(4.290)
Centrale Laitière	0.009	-0.001	0.007	-0.001
	(0.047)	(0.045)	(0.049)	(0.056)

Table 4.2: Price Impact of Large Block Trades on Casablanca Stock Exchange

Entries are summary information on upstairs-negotiated block trades (CD segment of the market). 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 $\ln (p^{CD}_{t+j} / p^{CD}_{t-1})$ where p^{CD}_{t+j} and p^{CD}_{t-j} are closing prices. All entries are sample averages. The samples are S1 (Jan 1, 84-Sept 20, 1993), S2 (Sept 21, 1993-March 31, 1997).

	Temporary Impact	Permanent Impact Measured over the Period		
		t-22 to t+1	t-6 to t+1	t-1 to t+1
		Buyer Initiated		
S1	0.39	5.73	4.71	3.39
	(1.21)	(0.33)	(1.61)	(2.63)
S2	1.11	9.47	6.38	4.35
	(0.82)	(1.48)	(1.88)	(1.67)
S3	0.63	6.01	4.13	3.00
	(2.01)	(1.55)	(1.73)	(1.17)
S4	0.91	8.11	5.13	3.77
	(1.44)	(2.23)	(1.81)	(1.61)
		Seller Initiated		
S1	-2.01	-4.85	-3.86	-3.30
	(0.24)	(0.81)	(0.73)	(0.69)
S2	-6.14	-9.10	-7.61	-4.18
	(3.07)	(2.11)	(1.91)	(1.07)
S3	-3.48	-5.99	-4.33	-3.81
	(0.34)	(1.73)	(1.47)	(1.23)
S4	-4.49	-6.91	-5.01	-4.25
	(2.02)	(1.11)	(1.55)	(1.61)

APPENDIX A : THE ADJUSTMENT PROGRAMS - A BRIEF REVIEW

Roughly a decade ago, namely in 1989, Morocco embarked on a set of reforms which started with ambitious privatization and economic liberalization programs. The main scope of the adjustment program was to make Morocco's economy more competitive. This could not be accomplished without the overhaul of the financial sector and a privatization program targeting the many publicly owned firms. The structural adjustments undertaken since the mid-1980's took the form of various economic policy measures which significantly increased the openness of the economy. 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.[28]

The reforms of the financial sector have tended towards the liberalization of interest rates, a decrease in the government access to credit, the use of direct instruments in the conduct of monetary policy an improvement of the supervisory and regulatory framework of the banking sector and an important reform of the securities market.[29] Morocco's monetary policy was based up to 1990 on a credit rationing mechanism limiting the increase in bank loans. After 1990 cash reserves were used extensively to control the money supply and the rate of reserve requirements. To adapt the banking sector to the new, more open, economic environment, a new law was voted in July 1993. This new law unified the legal framework for financial and banking institutions and authorizes foreign banks to have subsidiaries in Morocco. Another significant element in the financial sector reforms was the liberalization of interest rates which started in 1990. Both the lending and the borrowing rates were liberalized progressively.[30]

The privatization program had many objectives which included easing the strain the state enterprises were putting on the state budget and

[28] A useful reference on Morocco's economic reform program is the 1995 report of the World Bank.

[29] Morocco's financial sector is composed of 15 commercial banks, 3 foreign offshore commercial banks, the central bank (Bank Al Maghrib), 23 insurance companies, a national savings bank, some pension funds, a specialized financial institution (Caisse de dépôt et de gestion) and the CSE.

[30] The deposit rates were first liberalized in 1985 for deposits of more than a year, in 1989 for deposits of more than six months and in 1990 for 3 month deposits and in 1992 on all time deposits. The lending rates liberalization started in 1990 and the rate of reserve requirements was increased to 25 percent (its maximum rate) in 1992 due to the important growth in credit resulting from the lifting of the mandatory use of funds.

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 and promulgated in April 1990. It authorized the transfer from the public to the private sector of 75 companies and 37 hotels. It was amended on January 1995 to include 2 more entities and to move the transfer deadline to December 1998. The methods used in the transfer process are direct negotiation, tenders and Initial Public Offerings through the CSE or a combination of the 3 methods. After some delays the privatization really took off in 1993.[31] A total of 22 companies and 17 hotels have been transferred to the private sector between 1993 and 1996 generating 8.9 billion Moroccan *Dirhams* (DH) of which 32.5 percent resulted from public offerings on the CSE.[32]. In January 1996 the government issued convertible privatization bonds. The terms of these bonds are that holders have priority in buying firms to be privatized and receive an annual interest rate of 8 percent at conversion into equity or 8.5 percent if held to maturity. 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 IPO's were oversubscribed by the general public. During the five years following the stock market reform Moroccan nationals also had a 50 percent tax break on equity returns.

As explained in Section 2, a stock market reform program was undertaken in the summer of 1993 almost simultaneously with the onset of an ambitious privatization program. On September 21 1993 three laws (so called *Dahir*) came into effect regarding: the Casablanca stock exchange, the securities commission (*Conseil Déontologique des Valeurs Mobilières*) 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 details of the stock market reform program are described in section 2. It is worth noting that the daily price fluctuations on the CSE are limited to plus or minus 3 percent. Companies listed on the CSE are required to report financial statements twice a year. This reporting requirement was introduced by the summer 1993 law and includes the publication of sale revenues and a balance sheet. The withholding tax on dividends is 10 percent for both foreigners and locals and there are

[31] A useful reference on the privatization program is the document produced by the Ministry of Privatization and the State Entreprise (1996). In addition, the Ministry maintains a website with information regarding the privatization program: *http* : *//www.minpriv.gov.ma/index.html*.

[32] As noted before, one US dollar is roughly 9 DH.

no foreign investor restrictions.

The stock market reform program can be called a success. The *Bourse de Casablanca* was included in the *International Finance Corporation* 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 percent to the Morocco index in the computation of the global emerging market index. This weight exceeds that of Egypt (0.1 percent) and some of the previously incorporated emerging markets such as Jordan (0.2 percent). 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.

Table A.1: Companies Listed on the Casablanca Stock Exchange and Number of Shares

A complete list of the stocks traded on the Casablanca Stock Exchange is provided in this table. It describes all stocks appearing in our sample, including delisted stocks as well as stocks introduced to the market. The stocks are ranked by industry. The first two columns are the ticker symbol and company name. The next three list the number of shares at three pivotal dates: January 1984 (beginning of data sample), September 1993 (introduction of market reforms) and March 1997 (end of sample). The last three columns list the stock prices for the same pivotal dates.

		Number of Shares			Stock Price		
Ticker	Company Name	84.01	93.09	97.03	84.01	93.09	97.03
		Banking Sector					
1. BCM	Banque Commerciale du Maroc	9177812	11155053	13250000	300	380	731
2. BCM "B"	Banque Commerciale du Maroc	697752	--	--	87	--	--
3. BCM "V"	Banque Commerciale du Maroc	760848	--	--	90	--	--
4. BMCI	Banque Marocaine pour le Commerce et l'Industrie	550000	1054952	6187500	124	240	485
5. BMCE	Banque Marocaine du Commerce Extérieur	269096	2871850	14431945	125	230	610
6. Uniban	Union Bancaria Hispano Marroqui	176000	2464000	2464000	12	207.21	144
7. CDM	Crédit du Maroc	517000	8338176	8338176	126	325	425
8. CMCB	Caisse Marocaine du Crédit et de Banque	647500	5481500	--	124	156	700

Table A.1 -- cont'd

9. Wafabank	Wafabank	--	--	5481500	--	--	750
		Other Financial Institutions					
10. BNDE	Banque Nationale pour le Développement Économique	465988	1118371	12000000	31	80	209
11. CIH	Crédit Immobilier et Hôtelier	128000	6280000	10205000	125	160	265
12. Diac-Maroc	Diffusion Industrielle Automobile Agricole Chérifienne	220000	400400	480480	132	170	560
13. Sofac-Maroc	Société de Financement d'Achat à Crédit	200000	750000	750000	110	350	525
14. ACRED	Société pour le Développement des Achats par le Crédit	125000	400000	600000	135	250	434
15. CREDOR	CREDOR	--	--	1200000	--	--	645
16. Crédit-Eqdom	Société d'Équipement Domestique et Ménager	232500	1111000	1670250	136	230	925
17. SNI	Société Nationale d'Investissement	--	--	9900000	103	162	433
18. SNI "V"	Société Nationale d'Investissement	1194000	2189000	--	110	705	--
19. SNI "B"	Société Nationale d'Investissement	306000	561000	--	103	560	--
20. Épargne Croissance	Épargne Croissance	99640	99640	99640	93	110	--
21. Maroc-Investissment	Maroc-Investissement	75000	--	--	100	--	--

Table A.1 -- cont'd

22. CMDE	Consortium Marocain de Développement Économique	100000	100000	--			
23. Maroc Leasing	Maroc Leasing	--	--	1063300	--	--	264
24. Sinvest	Société d'Investissement	100000	100000	--			
25. ONA	Omnium Nord Africain	760000	9542082	17200000	80	370	715
26. ONA "M"	Omnium Nord Africain	150000	--	--	100	--	--
27. Compagnie Marocaine	Compagnie Marocaine	224000	224000	--	550	70	--
28. OMI	Omnium Marocain d'Investissement	--	88000	--	--	130	--
29. Zellidja	Zellidja S.A.	572832	572832	572849	400	73.87	360
30. Financière Diwan	Financière Diwan	--	7001568	8237138	--	220	262
31. HSM	Société de Holding Marocaine	2052	55200	--	52.93	46	--
32. Finlac	Financière Lesieur Afrique	100000	--	--	140	--	--
33. Rebab	Rebab Company	--	64166	64166	--	56	190
34. CGE Maroc	CGE Maroc	186960	1121760	--	160	309	--
35. Somafic	Société Marocaine de Financement de Crédit	--	400000	1000000	--	150	395
36. Diac-Equipement	Diac Équipement	--	108000	129600	--	160	381

Table A.1 -- cont'd

		Energy					
38. Chérifienne des pétroles	Société Chérifienne des Pétroles	705840	1753390	1754350	19.80	130	377
39. CMM -O-	Caisse Marocaine des Marchés	--	5000	--	--	77	--
40. CMM -M-	Caisse Marocaine des Marchés	--	5000	--	--	77	--
41. Samir	Samir	--	--	20641500	--	--	275
		Industrial (Agro)					
42. Oulmes	Compagnie Fermière des Source Minérales	90000	150000	150000	80	210	410
43. Lessieur-Afrique	Lesieur Afrique Casablance	196000	2302626	2763151	175	490	1812
44. Unigral-Cristal	Unigral Cristal	280000	--	--	125	--	--
45. SEPO	Société d'exploitation ds Produits Oléagineux	330000	--	--	90	--	--
47. LGM -o- "V"	Les Grandes Marques de la Conserve	40331	40331	--	102	190	--
48. LGM -m- "B"	Les Grandes Marques de la Conserve	40331	40331	--	105	156	--
49. Brasseries du Maroc	Les Brasseries du Maroc	368500	3826250	2826250	155	380	1809

Table A.1 -- cont'd

50. Branoma	Les Brasseries du Nord Marocain	100000	100000	500000	145	570	1184
51. Centrale Laitière	Centrale Laitière Maroc	231000	745689	838900	118	315	2626
52. Somadir	Société Marocaine de Distillation et de Rédification	220000	330000	--	75	310	--
53. Cosumar	Compagnie Sucrière Marcoaine de Rafinage	--	1200000	4191057	--	460	860
54. Sofacal	Société Marocaine de Fabrication et de Commercialisation de Conserves Alimentaires	--	48884	--	--	580	--
	Industrial (Textiles)						
55. Chérifienne Textiles	Chérifinne des Textiles	115200	115200	--	50	125	--
56. Cofitex	Compagnie Marocaine de Filature et de Textile	100000	--	--	110	--	--
57. Orbonor	Société Orbonor	160000	160000	160000	125	125	125
	Industrial (Chemicals)						
58. Chimicolor	Chimicolor	69375	69375	--	75	75	--
59. Chérifienne d'engrais	Société Chérifienne d'Engrais	344000	616448	616448	79	129	71
60. Fertimat	Fertima	--	--	2300000	--	--	244

Table A.1 -- cont'd

61. CPCM	Compagnie de Produits Chimiques du Maroc	15000	30000	--	142.42	350	--
62. Cadem	Ciments Artificiels de Meknès	207000	1304100	--	145	405	--
63. Ciments d'Agadir	Ciments d'Agadir	172500	2519888	5129772	165	580	570
64. SNCE	Société Nouvelle des Conduites d'Eau	560000	--	--	130	--	--
65. DOMEC	Compagnie Générale de Chauffage et de Plomberie	30000	--	--	84	--	--
66. SMCM	Société Marocaine de Construction Métalurgique	337500	--	--	140	--	--
67. Asmar	Société de Ciment de Marrakech	--	161700	2371600	--	387.20	720
68. CIOR	Société de Ciment Oriental	--	--	4210000	--	--	505
69. Lafarge Ciments	Société de Ciment Lafarge	--	--	4764305	--	--	1300
		Industrial (Other)					
70. Le Carton	Société Le Carton	53333	53333	76190	75	185	150
71. Carnaud	Société Carnaud Maroc	403920	1445850	1445850	114.86	300	580
72. Cema	Contreplaqués et Emballages du Maroc	151875	151875	--	250	600	--
73. Gaillard	Société Gaillard-Maroc	--	170000	--	99	--	--

Table A.1 -- cont'd

74. General Tire	General Tire and Rubber Company of Morocco	--	--	1260000	--	--	300
75. Sifiche	Société Immobilière Financière Chérifienne	--	15000	--	--	75	--
		Services					
76. Balima	Balima	43600	43600	43600	--	--	390
77. SMM	Société Marocaine Métallurgique	272527	368713	--	75	250	--
78. Sonasid	Sonasid	--	--	3900000	--	--	433
79. Comameto "V"	Compagnie Marocaine de Métaux et d'Entreprise	57861	216000	--	123.92	990	--
80. Comameto "B"	Compagnie Marocaine de Métaux et d'Entreprise	58014	--	--		--	--
81. Longometal	Longométal Afrique	315360	315360	946080	87	120	150
82. Maysonnier	Maysonnier	40000	40000	--	115	250	--
83. Auto-Hall	Auto-Hall	--	230000	460000	--	750	1545
84. Auto-Hall "M"	Auto-Hall	130000	--	--	85	--	--
85. Auto-Hall "O"	Auto-Hall	100000	--	--	83	--	--
86. Berliet-Maroc	Société Marocaine des Automobiles Berliet	285000	625000	625000	78	100	165

Table A.1 -- cont'd

87. Technical-Equipement	Technical Equipement	25000	25000	--	50	50	--
88. Damestoy	Damestoy	--	50000	--	--	50	--
89. CTM-LM	Compagnie de Transport au Maroc - Lignes Nationales	--	377224	1225978	--	300	314
	Total Number of Stocks	62		63		48	
	Total Number of Shares	24687047		8330317		178663000	
	Capitalization	1.4 billion DH		22.4 billion DH		94.2 billion DH	
	Daily Mean Number of Shares Traded	--		40785		211611	

Table A.2: Privatized Firms Sold Through the Casablanca Stock Exchange 1993-1997

TRANSFERS COMPLETED BY 15 JANUARY 1997						
FIRM	ACTIVITY	SOLD (%)	DATE	METHOD	BUYER	PRICE PAID (Million DH)
BMCE	Commercial bank	14.01	12/94	Stock Exchange underwriting	Moroccans	455.3
		26.00	04/95	Tender	Moroccan & int'l. financial inst.	1,243.4
		3.00	12/94	Workers' payment for 1995 transfer	Moroccans	82.9
CIOR	Cement	51.00	08/93	Tender followed by direct negotiation	Swiss, Holdercim, subsidiary of Holderbank	614.0
		34.00	12/93	Stock Exchange	99.1% Moroccan	329.2
		1.22	01/95	Workers	Moroccans	10.0
Crédit-Eqdom	Finance-Consumer credit	18.00	06/95	Stock Exchange	Moroccans	72.0
		1.54	11/95	Workers	Moroccans	5.2

Table A.2 -- cont'd

TRANSFERS COMPLETED BY 15 JANUARY 1997						
FIRM	ACTIVITY	SOLD (%)	DATE	METHOD	BUYER	PRICE PAID (Million DH)
CTM-LN	Inter-urban bus company	35.00	07/93	Tender	Moroccan, consortium of financial institutions	111.6
		40.00	06/93	Stock Exchange	99.5% Moroccan	94.3
		2.60	12/94	Workers	Moroccans	5.2
		18.46	09/94	Stock Exchange	Moroccans	48.7
FERTIMA	Fertilizers	35.00	10/96	Stock Exchange	98.8% Moroccan	102.1
SAMIR	Oil refinery	30.00	03/96	Stock Exchange	99.7% Moroccans	1504.8
		1.11	06/96	Workers	Moroccans	47.3
SNI	Financial Holding	15.63	10/94	Stock Exchange	Moroccans	361.1
		51.00	11/94	Tender	Moroccan & int'l. financial inst.	1669.0
SOFAC/ Crédit	Consumer credit	35.00	04/94	Tender followed by direct negotiation	Moroccan, consortium of financial institutions	89.3
		18.37	04/94	Stock Exchange	Moroccans	40.0
		0.81	08/95	Workers	Moroccans	1.5
SONASID	Steel laminator	35.00	06/96	Stock Exchange	98.3% Moroccan	420.4

APPENDIX B : TECHNICAL DETAILS OF EXTENDED HASBROUCK MODEL

In this appendix we provide the technical details of the model discussed in Section 3.2. Let us begin with reconsidering equations (2) and (3):

$$p_\tau = m_\tau + s_\tau, \tag{8}$$

$$m_\tau = m_{\tau-1} + \omega_\tau, \tag{9}$$

where m_τ is the efficient price and 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 $-s_\tau$. As noted in the main body of the paper, 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, yielding equation (4):

$$m_t = \mu\Delta_t + m_{t-1} + (\Delta_t)^{1/2}\omega_t, \tag{10}$$

where Δ_t represents the duration in calendar time between two consecutive trades. As a matter of convention we set Δ_t equal to one plus the number of trading days between two consecutive trades. So far we assumed that trades took place on different days. For the cases where more than one trade occurs for the same stock on a given day we set Δ_t equal to one. 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 one for intra-daily returns. Using (2) and (4) we can write the returns (in calendar time) as:

$$\Delta p_t = \mu\Delta_t + (\Delta_t)^{1/2}\omega_t + (\Delta_t)^{1/2}(s_t - s_{t-1}) \tag{11}$$

where the normalization with respect to Δ_t is also applied to s_τ to obtain the calendar time representation. 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 and Watson decompositions. For instance in the Roll (1984) bid-ask model discussed before 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 data recorded 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 micro- and transaction cost structures. 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:

$$E\big((p_t^{MO} - p_{t-1}^{MO}) - \mu\Delta_t\big)^2 = E\big((\Delta_t)^{1/2}(\omega_t + s_t^{MO} - s_{t-1}^{MO})\big)^2 \qquad (12)$$

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

$$E\big((p_t^{CD} - p_{t-1}^{CD}) - \mu\Delta_t\big)^2 = E\big((\Delta_t)^{1/2}(\omega_t + s_t^{CD} - s_{t-1}^{CD})\big)^2. \qquad (13)$$

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 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 $p_t^{MO} - p_{t-1}^L$ where the index L indicates that the price is taken from the last transaction.[33] The same approach was also taken for the CD market. The model can then be written as equation (5) appearing in the main body of the paper:

$$E\big((p_t^j - p_{t-1}^L) - \mu\Delta_t^L\big)^2 = E\big((\Delta_t^L)^{1/2}(\omega_t + s_t^j - s_{t-1}^L)\big)^2 \qquad (14)$$

for $j = MO$ 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.

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

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

$$\sum_{t=1}^{T} \left[\left(p_t^j - p_{t-1}^L \right) - \left(\Delta_t^L \right) \mu \right] / T = 0 \tag{15}$$

for $j = MO$ and CD. These two moment conditions (over)identify the drift μ. 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 (14) as the variances σ_j where $j = CD$ and MO when normalized by Δ^L. We want to obtain these estimates via a GMM setup to guarantee that the estimators of σ_j are heteroskedastic and autocorrelation consistent estimators as described by for instance Andrews (1991) and Andrews and Monahan (1992). In order to obtain these estimators, we formulate the following moment conditions (including those for the Δ_t process):

$$\left[\sum_{t=1}^{T} \left(\left(p_t^j - p_{t-1}^L \right) - \left(\Delta_t^L \right) \mu \right)^2 - \left(\Delta_t^L \right) \sigma_j^2 \right) / T \Big] = 0 \tag{16}$$

$$\left[\sum_{t=1}^{T} \Delta_t^L / T \right] - \mu_\Delta = 0 \tag{17}$$

$$\left[\sum_{t=1}^{T} \left(\Delta_t^L - \mu_\Delta \right)^2 \right] / T - \sigma_\Delta^2 = 0 \tag{18}$$

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

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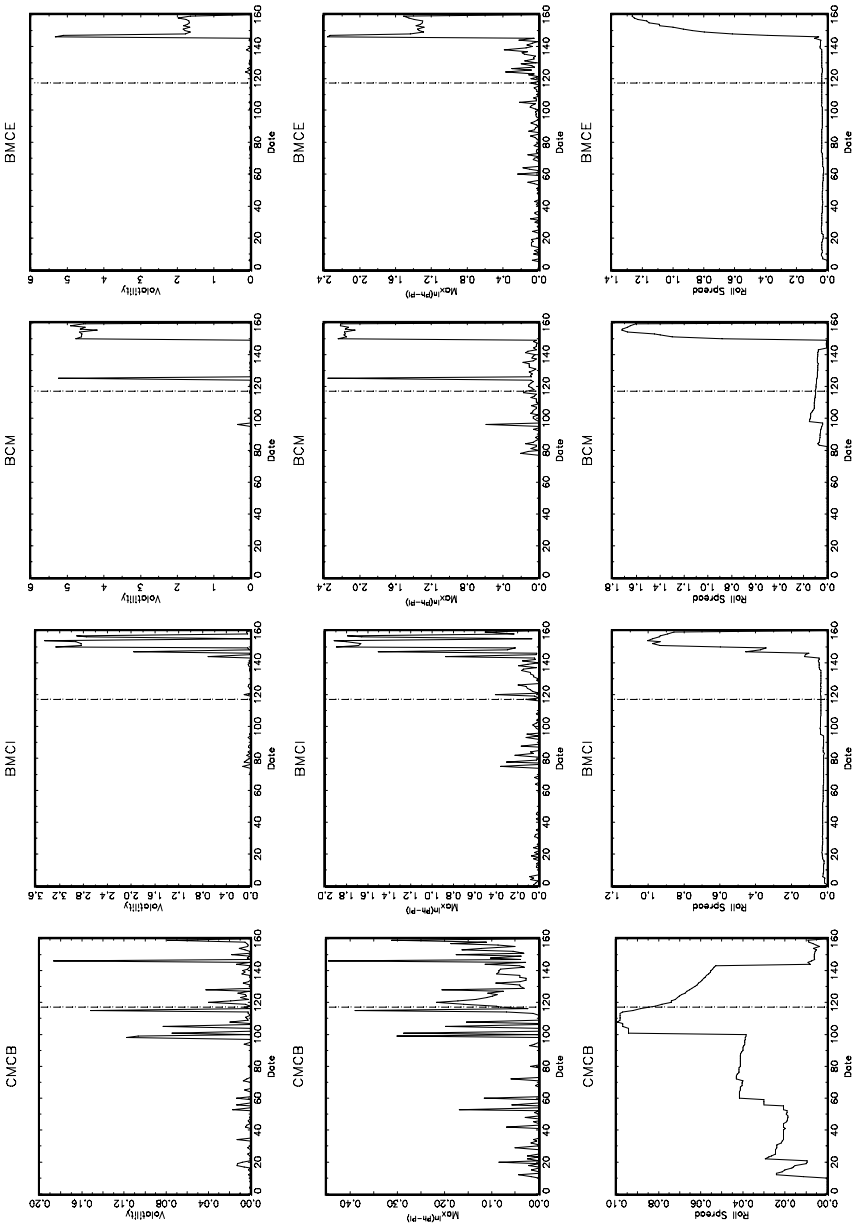

Figure 1: *Monthly Estimates of Volatility, High-Low Spreads and Roll Spreads for CMCB, BMCI, BCM and BMCE*

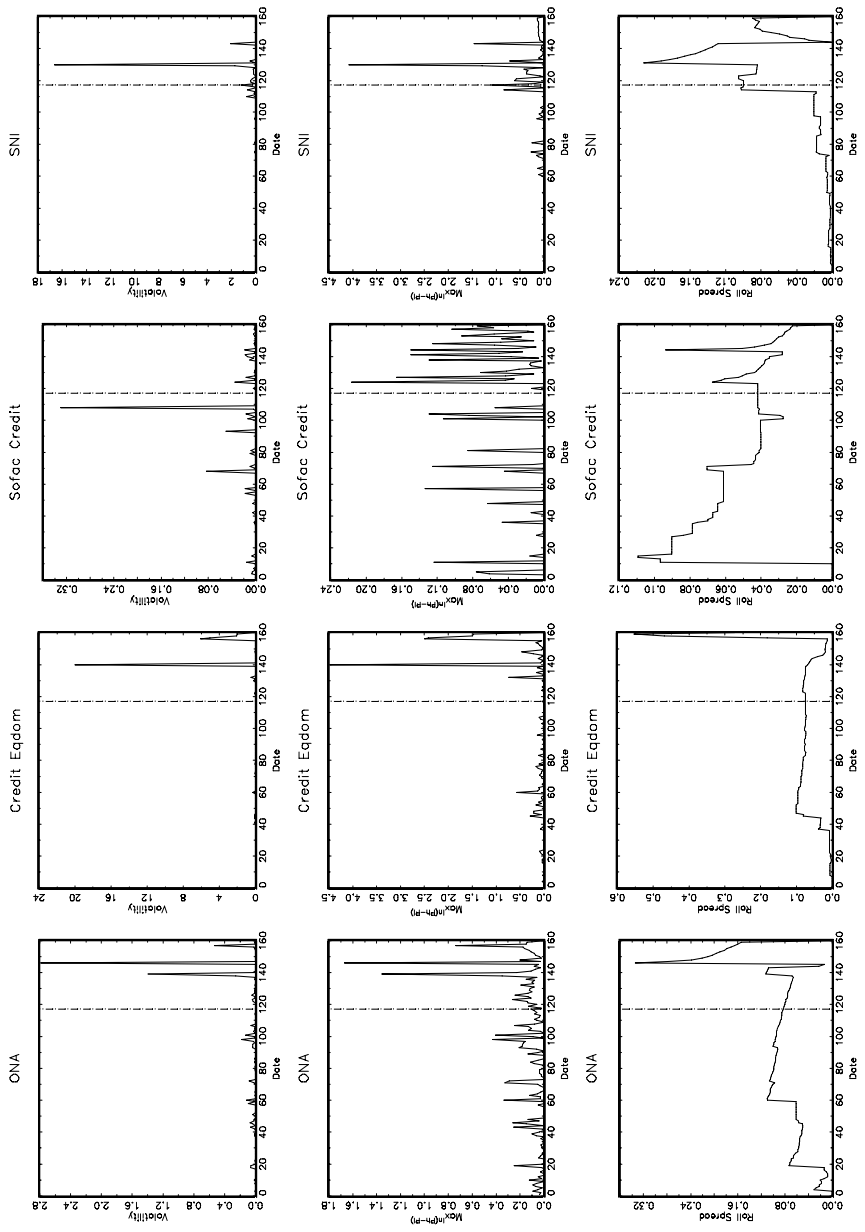

Figure 2: *Monthly Estimates of Volatility, High-Low Spreads and Roll Spreads for ONA, Credit Eqdom, Sofac Credit and SNI*

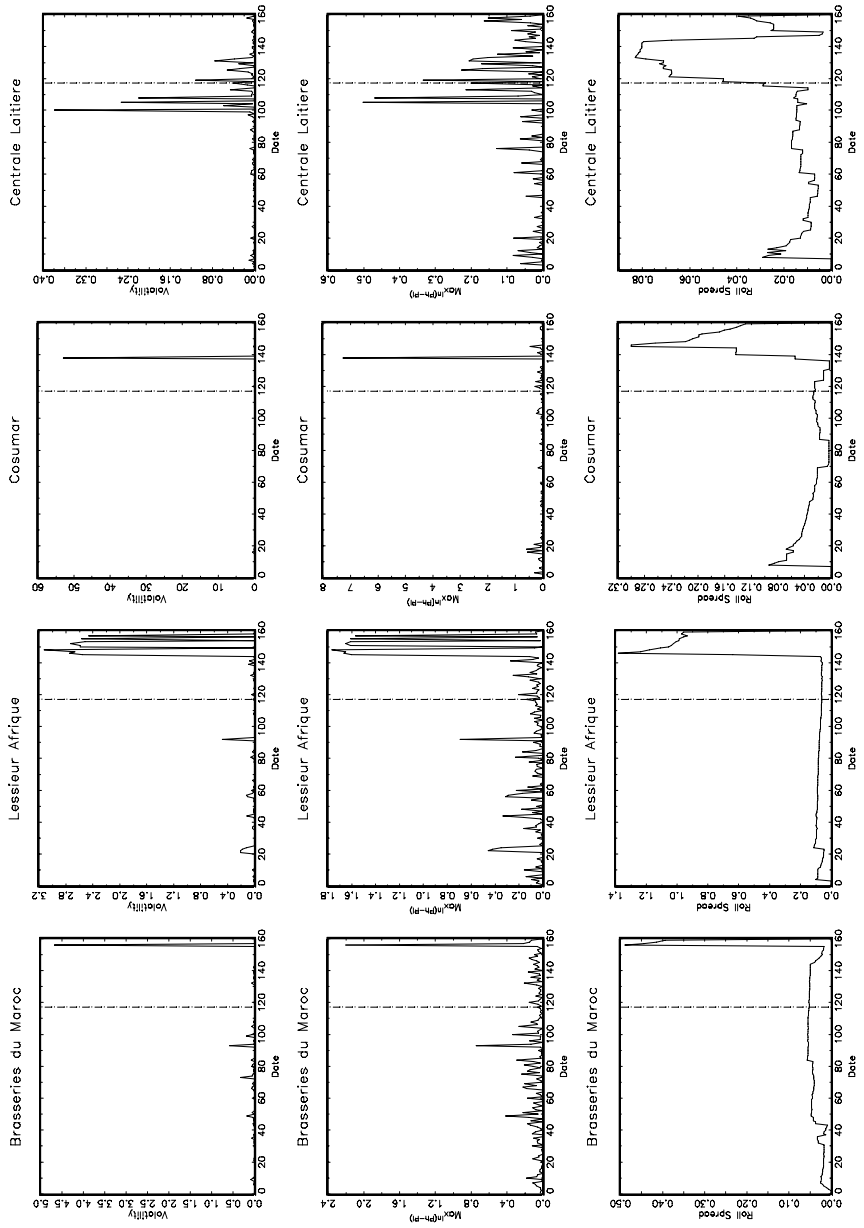

Figure 3: *Monthly Estimates of Volatility, High-Low Spreads and Roll Spreads for Brass. du Maroc, Lessieur Afrique, Cosumar and Centrale Laitiere*

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