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Dealer Behavior and Price Strategy in the Foreign Exchange Market: Evidence from FX Tunisian Market Dealer

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Abstract

This paper study the relationship between trading volumes, volatility and bid-ask spread in Tunisian FX market. It uses a new data set includes intra-day total trading volume, exchange rates and spreads for inter-dealers and customer markets. We study one exchange rate for two periods, before and after Arab Spring. Consistent with literature and mixture of distribution hypothesis, we find that volume and volatility are positive related during the period before Arab Spring, but there are negative related after Arab spring. We also find a positive correlation between volume and volatility during stability period and negative during turbulence period. Finally, estimation shows a significant impact of unexpected volume on spread and a positive relation between volatility and spread.

JEL classification: F31; G14

Keywords: Dealer behavior; bid-ask spread; trading volume; foreign exchange market.

1- Introduction

In the past two decades, an increasing body of literature has been devoted to the relation between trading volume, volatility and bid-ask spreads in the foreign exchange market. Theoretically, economists have recognized many models examining relation between these variables. Accordingly, many studies made empirical investigations about the relationships between volume, volatility and spread. This issue is important because it studies the liquidity and the risk of the foreign exchange market. Indeed, a market can be considered to be liquid when large transactions can be executed with a small impact on prices (BIS 1999).

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This article empirically examines the relationship between trading volume, volatility and bid-ask spread in the foreign exchange market. A new data set has been collected from a foreign exchange dealer. The data cover the daily EUR/TND exchange rate for two periods, first one from January 2010 to December 2010 and the second from Januarys 2012 to December 2012. Then the data are tested by an econometric model to find out the relationship between trading volume, volatility an spread. We test the applicability of the Mixture of Distribution Hypothesis (MDH). Galati (2000) has found a positive correlation between volumes and volatility. He explain this finding by the arrival of new information. The MDH predicts that volatility will move together with unexpected trading volume. The theory also predicts that spread increases with the market volatility, because spread determined inter alia by inventory costs.

A main finding of this paper is that unexpected trading volume and volatility are positively correlated during the first period, suggesting that they both react to the arrival of new information, as MDH predicts. By contrast, these findings not validate for the second period. This can be explained by market uncertainty after revolution that began on 17 December 2010. This result is in line with the findings of Galati (2000) for the Mexican peso and the Brazilian real. We find evidence of a positive correlation between volatility and spreads for the second study period, as suggested by inventory cost models. However, the results do not show a significant impact of trading volumes on spreads for the first period.

The remainder of the paper organized as follows: Section 2 summarizes the current literature about the relationship between trading volume, volatility and spread; Section 3 examines database and descriptive statistics; section 4 determines the relationship between variables empirically and displays results; and Section 5 concludes.

2- Literature review

The relationship between trading volume, volatility and bid-ask spread is an interest issue in financial research. According to market microstructure theory, volume, volatility and price variation related to arrival of new information (Glosten and Milgrom 1985; Galati 2000; Jinliang and Chunchi 2006).

A number of studies on the volume volatility and spread relationship have adopted the mixture of distribution hypothesis (MDH) advanced by Clark (1973). A further common finding of the literature is that volume and spreads are positively correlated. The microstructure theory predicts that spread increases with market uncertainty, in other word when exchange rate volatility increases (Galati 2000). Many empirical studies find evidence supportive of MDH model (Clark 1973; Tauchen and Pitts 1983; Harris 1987). Batten and Bhar (1993), Jorion (1996) and Galati (2000) found a positive correlation between volume and volatility. Other empirical model proposed by Anderson (1996) that examines relationship between volume and volatility. He advances that each information arrival induces a price discovery phase followed by an equilibrium phase. The market maker obtains information from public and private signals. He sets the price conditional on his current information and the type of the next trade. Madhavan and Smidt(1991) develop theoretical model that incorporate both effects and test them using inventory and trade data. They found that price changes reflect significant information effects but weak inventory control effects. O'Hara and Oldfield (1986) consider the pricing problem faced by risk adverse dealers to keep their inventories within bounds.

3-Database

The data used in this paper were collected from a foreign exchange dealer. This dealer displayed both customer and inter-dealers quote for several major currencies. I focused on the rate of the EUR versus TND (EUR/TND), currently the most frequently traded currency in Tunisian exchange market. The data set matches intraday spot data on trading volumes, volatility and spread. It covers two periods, first one from January 2010 to December 2010 and the second from January 2012 to December 2012. These data allow comparison of spot foreign exchange market before and after revolution. The market maker has a substantial order flow. He made 1430 and 849 transactions respectively for 2010 and 2012.

Exchange rate

Table 1 provides descriptive statistics on exchange rate behavior. The EUR/TND made the average of 1.897588 and 2.006682 respectively for 2010 and 2012. The Tunisian dinar depreciated on average of 5.75% during two year. This can be explained by the political and economic instability after revolution. The depreciation was particularly sharp following January 2011 began of revolution. Since this date, we observe a real depreciation followed by foreign deficit, low foreign reserves and market uncertainty. The Tunisian dinar's weakness was exacerbated in 2013, when it depreciated by around 10% against the Euro. Since 2012, the Tunisian Central Bank (TCB) has cancelled the obligation for the banks to transfer to the TCB their daily position of currencies. The consequence of this decision has a negative effect, which entrains a stronger volatility in interbank market, because of the inadequate previsibility of foreign exchange assets by the TCB. Thus, I can conclude that the TCB cannot lead a defense policy of the parity because of the constraints in terms of entrances of currencies that is a consequence of political instability in Tunisia. The effects of shocks also have a permanent effect on the rate as the rate responds to a shock by depreciating to a permanently higher level. Using the Augmented Dickey Fuller Test, the null hypothesis that the exchange rate has a unit root could not be rejected.

Table 1

Trading volume

The microstructure literature advance that the large size of foreign exchange market has a positive effect on market maker price strategy Lyons (1995). Several empirical studies underline that the volatility increases with size of transactions. By contrast, Tauchen and Pitts (1983) show that if the number of the participants and the sizes of transactions increase the market maker price strategy stabilizes. Ding (2007) shows that if order flow is large the bid-ask spread decrease.

The trading volume and the number of transactions of my market maker have been decreased in 2012. This can be explained by the decrease of the interbank exchanges and market uncertainty, further the decision taken by TCB in 2012, the previsibility of the foreign exchange assets was weakened. Furthermore, the exchange with customer was decreased further to decrease of the exports and resulting capital flight triggered a liquidity crisis in the foreign exchange market.

Volatility

In financial markets, the volatility considered one of the most issues, because it is the measure tool of the market risk. Jorion (1996) tested the risk by using the prices of options, however I use the historic data to test the risk of my market maker i. He shows that there is a positive correlation between volatility and volume. Galati (2000) explains the positive correlation that both are driven by arrival of new information.

We test this relationship following Galati (2000). He tests the pertinence of MDH by the following estimate equation:

$$R_{t+1}^2 = a + bE_t(v) + c(v - E(v)) + \varepsilon_{t+1} \qquad (1)$$

Where R_{t+1}^2 is defined as squared returns, and log volume are decomposed into an expected component $E_t(v)$ and an unexpected component $[v - E_t(v)]$ by using a fitted AR series and its residuals. We also use GARCH(1,1) model to describe expected volatility.

The GARCH(1,1) model can be written as:

$$R_t = aR_{t-1} + r \qquad (2)$$

$$r_t \rightarrow N(0, h_t) \qquad (2')$$

$$h_t = \alpha_t + \alpha_1 r_{t-1}^2 + \alpha_2 h_{t-1} \qquad (2'')$$

Where $R = \log\left(\frac{S_t}{S_{t-1}}\right)$ is the return and h_t its the conditional variance at time t.

Spread

Table 1 reports descriptive statistics on bid-ask spread, expressed as a fraction of the exchange rate. The spread of EUR/TND parity made average of 1.31% and 2.39% respectively for 2010 and 2012. Ding (2007) show that there is a negative relation between volume and spread, indeed during the first period the spread of my market maker decrease when volume of transaction increase, but this finding is not validate to the second period. This can be explaining by market uncertainty and low market liquidity. In fact, the spread represents the market maker remuneration and we have already mentioned that the risk of the market (measured by volatility), this explain the increase of spread between 2010 and 2012.

In this respect, we regressed the spread on GARCH variance forecast and measures of expected and unexpected trading volumes:

$$S_t = \alpha + \beta_1 h_{t+1} + \beta_2 E_t(v) + \beta_3 [v_t - E(v)] + \varepsilon_t \qquad (3)$$

4 - Empirical results

The methodology is similar to methodology of Jorion (1996). In order to measure expected trading volumes, we used the Box-Jenkins analysis to select the parsimonious ARMA model for the volume series, which are taken in lags. In fact, Augmented Dickey-Fuller tests suggest that trading volumes are stationary. The simple and partial autocorrelation functions show that AR models seemed appropriate to represent the trading volumes. These models allow trading volumes to be split into an expected and an unexpected component. To test the validity of the AR model, we test the absence of autocorrelation by using Lajung-Box test and the homoscedasticity of white. Results show the absence of autocorrelation of residues and the times series are heteroscedastic.

Tables 2,3,4

In terms of correlation between intra-day trading volume and exchange rate volatility, table 5 shows positive coefficients for EUR/TND. Galati (2000) advances that the positive correlation between volume and volatility is a sign of good liquidity of the dealer. This result shows the pertinence of MDH advanced by Clark (1973) for EUR/TND. As that dealer reacts to the arrival of new information, his demand curve will shift, thereby leading to a positive correlation between volume and volatility. To test this hypothesis, we split volatility and volatility into two components (expected and unexpected). We use estimates from a GARCH(1,1) model to describe expected volatility. This model appears to fit the time series well.

Table 5

Table 6 synthesize the conditional variance of the return, we find that $\alpha_1 + \alpha_2 \prec 1$, this explain stability spot FX market risk. Indeed the conditional variance can be considered as a better forecast of the risk on the foreign exchange market.

Table 6

After estimate conditional variance, we test the relationship between volatility and expected and unexpected volumes. Table 7 reports the regression results for equation (1). The coefficient on unexpected volume is positive and statistically significant for 2010 and negative for 2012. The result in 2010 support the idea that information flows drives volumes and volatility, as implied by the mixture of distribution hypothesis. This result is consistent with literature that used data on option market Galati (2000). The negative coefficient for 2012 can be explained the instability and uncertainty of the spot FX market after the Arab Spring. The coefficient of expected volume is negative for 2010, but it's positive for 2012, this positive coefficient is consistent with results presented in Jorion(1996). This result shows that the volatility and return are dependent of trading volume especially unexpected component.

Table 7

Equation (1) is then augmented with an expected volatility, which represents the one step ahead conditional return variance form a GARCH(1,1) specification:

$$R_{t+1}^2 = \alpha + \beta_1 GARCH + \beta_2 E_t(v) + \beta_3(v - E(v)) + \varepsilon_{t+1}$$

Table 8 reports the regression results for equation (1'). The coefficient on unexpected volume kept the sign, it's positive and statistically significant for the first period and negative for the second. The coefficient of expected volatility is positive and significant. Galati (2000) suggests that the volume and volatility are driven by the public information flow. The trading volume and volatility increase when the circulation of a new information increase and when the price decrease. This explains that my dealer follows a good strategy in spot market and he includes the new information in his intra-day activity. My dealer has a substantial customer flows over the two periods, his activities offer a reasonable proxy for market making activities in the FX market.

Table 5 reports that the spread and trading volume are negative correlated. This result show that, the spread increase when the activity of my dealer decrease. In other hand the volatility and spread are positive correlated, this explain that the spread follows the market risk.

Table 8

to test these assertions, we regressed bid-ask spreads on the GARCH variance forecasts and measures of expected and unexpected trading volumes:

$$S_t = \alpha + \beta_1 h_{t+1} + \beta_2 E_t(v) + \beta_3(v - E(v)) + \varepsilon_{t+1}$$

The results are presented in table 9. The coefficient on the GARCH variance forecast is negative for the first period; this shows the good liquidity spot market of my dealer. However, this coefficient is positive for the second period, this result suggests that the volatility influences bid-ask spreads through its effect on inventory costs Galati (2000). Consistent with the findings of the literature, we find positive coefficient on unexpected volumes for two periods. This can explain the stability of exchange between my dealer and his competitors.

Table 9

5- Conclusion

This paper investigates the empirical relationship between trading volume, volatility and spread. However, in contrast of the literature, most research in this area has relied on data on futures and options markets, we use data in spot FX market. This paper uses a new data set that includes intra-day data on trading volume, exchange rates, bid-ask spreads of EUR/TND.

An important result is that unexpected trading volumes and volatility are positively correlated in the first period, suggesting that they both respond to the now information flow, as predicts by MDH Clark (1973). We find a positive relation between volume and volatility for the first period, but its negative for the second period. This indicates that the negative average coefficient on trading volumes influenced by the incidence of period of turbulence and instability. We can explain this result by positive relation during stability period, but turns negative when the market uncertainty increased especially during periods of stress, like Tunisian market after Arab Spring. Galati (2000) advances that the MDH holds under normal period conditions but not during periods of stress.

We also find evidence of the positive correlation between volatility and spreads, as suggested by inventory cost models. Consistent with the findings of the literature and to the MDH, we find positive coefficient on unexpected volumes for two periods.

References

- Admati AR, Pfleiderer P. 1988. Selling and trading on information in financial markets. *American Economic Review* 78: 96–103.

- Biais B. 1993. Price formation and equilibrium liquidity in fragmented and centralized markets. *Journal of Finance* 484: 157-185.

- BIS (1999a): "Market liquidity: research findings and selected policy implications". Report for the CGFS.

- Bjønnes GH, Rime D. 2005. Dealer behavior and trading systems in foreign exchange markets. *Journal of Financial Economics* 75: 571-605.

- Bollerslev, Tim and I Domowitz (1993). Trading patterns and prices in the interbank foreign exchange market. *Journal of Finance*, 48 : 1421-43.

- Bollerslev, Tim and Michael Melvin (1994). Bid-ask spreads and volatility in the foreign exchange market: an empirical analysis. *Journal of International Economics*, Vol. 36: 355-372.

- Cheung YW, Chinn MD, Marsh IW. 2004. How do UK-based foreign exchange dealers think their market operates? *International Journal of Finance and Economics* 9: 289-306.

- Cornell B (1978). Determinants of the bid-ask spread on forward foreign exchange contracts under floating exchange rates. *Journal of International Business Studies.* 9 : 33-41.

- Danielsson, Jon and Payne, R. 2002**.** Real trading patterns and prices in spot inter-dealer foreign exchange markets. *Journal of international money and finance*, 21 2: 203-222. ISSN 0261-5606
- Demsetz H. 1968. The cost of transacting. *Quarterly Journal of Economics* 82: 33-53.
- Demos AA, Goodhart C. 1996. The interaction between the frequency of market quotations, spread and volatility in the foreign exchange markets. *Applied Economics* 28: 377-86.
- Ding. L. 2009. bid-ask spread and order size in the foreign exchange market: an empirical investigation. International journal of Finance and Economics. 14: 98-105
- Evans M, Lyons R. 2002. Order flow and exchange-rate dynamics. *Journal of Political Economy* 110: 170-180.
- Faisal.M and Neal.C (2012) :" Bid-Ask Spread, futures market sentiments and exchange rate returns", Journal of Economic Cooperation and Development, 33, 4, 2012, 63-85.
- Galati.G. 2000. trading volumes, volatility and spread in foreign exchange markets: evidence from emerging market countries. BIS, WP No 93- October 2000.
- Glosten LR, Milgrom PR. 1985. Bid, ask, and transaction prices in a specialist market with heterogeneously informed traders. *Journal of Financial Economics* 14: 71-100.
- Hartmann P. 1998. Do Reuters spreads reflect currencies' differences in global trading activity? *Journal of International Money and Finance* 17: 757-784.
- Hartmann P. 1999. Trading volumes and transaction costs in the foreign exchange market. *Journal of Banking and Finance* 23: 801-824.
- Ho T, Stoll H. 1981. Optimal dealer pricing under transactions and return uncertainty. *Journal of Financial Economics* 9: 47-73.
- Jorion, Philippe (1996): “Risk and turnover in the foreign exchange market”, in Frankel, Galli and
Giovannini *The Microstructure of Foreign Exchange Markets*, University of Chicago Press, Chicago,
pp. 19-36.
- Kyle A. 1985. Continuous auctions and insider trading. *Econometrica* 53: 1315–1336.
- Lyons RK. 1995. Tests of microstructural hypotheses in the foreign exchange market. *Journal of* 14 *Financial Economics* 39: 321-351.
- Madavan and Smidt. 1991:"A Bayesian model of intraday specialist pricing", journal of financial Economics 30, 99-134.
- O'Hara, M. and G. S. Oldfield (1986). The microeconomics of market making. Journal of Financial and Quantitative Analysis 21, 361-76.
- Osler CL, Mende A, Menkhoff L. 2006: Price Discovery in Currency Markets. Mimeo.
- Payne R. 2003. Informed trade in spot foreign exchange markets: an empirical investigation. *Journal of International Economics* 61: 307-329.
- Sirimon. T, Tim. B and Stephen. G (2013):"explaining the bid-ask spread in the foreign exchange market: a test of alternative models", Australian Journal of Management, 25, 2013.
- Stoll HR. 1978. The supply of dealer services in securities markets. *Journal of Finance* 33: 1133-51.
- Yao JM. 1998. Market making in the interbank foreign exchange market. Working paper S-98-3, Stern School of Business, New York University.

Table 1 : Descriptive satatistics EUR/TND

	2010			2012		
	Cours	**Volume**	**Spread**	**Cours**	**Volume**	**Spread**
Mean	1.897588	2460666	0.002461	2.006682	3723613.	0.004856
Median	1.894600	1455174	0.001500	2.005750	2438099.	0.002433
Maximum	1.956000	17984921	0.032100	2.052250	28904799	0.036000
Minimum	1.837500	29000.00	-0.029500	1.927400	15262.00	-0.009000
Std.dev	0.025012	2617369.	0.006495	0.025943	4378245.	0.008122
Skewness	0.140467	2.088614	1.007501	-0.587327	2.614705	1.576719
kurtosis	2.855890	9.172833	10.58162	3.428909	12.29705	5.621087
Jarque-Bera	1.021842	569.4193	630.7972	15.05133	1095.150	161.8373
prob	0.599943	0.000000	0.000000	0.000539	0.000000	0.000000

Table 2: ADF statistics log volumes

		Statistique ADF	Valeurs critiques	
EUR/TND	2010	-6.564442	1%	-3.4590
			5%	-2.8736
			10%	-2.5731
	2012	-5.838190	1%	-3.4607
			5%	-2.8744
			10%	-2.5736

Table 3: Autocorrelations Fonctions log volumes

	EUR/TND							
	2010				2012			
Retard	FAC	FAP	Q-STA	PROB	FAC	FAP	Q-STA	PROB
1	0.062	0.062	0.9637	0.326	0.038	0.038	0.3331	0.564
2	-0.008	-0.012	0.9813	0.612	-0.053	-0.054	0.9812	0.612
3	0.065	0.066	2.0318	0.566	0.052	0.056	1.6206	0.655
4	-0.087	-0.096	3.9229	0.417	0.035	0.028	1.9100	0.752
5	0.065	0.080	4.9814	0.418	0.078	0.082	3.3460	0.647
6	0.061	0.045	5.9338	0.431	-0.064	-0.071	4.3291	0.632
7	0.067	0.076	7.0841	0.420	0.043	0.055	4.7708	0.688
8	0.052	0.026	7.7742	0.456	0.041	0.019	5.1677	0.740
9	0.053	0.058	8.4886	0.486	0.090	0.099	7.1504	0.621
10	0.025	0.015	8.6530	0.565	0.014	0.001	7.2014	0.706
11	-0.021	-0.021	8.7677	0.643	-0.022	-0.006	7.3190	0.773
12	0.033	0.025	9.0530	0.698	0.151	0.132	12.898	0.376

13	-0.021	-0.032	9.1661	0.760	0.016	-0.001	12.964	0.451
14	-0.039	-0.045	9.5718	0.793	-0.019	-0.014	13.052	0.522
15	-0.024	-0.044	9.7246	0.837	-0.036	-0.043	13.384	0.573
16	-0.078	-0.077	11.324	0.789	-0.046	-0.059	13.916	0.605
17	-0.013	-0.015	11.371	0.837	-0.010	-0.041	13.941	0.671
18	-0.012	-0.020	11.410	0.876	0.047	0.061	14.508	0.695
19	-0.042	-0.035	11.888	0.890	0.086	0.080	16.405	0.630
20	0.008	0.011	11.905	0.919	0.022	0.027	16.528	0.683

Table 4 : AR(1) for EUR/TND

	variables	**coefficient**	**Std.Error**	**t-Statistic**	**Prob**
2010	C	6.131983	0.037120	165.1914	0.0000
	AR(1)	0.063088	0.064105	1.984137	0.03260
	R-squared	0.03970	Mean dependent var		6.131472
	Adjusted R-squared	-0.000129	S.D. dependent var		0.544277
	S.E.of regression	0.544312	Akaike info criterion		1.629541
	Sum squared resid	71.99489	Schwartz criterion		1.658122
	Log likelihood	-197.6187	F-statistic		0.968525
	Durbin-Watson stat	1.985953	Prob (F-statistic)		0.326027
	variables	**coefficient**	**Std.Error**	**t-Statistic**	**Prob**
2012	C	6.280005	0.039931	157.2711	0.0000
	AR(1)	0.037809	0.064575	2.585508	0.04588
	R-squared	0.01501	Mean dependent var		6.279609
	Adjusted R-squared	-0.002878	S.D. dependent var		0.581762
	S.E. of regression	0.582599	Akaike info criterion		1.766021
	Sum squared resid	77.38800	Schwarz criterion		1.795917
	Log likelihood	-201.0924	F-statistic		0.342820
	Durbin-Watson stat	1.967000	Prob(F-statistic)		0.558785

Table 5: Correlation volume, volatility and spread

EUR/TND	Vol_vot	Vol-spd	Vot-spd
2010	0.017878	-0.078255	0.159872
2012	0.215382	-0.328141	0.415127

Table 6 : volatility estimation

EUR/TND	α_0	α_1	α_2
2010	1.05E-11 (2.656538)	0.088107 (1.825158)	-0.146993 (-0.340089)
2012	3.16E-12 (2.477196)	0.150000 (3.960182)	0.599984 (4.435638)

Table 7 : regression trading volume

EUR/TND	α	β_1	β_2	R^2
2010	-5.04E-05 (-1.516710)	-8.46E-06 (-1.560481)	2.14E-07 (0.625806)	0.011546
2012	-1.01E-05 (-0.187843)	1.90E-06 (0.223221)	-1.23E-06 (-3.734670)	0.048082

Table 8 : regression volume - volatility

EUR/TND	α	β_1	β_2	β_3	R^2
2010	-4.69E-05 (-1.395174) (0.1642)	34732.31 (2.769941) (0.04421)	7.94E-06 (2.451327) (0.01480)	2.12E-07 (2.618127) (0.005371)	0.013971
2012	-9.28E-06 (-0.172809) (0.8630)	-7456.877 (-2.293221) (0.007696)	1.79E-06 (0.209890) (0.8339)	-1.23E-06 (-3.724514) (0.0002)	0.058440

Table 9 : Spreads, volume and volatility estimation

EUR/TND	α	β_1	β_2	β_3
2010	0.111214 (1.479965)	-88949102 (-0.881852)	-0.017596 (-1.438287)	1.56E-06 (0.002039)
2012	0.734825 (5.202537)	1.28E+08 (1.919529)	-0.116502 (-5.181082)	0.000785 (0.901498)