

1 Measures, Determinants and Commonality in Liquidity: 2 Empirical Tests on Tunisian Stock Market

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5

6 **Abstract**

7 This paper examine empirically variables that can be significantly correlated with
8 inter-temporal changes of measures of the individual?s securities, for example: trading
9 volumes, number of transactions, return, volatility, arrival of new information etc. Before a
10 study of a sample of 40 quoted securities in Tunisian financial market, on the period of
11 February 07, 2011 until January 31, 2013, results appear conclusive. First, as expected, depth
12 has negative correlation with all spread measures. Besides, we observe perfect positive
13 correlations between spread measures. This shows the validity of these liquidity measures on
14 the Tunisian stock market. Furthermore, the results suggest that volume, return and arrival of
15 new information contribute to explain significantly the inter-temporal changes of various
16 measures of the securities liquidity. Finally, we can consider, probably, the arrival of new
17 information as a common factor for the different liquidity measures for all stocks in our sample.

18

19 **Index terms**— microstructure, price formation, inventory costs theory, asymmetric information costs theory,
20 commonality in liquidity.

21 **1 Introduction and background**

22 traditionally, asset pricing models (option pricing model ??MEO], capital asset pricing model ??CAPM] and
23 arbitrage pricing theory model ??APT]) are formulated under the hypothesis of a "perfect" market without
24 frictions (transaction costs, asymmetry information costs etc.?). However, the empirical studies show that these
25 frictions, known under «market microstructure», have an influence on price formation and on market liquidity.

26 In a more and more competitive environment, the financial markets try to guarantee an important quality:
27 the liquidity. Indeed, the liquidity becomes an element of investment choice between the financial rooms that
28 quote the same values of fact that the investor wishes to exchange without delay and without loss whatever is
29 the volume.

30 In spite of the importance of concept of liquidity, researchers in finance don't have very successful to give
31 him a standard measure. Indeed, liquidity depends on structure of market, nature of the exchange and other
32 factors. Market microstructure literature has, at least since Demsetz (1968), based primarily on the bid-ask
33 spread. This last is considered as a measure of transaction cost and market efficiency. It is admitted for a
34 long period that the quoted bid-ask spread is inadequate for measuring market liquidity. According to ??toll
35 (1985) and ??rossman & Miller (1988), for example, the bid-ask spread measures liquidity precisely only when
36 the market maker simultaneously crosses a trade at the bid and ask. Hasbrouck (1993) discusses the defect of
37 the traditional measures of transaction costs (such as bidask spread) and propose new improved measures of the
38 liquidity: trading restrictions. Brennan, Chordia and Subrahmanyam (1998) measure liquidity by two variables:
39 trading volume and securities rate rotation. Chordia, Roll and Subrahmanyam (2000) measure the liquidity by:
40 quoted spread, effective spread and quoted depth. Several others measures are used, for example: volatility,
41 lambda, CRT (cost of round trip trade), etc.

42 Several researches are interested to the identification of variables that can influence liquidity. To this stadium,
43 several empirical studies have been done. ??rennan and al (1998) identify a negative relation between returns and
44 trading volume (considered as "proxy" of liquidity). Chordia, Roll and Subrahmanyam (2000) detect a strong

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45 correlation between trading volume and measures of liquidity (spread, depth etc.). Other authors tried to
46 examine the nature of relation between liquidity and others variables, such as: volatility, number of transactions,
47 information, quoted tick size etc.

48 This paper proceeds to a sweep of an extensive literature permitting to examine the problematic relative to
49 the identification of the determinants of liquidity. Our survey is incorporated in context of market microstructure
50 aiming to describe the evolution of various measures of liquidity and study the factors that can be contributed
51 to explain these different measures of securities quoted in continuous on the Tunisian stock market.

52 Our survey presents an institutional and methodological interest. On the first plan, it is about bringing a
53 contribution to the reflection on the concepts, such as: theory of market microstructure, theory of bid-ask spread,
54 measures and determinants of market liquidity.

55 On the methodological plan, we widened the approach of the event survey to the new parameters measuring
56 liquidity, such as: spread and depth. Indeed, if this methodology is applied extensively to returns and volume, it
57 is only used little for spread and depth.

58 The rest of the paper is organized as follow. Section 2 recalls and studies the literature of "marketmicrostruc-
59 ture" while insisting on the theory of the bid-ask spread. Section 3 defines market liquidity measures. Section 4
60 exposes theoretical and empirical works that study the influence of the strategically variables of microstructure
61 (trading volume, returns, volatility, information, tick size etc.) on market liquidity. In section 5 we empirically
62 study the evolution of the different measures of liquidity/illiquidity, variables influencing the market liquidity on
63 the Tunisian stock market.

64 In the canonical model of efficient markets, price reflects all public information. In this model, agents are
65 supposed to have homogeneous anticipations and frictions are negligible. Therefore market prices converge to
66 the anticipated values. It is the example of asset pricing models (MEDAF, MEO, APT) that are formulated
67 independently of transaction cost, dealers behaviour and market design.

68 In contrast to the model of efficient markets above, market microstructure theory interests to study the
69 impact of the various market frictions and heterogeneity of anticipations 1 The bid-ask spread is the difference
70 between seller price (ask) and buyer price (bid). In the development of the theoretical components of the
71 bidask spread, Glosten& ??arris (1988) and others decompose the bid-ask spread into to parts. In the first
72 part, due to informational asymmetries, the bid ask spread constitutes a potential loss indemnity supported by
73 the market makers while he executed transaction with informed traders. In the second part, due to inventory
74 control considerations, we can distinguish order processing costs (include exchange fees and taxes as on price
75 formation process. The central idea of the microstructure theory is that prices cannot be reflected all available
76 information because of the variety of markets frictions (transaction costs, disagreement between dealers etc.).
77 These frictions drive to have bid-ask spread prices that become, since Demsetz (1968), the central theme of the
78 market microstructure theory. 1 Heterogeneity of anticipations results in the presence of the informed traders,
79 liquidity traders and market makers. Dealers are facing problem of asymmetric information when they display
80 their prices ask/bid because they don't distinguish insiders to outsiders.

81 well as the more immediate costs of handling transactions) and inventory holding costs components
82 (compensation costs so that market maker accepts to detain no optimal portfolio).

83 2 a) Definitions

84 One of the first definitions of the liquidity comes to J.M Keynes (1930) according to which "an asset is as much
85 more liquid if it is transformable in short-term currency and without loss ". This definition permits to put
86 in evidence the two aspects of the liquidity: the temporal factor expressed by "short-term" and price factor
87 translates by "without loss".

88 This definition can be adapted to financial markets: "A financial room is said liquid if intervening parties can
89 buy and sell at all times an important quantity of securities to a fixed price ".

90 The previous definitions emphasize, always, the two dimensions of liquidity: time and cost. These two
91 dimensions have tendency to evolve in an inverse sense: more the investor is hurried to achieve his transaction,
92 more the cost generated by this one is important while more it is patient, more the cost of execution is
93 advantageous.

94 Because she clothes several facets, the liquidity is a notion that is not simple to define and to measure. In
95 their studies, researchers (Black [1971] and others) distinguish, generally, four dimensions of liquidity: immediacy,
96 depth, tightness and resiliency.

97 The immediacy refers to the time that passes between the placing of a market order and its execution.

98 Depth is the maximal amount of an operation for a determined spread; a market is deep if large orders can be
99 executed without much effect on prices. Tightness refers to the cost of obtaining liquidity in the market and is
100 directly measured by the bid-ask spread. Resiliency refers to the speed with which the bid and the ask schedules
101 move back to their initial positions after an order has been executed.

102 3 b) Liquidity measurements

103 Some of the most interesting researches in microstructure theory deposit a problem of determination of a suitable
104 measure of liquidity. It has been demonstrated that the choice of the "proxy" of liquidity is a very delicate task

105 and depend on the room of quotation and the market design. In the literature, several measures of liquidity have
106 been proposed, such as: trading volume, ratio of liquidity, the rotation rate, spread, depth, CRT, VNET, etc.

107 ? Trading volume: Traditionally (Demsetz (1968)), liquidity is measured by the trading volume. This is
108 maladjusted, because it disregards properties of the concept of liquidity (immediacy, tightness, depth and the
109 resiliency).

110 ? Liquidity ratio: Bernstein (1986) defines it as the report of the absolute variations of prices to the trading
111 volumes. It is considered as measure of liquidity degree of securities. ? Turnover: Turnover is generally used to
112 measure the financial asset liquidity. It is equal to the number of securities exchanged divided by the number of
113 securities in circulation. This measure is criticisable in the sense that it doesn't integrate features of the concept
114 of liquidity. ? The ask-bid spread: the spread is generally considered as the best measure of the concept of
115 liquidity. Under this term, we distinguish the quoted spread and the effective spread. Generally, the spread is
116 considered as a measure of illiquidity. ? Depth: One of the most measures abundantly used as proxy of liquidity
117 is depth. Depth is the number of units offered to "ask" price plus the number of units demanded at "bid" price.
118 Depth can be measured by the number of securities exchanged (depth quantity) or by the number of monetary
119 units (dollars depth). The depth is a quality offered by the electronic markets in the difference to floor-based
120 markets, where we meet a big number of participants supplied of liquidity but incapable to execute some orders.

121 ? Lambda: Kyle (1985) watch that the tie between prices and quantities in a note orders-book 2

122) () (size bid size ask bid ask + ? = ? can be used to appraise the degree of illiquidité of securities while
123 supposing a linear relation between prices and quantities exchanged on the market; the lambda is the slope of
124 the linear line.

125 (1)P Q μ ? = +(2)

126 P: price of securities, Q: trading volume. $Q > 0$, if it corresponds to a purchase and $Q < 0$, if it corresponds to
127 a sale, μ : represent the informational value of asset.

128 ? VNET: Robert, Engle and Joe Lange (1997) propose a new intraday measure of market liquidity, VNET.
129 This measure is constituted by the excess volume of buys or sells during events observed on the market defined
130 by movements of prices. If price increase with a weak excess buys, the market is considered as illiquid, but if
131 this same price increase with a large excess of buys, the depth would be more important. VNET is defined as
132 follows:

133 2 A note orders-book unites (by dates, volumes and categories) the waiting orders according to the asked price
134 (on pouring it superior of the notebook) and the offered prices (on pouring it lower). $VNET = \sum_{i=1}^n \sum_{j=1}^d vol \times$
135 ?(3)

136 d: is an indicator of trading (buys = +1 and sells = -1), vol: is the trading volume.

137 VNET measures the net directional volume that can be traded before prices are adjusted. If VNET converge
138 to zero, the market is considered as being very liquid.

139 ? CRT (the cost of round trip trade): Paul Irvine and George Benston (2000) propose an ex-ant measure of
140 market liquidity, CRT. All low values of buyer prices "bid" and those of the high values of seller prices "ask" are
141 respectively: $P-1 > P-2 > P-3 > \dots$ and $P1 < P2 < P3 < \dots$. Quantities of securities offered and asked are represented
142 by the vector: $Q[? . Q-2 Q-1 Q-0 Q0 Q1 Q2?]$.

143). The number of securities that we can sell it to mid price " is: $0 0 2 () D T D P P ? = +(4)$

144 Year () D 2014

145 We define two indicators: I_k and I_{-k} that correspond to buyer and seller orders expressed in dollars
146 respectively.

147 () () ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? = ? ? ? ? + ? ? = ? ? = + ? ? = ? ? = ? not if $Q D T Q$
148 if $Q Q D T Q D T$ if $I_k i k j j i k k i i k 0 / 1 1 0 0 1 0 0 (5) () () () ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?$
149 ? = ? ? ? ? ? = = = not if $Q D T Q$ if $Q Q D T Q D T$ if $I_k j k i i j k k i i k 0 / 1 1 0 0 0 0 (6) () ()$
150 $D Q P I Q P I C R T k k k k k k k k ? + ? = ? ? ? + ? = ? = 0 0 (7)$

151 We can say that market i offer a higher liquidity than market j if $CRT_i(D) < CRT_j(D)$.

152 4 IV. The theoretical and empirical studies relating of actors 153 influencing liquidity

154 The market design, regulators and management of investment can be all improved by the knowledge of factors
155 influencing liquidity. A good understanding of these determinants can improve the confidence of investors on the
156 financial markets and in this fact, to heighten the efficiency of resources allowance.

157 In the market microstructure literature, several researches (notably those led by Kyle (1985); Amihud and
158 Mendelson (1986); Admati and Pfleiderer (1988); ??arris (1995) as well as of others) note that liquidity is
159 conditioned by several factors that will be studied in the following of the paper. a) Information and insider's
160 transactions impact A set of empirical studies tempted to measure the impact of the asymmetric information
161 on the bid-ask spread. Gajewski (1996) achieves a survey of event on data around announcements of earnings.
162 Two types of situation of asymmetric information can appear. The first is that some investors can be informed
163 exceptionally before the announcement, either because they collected information (financial analysts), either
164 because they are insiders (majority shareholders, chief of enterprise?). The second type of situation of asymmetric
165 information results the public information. Investors having a better capacity to interpret information arrange an

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166 informational advantage on others. Morse and Ushman (1983) study the evolution of the bid-ask spread around
167 the quarterly result announcement on the period 1973-76 on a composed sample of 25 securities quoted on the
168 OTC (Over The Counter). The authors don't put in evidence meaningful change of the size of the bid-ask spread
169 around the date of quarterly earnings announcement.

170 To study the impact of insiders transactions on liquidity, Lee, Macklow & Ready (1993) study the evolution
171 of the quoted spread and quoted depth (considered as "proxy" of liquidity) on 53 intervals of a half-hour where
172 makes himself the announcement of earnings. The empirical results reinforce the hypothesis that the intervention
173 of insiders results in the widening of quoted spread and therefore a deterioration of the market liquidity. In the
174 goal to verify this prediction on the Paris Bourse, Annaïck Guyvar'ch (2001) studies empirically the evolution
175 of the quoted spread following insiders transactions. This survey shows that the quoted spread enlarges on the
176 days where insiders achieve their criminal transactions, and recover his normal level on the end of the quotation
177 session.

178 5 b) Liquidity and returns

179 The idea that measures of liquidity can influence returns is well accepted. Several studies ??Amihud and
180 Mendelson, 1986) show that expected returns are in decreasing function of liquidity because investors must Amihud
181 and Mendelson (1986) leave of the hypothesis that investors require an elevated expected return for an enlarged
182 spread to compensate transaction costs. Thus, investment decisions don't depend solely on specific risk hound
183 to securities, but also to their liquidity risk. Besides, it is important to note that when investors can reduce a
184 risk bound to the securities by the diversification of his portfolio or by techniques of hedging, it is difficult to
185 make it to eliminate illiquidity costs 3 c) Liquidity and tick size . In order to support the idea that liquidity
186 has a measurable effect on returns, Amihud and Mendelson (1986) examine the importance of introduction of
187 liquidity (measured by the bid-ask spread) in asset pricing. They test the hypothesis that expected returns are
188 an increasing concave function of ask-bid spread. Empirical result, on the NYSE/AMEX common stocks in the
189 period 1961-1980, indicate there is a significantly positive relation between returns and the bid-ask spread.

190 These results have a number of implications for the investment and for the portfolio choice. One of implications,
191 is that investments of weak liquidity generate some elevated returns for their holders. Tick size constitutes the
192 minimum price variation for quoting and trading stocks. It is determined of two ways: either in percentage of
193 prices level, which limits his impact, either by authorities of the market; independently of prices. A number of
194 papers examine theoretically and empirically the effect of a tick size reduction on market liquidity. Harris (1994)
195 applies that a reduction in tick size should reduce liquidity; since the tick size represents the subsidy paid to
196 liquidity providers. Specifically, in the wake of a reduction tick size, liquidity providers could choose to reduce
197 their interventions on the market. Therefore, market liquidity provision decrease.

198 Empirically, several studies done on the international markets (Stockholm Stock Exchange band others) confirm
199 the theoretical survey of Harris (1994), others invalidate it. Engel (1997) argues that a small tick size increase
200 liquidity by allowing for a small bid-ask spread. Niemeyer and Sandás (1994) also the arguments in Harris (1994),
201 showing that the tick size is positively related to the bid-ask spread and negatively related to trading volume.

202 6 d) Liquidity and trading volume

203 The takes in account of volume as resulting of the strategic intervention of operators puts in evidence the
204 importance of studies for the impact of trading volume on liquidity. The empirical results recorded show that
205 researchers were in situation of conflict.

206 Chordia, Roll and Subrahmanyam (2000) recommend a positive relation between trading volume and liquidity;
207 negative relation (positive) between trading volume and quoted spread (quoted depth). These results confirm
208 the strategic behavior of operators that choose to negotiate on the moments where the securities are most liquid
209 (narrow spread and elevated depth).

210 Of their part, Clyman, Allan and Jaycobs (1997) reject the idea that a strong liquidity requires an elevated
211 volume. They appraise that, on a liquid market, we must predict a symmetrical variations of the bid and ask
212 prices, but on an illiquid market these variations being asymmetric. This is imply that only the bid price go up
213 toward the ask price or that only the ask price lower toward the bid price.4.5

214 7 e) Liquidity and volatility

215 The spread is also related to the volatility. This predicts the inventory and asymmetry information models.
216 Several studies showed a negative relation between liquidity and prices volatility (Domowitz, Glen and Madhavan
217 (2000) and others?). In particular, it has been observed that an increase of volatility takes, generally, to an
218 enlargement of the bid-ask spread. Theoretically, this result can be explained by the fact that in period of a
219 strong volatility, market makers are going to require a more elevated return (enlargement of the bid-ask spread)
220 to compensate the free loss of an unexpected prices variations.

221 8 f) Seasonality in liquidity

222 The first empirical studies describing the evolution, in sitting, of liquidity measures have been achieved on the
223 American stocks markets. Handa (1992) analyzes a behavior of an intraday spreads calculated at intervals of a

224 half-hour for 1902 quoted securities on the NYSE/AMEX. He observes a curve in U of quoted spread of market
225 makers during the quotation sitting.

226 In the goal to test seasonality in liquidity, Chordia, Roll and Subrahmanyam ??2000) show that the liquidity,
227 in NYSE, is affected by days of the week. They prove that Tuesdays, Wednesdays and Thursdays have a negative
228 and significant effect on the spread and a positive and significant effect on the depth. Specifically, they observe
229 that Tuesdays have some more elevated coefficients in absolute value than the other days of the week. The
230 authors show, also, that liquidity decreases in Friday and that depth has tendency to increase around the holiday
231 days.

232 V.

233 9 Application to the Tunisian stock market

234 The Tunisian stock market knew since 14 November 1994 (law n° 14-117 carrying reorganization of the financial
235 market) mutations characterized by the following criteria: security (guarantee put in room by mediators),
236 transparency and necessity of a diffusion of information in real time and liquidity that constitutes criteria of
237 judgment of the market. This reform can contribute to facilitate the activity of exchange and to improve the
238 liquidity on the Tunisian stock market.

239 Our empirical survey was integrated in the domain of market microstructure aiming to describe the evolution
240 of the different measures of the liquidity and to study the impact of factors that can contribute to explain these
241 different measures of quoted stocks in continuous on the Tunisian stock market.

242 Data concerning the daily prices, the nearest preceding bid and ask prices, number of shares the specialist had
243 guaranteed to trade at the bid and ask quoted , the trading volume and the number of trades are provided by a
244 financial intermediary (broker). It is to note that we are going to exclude Saturdays, Sundays, the holiday and
245 days for which stocks have not been quoted. The study is conducted on the period going February 07, 2011 until
246 January 31, 2013. The sample is constituted by 40 quoted securities in Tunisian stock market.

247 10 a) Evolution of liquidity measures on the Tunisian stock 248 market

249 The first stage of our survey consists to calculate for four liquidity measures the weekly average of: quoted spread
250 (S), proportional effective spread (SP), effective spread or lambda (SE) and quoted depth (DE). Measures of the
251 liquidity used are formulated as follows:

252 -The quoted spread: $S = \text{Log}(\text{Ask}/\text{Bid})$; (where Ask, is the seller price and Bid, is the buyer price).
253 -The proportional effective spread : -The depth : $DE = \text{Log}(Q \text{ ask}) + \text{Log}(Q \text{ bid})$ (Where Q ask and Q
254 bid denote the quantity guaranteed available for trade at the quotes ask and bid) -Another measure of liquidity
255 (lambda) proposed by Handa (1992) that combines two measures of liquidity, quoted spread and depth, :
256 $(S) / (DE) = \text{Log}(Q \text{ ask}) - \text{Log}(Q \text{ bid})$ (2)

257 Second, we try to test the hypothesis that all measures of spread are positively correlated with each other
258 across time and negatively correlated with depth. As expected, depth (DEM) has negative correlation with all
259 spread measures. Besides, we observe perfect positive correlations between spread measures. This shows the
260 validity of these liquidity measures on the Tunisian stock market.

261 11 b) Influence of market liquidity on individual stocks liquidity

262 We first estimate autoregressive model of the liquidity proxy for individual stocks and examine whether the
263 residuals from the autoregressive model are correlated for the different individual stocks.t i t i i m i t i L L , 1 ,
264 , , 0 , ? ? ? ? + + = ? (8)

265 Li,tet Li,t-1 are the liquidity measures for stock i at the dates t and t-1.

266 Note that the 40 individual stocks (or regressions for each liquidity measure) are arranged alphabetically by
267 stock name. So we run 39 time series regressions between adjacent residuals;it it i i t i ? ? ? ? + + = + 1 0 ,
268 1(9)

269 -0 i ? and are estimated coefficients. We interpret positive correlations for thirty four regressions among thirty
270 nine for each liquidity measures. The average correlation is to 0.23 for Depth, 0.36 for quoted spread, 0.31 for
271 proportional effective spread and 0.33 for lambda. This result is compliant to Huberman & Halka (2001) and
272 proves the presence of the common liquidity factors in Tunisian stock market.

273 These common factors can be associated to factors that can vary with these different measures, such as: trading
274 volume, number of trades, return, volatility and lag variable of liquidity measure, etc? According to Chordia,
275 Roll and Subrahmanyam (2000), we going, initially, to estimate simple "market model" time series regressions;
276 liquidity variables for an individual stock regressed on market measures of liquidity:t i t m i m i t i L L , , , 0 ,
277 p ? ? + + = (10)

278 L i,t et L m,t are the liquidity measures for stock i and market respectively. ? m,t , is sensibility of stock
279 liquidity to the aggregate market. p i,t , is the innovations.

14 II. NUMBER OF TRADES

280 The estimation in (10) by OLS method 4 clears a Durbin-Watson value near to unit for all measures of liquidity.
281 This implies the existence of positive autocorrelations in innovations. These auto-correlations are in order 1 5t t
282 t m i m i t i L L ? p ? ? ? + + + = ?1 , , , 0 ,
283 for all stocks liquidity measures in our sample.

284 To solve this problem of auto-correlations in innovations, we estimate model (11), while using the Eviews
285 6 Software that permits to estimate by OLS method the auto-correlation coefficients: (11) ? , are the auto-
286 correlation coefficients in innovations between dates t and t-1.

287 Results of the estimation of market model in (11) are very powerful. Indeed, all coefficients are positive,
288 but 11% are only not significant. This proves that the individual stock liquidity was strongly correlated with
289 aggregated market liquidity, what again reinforces the hypothesis of the validation of a market model adapted
290 to different liquidity measures on Tunisian stock market.

291 It is to note that, the explanatory power of this last model is not important. Indeed, the average determination
292 coefficients for the different measures of the liquidity are 18% for the quoted depth, 28% for the quoted spread,
293 25% for the effective spread and 29.4% for the lambda. This is can be justified by the existence of noise or that
294 it exists other factors can influenced individual stocks liquidity.

295 12 c) Empirical studies on individual determinants of the liq- 296 uidity on the Tunisian stock market

297 In the literature of market microstructure many study reinforces the hypothesis according to which the liquidity is
298 conditioned by the strategic indicators measuring the performance of market, among these factors we distinguish:
299 trading volume, number of trades, return, volatility and lag variable of liquidity measure, etc.

300 13 i. Trading volume

301 The effect of trading volume on the spread is ambivalent. Trading volume is carrier of news that market maker
302 ignored; in this case, he enlarges his spread to hedge his position. However, by reason of the competition, he
303 could be obliged to reduce spread and play on the volume. With regard to the effect of trading volume on the
304 depth, the different studies detected a positive relation.

305 To study the relation between liquidity and trading volume (measured in number of stocks exchanged), we
306 estimate equation (12):t i t i t i u V a a L , ,1 0 , + + = (12)

307 V i,t , is the logarithm of trading volume for stocks at the time t.

308 To estimate this equation we use Panel data for 40 stocks quoted in continuous and most active on the Tunisian
309 stock market on the period going from February 07, 2011 to January 31, 2013, either 104 weekly observations for
310 each stock. Therefore, in whole, we have 4160 observations for each variable.

311 Estimation of equation (??2) by the OLS method 6t i t i t i u V a a L , ,1 0 , ? ? + + + =
312 proves the existence of positive auto-correlations in innovations (Durbin-Watson near of 1). To solve this
313 problem we estimate, rather, equation (??3): (13) Results of estimation are very powerful and reject the
314 hypothesis of an ambivalent relationship between liquidity and trading volume. Indeed, we detect a negative and
315 significant relationship between the different illiquidity measures (quoted spread, proportional effective spread
316 and lambda) and the trading volume. Besides, we detect a positive and significant relation between depth and
317 trading volume with a t-student of 6.2. This positive and significant relation between liquidity and trading volume
318 on the Tunisian stock market confirms the strategic behaviour of operators that chooses to negotiate just when
319 stocks become very liquid (narrow spread and elevated depth).

320 14 ii. Number of trades

321 In order to study the link between liquidity and number of trades we estimate, using data Panel, by the OLS
322 method equation (14):t i t i t i v N b b L , ,1 0 , + + = (14)

323 N i, t , is the logarithm of number of trades for stocks i at a date t.

324 To solve the problem of mistake autocorrelation in innovations, we estimate rather equation (15):t i t i t i
325 v N b b L , ,1 0 , ? ? + + + = (15)

326 Results of estimation show an ambiguous relationship between liquidity and number of trades. On the
327 one hand, we observe a negative and significant relation between illiquidity measures and number of trades. On
328 the other hand, we observe a negative and significant relationship between depth and number of trades. The
329 existence of a negative relation between the depth and number of trades can be explained by the tendency of
330 intermediaries in stock market to exercise some trading in block because the Tunisian stock market lacks of
331 informed traders.

332 iii. Return

333 In our empirical investigation we estimate by OLS method equation (16):, 0 1 , , 1 , i t i t i t L c c R v ?
334 ? ? = + + + (16)

335 R i, t = Log (P t / P t-1), is the return for stock i, at a week t.

336 Estimation results document a positive and significant relationship (but insignificant, solely, for the quoted
337 spread) between return and stocks liquidity. Indeed, we observe, on the one hand, some negative coefficients for

338 the different illiquidity measures; it is of -0.013 with a t-student of -0.64 for the quoted spread, -0.045 with a
 339 t-student of -4.54 for the proportional effective spread and of -0.006 with a t-student of -2.17 for the lambda.
 340 On the other hand, we detect positive and significant coefficients between the quoted depth and return. this is
 341 in contradiction with the result of ??mihud & Mendelson (1986) and Brennan, Chordia & Subrahmanyam that
 342 recommend that liquid stocks procure to their holding weak return. This positive relation between liquidity and
 343 return on the Tunisian market can be explained by the tendency of intermediaries in stock market to negotiate
 344 stocks that procure the most elevated returns.

345 15 iv. Volatility

346 By reason of the absence of a sufficient number of quotations inside the week to calculate prices volatility, we use
 347 an approach that consists to estimate the volatility from the past prices. There is little evidence that stock market
 348 varies systematically with time. There is also strong evidence that ARCH models (Autoregressive Conditional
 349 Heteroskedasticity; Engel, 1982) are good descriptions of time-varying volatility in stock prices. Review article
 350 such Bollerslev (1986) documents the effective application of ARCH(p) and GARCH(p,q) (General Autoregressive
 351 Conditional Heteroskedasticity) models to financial time series across a wide variety of markets.

352 In our investigation we use GARCH (1.1) model to estimate volatility: $? ? + + = + + = ? ?) () ()$
 353 $(1 2 2 1 1 0 1 1 0 b a u a a h a u P \text{Log } P \text{Log } t t t t t t ? ? (17)$

354 In equation (17. a), $? 0 = E[\text{Log } (P t \setminus F t-1)]$ is the conditional average of information in t-1 represented by
 355 the whole $F t-1$ and $u t$ designates the shock.

356 In equation (17. b), $h t = E t-1 (u t 2 \setminus F t-1)$ is the conditional variance to $F t-1$. By definition, it is the
 357 expected component of the volatility. The equation (b) is a modelling of this component that is then function of
 358 the passed innovations $u t-1$ (a 1 is interpreted as the size of this shock) and of the passed volatility $h t-1$ (a 2 is
 359 an indicator of persistence).

360 To estimate the volatility by the GARCH (1, 1) model, we, first, examine the distributions of stocks prices
 361 using the Eviews 6software. We notice that these distributions depart of the normal distribution as indicated
 362 by tests of skewness and kurtosis. The test of skewness rejects significantly the symmetry ($H0: sk = 0$) with an
 363 average value of 0.63. The test of kurtosis rejects the hypothesis of a normal distribution ($ku = 3$) with a The
 364 estimation of equation (a) by the OLS method puts a problem of a unit root for all stocks in our sample. The
 365 Dickey-Fuller test indicates that distributions are deference stationary (DS). Therefore, we estimate for every
 366 stock, the following model by the ARCH method: (18) Once this last model is estimated, using the ARCH
 367 estimation method with Eviews 6 software, we generates for every stock the data of the volatility $h t.1 .1 2 2 1$
 368 $1 0 ? ? + + = t t t h a a h \mu (19)$

369 Estimation results of model (19) indicate that current volatility depends of lagged volatility $h t-1$ (GARCH),
 370 whose coefficient a 2 is positive and significant for most stocks. Besides, the results suggest that current volatility
 371 depends of lagged squared innovations, $u t-1 2$ (ARCH), whose coefficient a 1 is positive and significant.

372 Once, the volatility is estimated, we examine their influence on the liquidity. Therefore, it is necessary to
 373 estimate the following model while using Panel data $8t i t i t i t i w h d d L , 1 , , 1 0 , ? ? + + = ? : (20)$

374 Estimation results in equation (20) show, on the one hand, that volatility is positively related to spreads
 375 (quoted spread and lambda). This can essentially be explained by the strategic behaviour of traders that choose
 376 to widen spread to compensate the risk of a strong prices volatility in them disfavour. On the other hand, results
 377 show a negative relationship, but not significant, between depth and volatility. This shows the absence of a strong
 378 relationship between liquidity and volatility on the Tunisian stock market.

379 16 v. Past information

380 To judge the influence of the past information on the stocks liquidity, we introduced a lagged variable because
 381 liquidity at time t-1 has an influence on the liquidity at time t. This influence is essentially owed to the
 382 incorporation in prices and volumes that are attached to information revealed by the past $() () [] 2 3 4 /$
 383 $1 *) 6 / (2 ? + ? = K S h N B J$

384 . Where, S is the skewness, K is the kurtosis, h is the number of parameters to estimate and N design the
 385 number of observations. 8 It is to notice that we lost for every stock the first observation. To the whole, we lost 40
 386 observations for each variable; therefore we dispose of 4160 observations. transactions. Some supplementary lags
 387 don't contribute to increase the explanatory power of the model. Therefore, liquidity follows an auto-regressive
 388 process of order $1.t i t i t i L e e L , 1 , 1 0 , ? + + = ? (21)$

389 Using Panel data, estimation results make appear that past liquidity contributes strongly to explain current
 390 liquidity. Indeed, coefficients of the past liquidity are positive and significant for all liquidity measures. This
 391 shows the importance of the past information to explain the behaviour of liquidity of stocks quoted in continuous.

392 17 d) Determinants of the common movements in liquidity on 393 the Tunisian stock market

394 To examine the hypothesis of the presence of common factors in liquidity, we based on previous results indicated
 395 that the trading volume, return and lagged liquidity measures contribute significantly to explain the behaviour

19 CONCLUSION

396 of liquidity measures of all stocks quoted in continuous on the Tunisian stock market. Therefore we are going to
397 examine if these variables can be considered as common factors in liquidity.

398 Therefore, we estimate, using panel data for each group, the following regression (pooled crosssection time
399 series):
$$t_i t_i t_i t_i t_i t_i L R V c L, . 1, . . . , ? ? ? + + + = ? (22)$$

400 L_i, t et $L_i, t-1$ are the liquidity measures for stock i at the weeks t and $t-1$. V_i, t , is the logarithm of trading
401 volume for stocks at a week t . $R_i, t = \text{Log}(P_t / P_{t-1})$, is the return for stock i , at a week t .

402 In tables 2 we report estimates coefficients for the regressions of our four liquidity proxies on the explanatory
403 variables. -Trading volume: Table 2 shows that trading volume is negatively and significantly correlated to
404 the different measures of illiquidity. However, the depth is negatively correlated with trading volume, but this
405 relationship is not significant (t-student of -1.13).

406 -Return: Table 2 reveals that return is negatively correlated to the quoted spread (with a t-student of -
407 0.652348), to the proportional effective spread (with a t-student of -3.65) and to the lambda (with a tstudent of
408 -2.10). Besides, return is positively and significantly correlated to the quoted depth (with a tstudent of 5.65).

409 -Past information: Tables 2 indicates that, even if we account for volume, return, the past information
410 (represented by the lagged liquidity variable) remains a strategically variable that contributes strongly and
411 significantly to explain the behaviour of the different liquidity measures of stocks. Thus, our results contradict
412 the hypothesis that volume and return contribute strongly to explain the behaviour of the liquidity. Therefore,
413 volume and return don't constitute a common factor for the different liquidity measures of the stocks quoted in
414 continuous on the Tunisian stock market.

415 In opposite, we can consider, probably, the past information as a common factor for the different liquidity
416 measures for all stocks in our sample quoted in continuous on the Tunisian stock market.

417 18 VI.

418 19 Conclusion

419 Literature of market microstructure proposed a diversity of measures, such as: the quoted spread, proportional
420 effective spread, lambda, quoted depth ? In the goal to judge the validity of these measures on the Tunisian
421 stock market, we tried to verify the hypothesis that different illiquidity measures (quoted spread, proportional
422 effective spread, lambda) vary in inverse sense with the quoted depth. Our survey led on 40 stocks quoted in
423 continuous reinforces this last hypothesis for the individual stocks as well as for the whole of the market.

424 The main goal of this paper was to test empirically the hypothesis of the presence of variables influencing
425 liquidity stocks quoted in continuous on the Tunisian stock market. The most important empirical results find
426 that:

427 -It exist a "market model" for liquidity.

428 -Trading volume has positive and significant relationship with the stocks liquidity.

429 -It exist ambiguous as for the influence of the number of trades on stocks liquidity.

430 -Return is positively and significantly correlated with stocks liquidity.

431 -Relationship between liquidity and the volatility is not significant.

432 -Liquidity is auto-regressive of order 1. Indeed, the lagged liquidity has strong contribution to explain the
433 current liquidity. So, we can consider, probably, the past information as a common factor for the different liquidity
434 measures for all stocks in our sample quoted in continuous on the Tunisian stock market. ^{1 2 3 4 5}

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³Let's note that investors can eliminate no systematic risk by the diversification and can form a portfolio with zero beta to eliminate the systematic risk (bound in market). However, investors cannot eliminate illiquidité costs.

⁴Note that all measures of liquidity are stationary.⁵ We used an econometric method that consists in adding to the regression(5), AR(1) AR(2)?then we tested the significant power of the auto-correlations coefficients . The result proves that only the coefficients of order 1 are significant.

⁵It is to note that the trading volume expressed in logarithm is stationary. In the same way, all other variables that we are going to use are thereafter are stationary, except variable «price (P)" that is stationary in difference (DS).

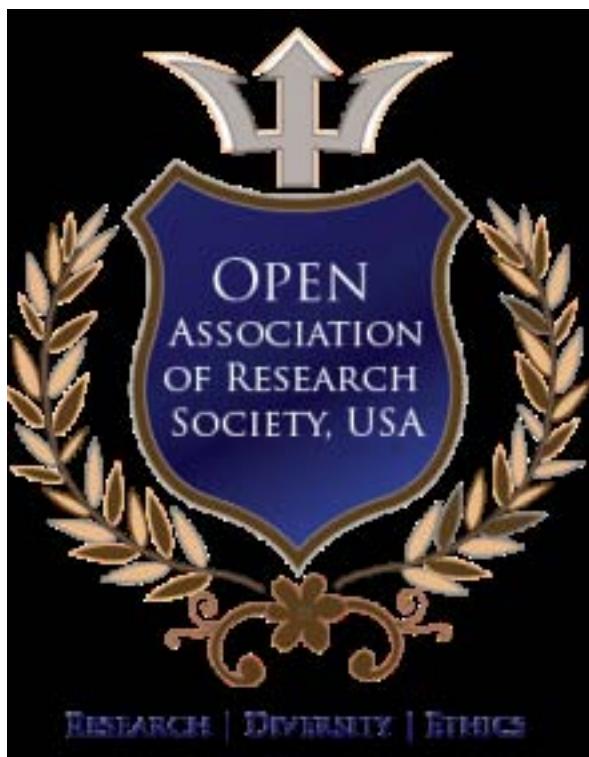


Figure 1:

1

documents the correlations between the aggregate market liquidity measures

Figure 2: Table 1

1

	SPM	SM	SEM	DEM
SPM	1			
SM	0.9203404	1		
SEM	0.9315732	0.971523	1	
DEM	-0.156081	-0.23458	-0.29524	1

Figure 3: Table 1 :

2

PANEL C		V	R	S(-1)	R 2
S	0.017485	-0.001276	-0.026352	0.254798	0.129083
t-st	(5.502999)*	(-4.221660)	(-0.652348)	(5.456235)	
SP	0.005576	-0.000432	-0.0756348	0.328254	0.219406
t-st	(6.893580)*	(-3.796875)	(-3.65234)	(7.489629)	
DE	2.712189	-0.045168	30.79190	0.488769	0.318134
t-st	(3.276671)* (-1.135465)		(5.6542387)	(13.00661)	
SE	0.001559	-0.000146	-0.010545	0.374519	0.255791
t-st	(5.082276)*	(-4.906551)	(-2.101210)	(8.489462)	

Figure 4: Table 2 :

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