Estimating the Volatility Effect of a Tobin Tax

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Abstract

We use minimum price variation rules (tick size rules) in the French stock market to discriminate between stocks with high and low transaction costs. If the stock price exceeds a threshold of 500 francs, the minimal tick size for quotes increases from 10 centimes to 1 franc. The increased tick size induces a considerable transaction cost increase and generates a natural experiment. The average cost of a roundtrip approximately doubles for stocks in the price range of 500 to 600 francs relative to the roundtrip costs for stocks with prices between 400 and 500 francs. We explore if this important increase in transaction costs is accompanied by a reduction in return volatility for the stocks in the high cost regime. Our data show a statistically significant, but economically insignificant reduction in the return volatility for daily, weekly and monthly measures of return volatility. This leads to a pessimistic assessment a security transaction tax as a suitable policy measure to reduce asset return volatility.

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1 Introduction

Financial markets have often been regarded as excessively volatile since Keynes (1936) famous verdict on price destabilizing financial speculation. More empirical research in the 1980s rendered this verdict more convincing to most financial economists (French and Roll (1987), Shiller (1989)). But Keynes' hope that transaction taxes might represent a suitable remedy against excess volatility remains most controversial. Some influential economists like Stiglitz (1989), Summers and Summers (1989), Eichengreen, Tobin and Wyploz (1995) agree with Keynes that such taxes discourage destabilizing investors with short-run horizons while being less costly for stabilizing investors with long-run horizons. Higher trading costs in this perspective privileges trading based on economic fundamentals. Other economist (Dooley (1996), among others) reject this assertion. Short-term speculation in this view is no more destabilizing than low frequency trading. This opposing view contests that the price impact of the speculative traders recedes more than that of the fundamental traders as transaction costs increase.[1] Unfortunately, the theoretical dispute of the stabilizing effect of transaction costs is guided by little evidence on the issue.[2]

While the policy debate remains unresolved important technological changes transform financial markets. Electronic trading systems provide increasingly attractive low costs market access previously reserved to professional traders. Again one may ask if this low cost access encourages destabilizing short-term speculation? Should we expect an overall increase in financial return volatility over the next years as popular market access at low cost comes widespread?

The existing evidence on the linkage between transaction costs and volatility is mostly based on an effort to identify intertemporal transaction cost variations.[3] Mulherin (1990) examines a long-run series of estimated trading costs in the NYSE and relates it to the daily volatility of the Dow Jones returns over the period 1897 to 1987. The data suggest a negative but statistically insignificant correlation. The inconclusive result is hard to interpret. It may result from changes in the underlying market structure or measurement errors for the

[1] For a recent theoretical investigation of this issue see Hau (1998). For a general discussion on the Tobin tax see ul Haq et al. (1996). We are fully aware that a comprehensive discussion of the Tobin tax includes many aspects outside the scope of this paper. However, the linkage between transaction costs and volatility is at the core of the theoretical debate.

[2] Grundfest and Shoven (1991) for example point out that our empirical knowledge is very limited.

[3] An exception is Campbell and Froot (1994). They review the international experiences with transaction taxes by examining such taxes and their change in 20 countries. But their analysis focuses on the impact on trade volume.

estimated transaction costs. Umlauf (1993) contributes an observation from the Swedish transaction tax experience in the 1980s. He finds that neither the introduction of a 1 percent round-trip transaction tax in 1984 nor its increase to 2 percent in 1986 decreased volatility in the Swedish stock market. However, the Swedish tax was collected from domestic security brokers and was increasingly avoided as a large percentage of trading volume in Swedish securities moved to international markets (Campbell and Froot, 1994). Jones and Seguin (1997) report on the liberalization of mandated minimal commission rates in the US. This regulatory change decreased transaction costs in the NYSE and the AMEX markets in 1975. The authors find a reduction in the market volatility in the year following the deregulation, but the same volatility decrease, although less pronounced, is also registered for the previously unregulated Nasdaq market. In general, regulatory changes in transaction costs may coincide with unrelated changes in market volatility. This renders the identification of the transaction cost effect difficult.

This paper provides a ross sectional approach to the role of transaction costs for financial return volatility. We use minimum price variation (tick size) rules to identify exogenous (regulation induced) differences in the transaction costs across stocks. The role of tick size regulation in international stock markets has recently been highlighted by Angel (1997). Most equity markets operate with a step function for the tick size. Tick size increases with the stock price. Each increase in the tick size represents a regime switch with repercussions for the bid-ask spread and the transaction costs for a stock in the respective regime. We can distinguish two different effects of higher tick sizes. First, bid-ask spreads come often relatively close to the average tick size. The minimal tick size regulation is therefore a frequently binding constraint and imposes exogenous differences in transaction costs. Second, higher tick sizes may increase spreads by facilitating market maker collusion. Electronic trading systems generally reward quote improvements with privileged execution (price priority). The costs of such quote improvements in terms of price sacrifice is increased for a higher tick size. Higher tick sizes therefore reduce the incentives for competitive price improvements. This increases spreads and transaction costs. The transaction costs increase due to tick size regulation can be quantitatively large. This allows for a cross sectional identification of different transaction costs within the *same market* and the *same time period.* Unlike previous studies we do not compare volatility measures across different markets or time periods.

Our analysis is based on French stock market data for which the tick size regulation generates a very dramatic discontinuity at the threshold value of 500 French Francs (FF). The minimal tick size increases by a factor 10 from 10 centimes (0.1 FF) to 1 FF as a stock price moves above 500 FF. Our results based on 4 years (1995-1998) of microdata from the French stock market can be summarized as follows:

1. The tick size regime is an important determinant of transaction costs. The tick size regime of 0.1 FF for stock prices between 400 and 500 FF has average roundtrip costs of 61 basis points, while these costs increase to 116 basis points for stock in the price range of 400 to 500 FF to which the 1 FF minimial tick size applies. This increase in the average transaction costs can mostly be attributed to an entire shift of the spread distribution. Censoring at the minimum tick size of 1 FF can at most explains a 20 basis points increase (1 FF of 500 FF). Measuring transaction costs as effective (transaction based) spreads gives very similar results. These results (though quantitatively larger) confirms qualitatively similar evidence from previous studies on other stock markets.

2. The increase in transaction costs induces a statistically significant reduction in the daily, weekly and monthly return volatility. This effect is not yet documented in the literature and marks the most important contribution of our study.

3. The volatility reduction (though statistically significant) is very modest and, in light of the large transaction cost increase, economically insignificant. We find that the average absolute deviation of the stock return from the mean return is approximately 6 to 15 percent lower in the regime 1 with high transaction cost relative to the low cost regime 2. The volatility reduction is similarly small for daily, weekly and monthly measures of absolute return deviations. We conclude that an increase in transaction costs does not lead to a substantial decrease in return volatility. A security transaction tax is therefore unlikely to make a major contribution to financial market stability.

The rest of the paper is organized as follows. Section 2 discusses the role of the tick size regime for transaction costs in more detail and points out differences to tax induced transaction costs. Section 3 describes the institutional framework and the data used in our study. We examine the relationship between tick size regime and average spread in Section 4. Section 5 presents the evidence on the volatility effect of tick size induced transaction costs. Section 6 concludes.

2 Tick Size versus Tax Induced Transaction Costs

The relationship between spreads as transaction cost measures and tick size regulation has been explored in a number of previous studies. Tick size is generally found to be an important determinant of spreads and transaction costs. Smaller tick size decreases quoted and effective spreads.[4] Can tick size regulation then serve as an instrument to identify the volatility effect of a security transaction tax? We can highlight two reasons why transaction costs induced by tick size regulation are not entirely comparable to a security transaction tax. First, both costs affect liquidity providers differently. While a larger minimal spread increases the transaction costs for traders with market orders (similar to a security transaction tax), it also increases the profitability of liquidity provision and generates a more liquid market. Goldstein and Kavajecz (1999) show for the NYSE that the market depth decreases with the adoption of smaller tick size. Ahn, Cao and Choe (1998) find similar results for the tick size change in Toronto Stock Exchange. They report quote size reductions of 26 to 52 percent. A more liquid market is ceteris paribus characterized by a smaller price impact of market orders and lower volatility. The positive liquidity effect of larger minimal tick size is absent if the larger spread is induced by a security transaction tax. In this case the liquidity provision (through limit order submission) itself is subjected to taxation and no increase in liquidity provision can be expected. These consideration lead us to the conjecture that for a similar transaction cost increases, the security transaction tax is less effective in reducing volatility than a transaction cost increase based on tick size regulation. Transaction taxes not only increase transaction costs for market order traders, but they also hurt stabilizing liquidity providers. The volatility reducing effects of transaction costs estimated in our study present therefore an *upper limit* on the volatility reduction due to a security transaction tax.

A second aspect of tick size induced transaction costs increase is its potential non-linearity in the volatility level. The tick size constrain is more likely to be binding in a period of low rather than high volatility. This could imply a negative correlation between the volatility level and the regime specific tick size costs. However, this argument neglects that tick size regulation might facilitate collusion between liquidity providers and therefore shift the entire

[4] Ahn, Cao and Choe (1996) show that a market-wide tick size reduction in the AMEX market generated lower quoted and effective spreads. Bacidore (1997) examines the effect of the change to decimal pricing for stocks traded in the Toronto Stock Exchange. He reports that the reduction of minimal ticks from 12.5 cents (1/8 dollars) to 5 cents for stocks trading above \$5 (Canadian) reduced effective spreads by 20 percent. Bollen and Whaley (1998) analyze the tick size reduction in the NYSE from eighths to sixtheenths in June 1997 and find that quoted spreads fall by 14 percent and effective (volume-weighted) spreads by nearly 9 percent.

distribution of bid ask spread. As pointed out by Harris (1996) the minimal tick size is the price for a limit order trader of obtaining execution priority among traders with the same limit if the trading system has strict price and time priority. A smaller tick size makes it cheaper to obtain execution priority against incoming market orders and this should forster the quote competition among the liquidity provides. We present evidence that the average spread in not only a censoring phenomenon, but indeed shifts the entire spread distribution. The non-linearity of the tick size induced transaction cost is therefore moderate and only a second order effect. We therefore maintain that the volatility effect of transaction costs induced by tick size regulation is informative for the volatility effects of a hypothetical security transaction tax.

3 Institutional Framework and Data

We use French stock market data.[5] This data source presents a number of advantages. First, the fully automated electronic limit order book of the French stock market provides an identical trading mechanism for all stocks. It generates transaction and quote data of high quality.[6] Second, French market regulation induces a dramatic tick size jumps of a factor 10 in a price range relevant for most stocks. By comparison the tick size jump from 1/32 to 1/8 at 10 dollars in the Nasdaq market prior to 1997 concerns mostly small and illiquid stocks.[7] The NYSE tick size breakpoint at 1 dollar is irrelevant for most stocks and would generate even more extrem selection bias. Third, French stock market data do not exhibit any strong correlation between price and market capitalization.[8] A stock selection based on tick size regime is therefore likely to provide a representative sample.

Important for our analysis are the tick size restrictions of the open limit order book. The tick size is a function of the stock price. A stock price between 0 and 5 FF is quoted with a 0.01 FF tick size, a stock price between 5 and 100 FF with a tick size of 0.05 FF, a stock price between 100 and 500 FF with a tick size of 0.1 FF, a stock price between 500 and 5000

[5]Previous studies on the same data source include Benos and Rockinger (1998), Hamelink (1998), Alphonse et Bourghelle (1998).

[6]Price data from Nasdaq for example is entered manually with time lags as long as 90 seconds.

[7]See Bessembinder (2000) for a transaction cost analysis for stocks trading below and above this breakpoint. He finds that the percent (though not the absolute) spread is lower for stocks above the 10 dollar tick size threshold. We suspect that this results from the fact that he did not condition his observation periods to a tight price interval around the tick size jumb, but included all observations periods for stocks which crossed the threshold at some point in 1995.

[8]According to Angel (1997), the French stock exhibited the lowest correlation between price and stock capitalization for the G7 countries.

FF with a tick size of 1 FF and a stock price above 5000 FF is subjected to the maximal tick size of 10 FF. Previous work on the transaction costs in the French market by Chevallier and Longin (1999) show that the discontinuity of the tick size regime has important effects on the average quoted bid-ask spread. The intuition for this result is straightforward. Since the bid-ask spread has to be positive, it cannot be smaller than the minimal tick size imposed by the electronic order book. As the tick size jumps for example at a stock value of 500 FF from 0.1 to 1 FF, it becomes frequently a binding constraint. Even if the inside spread would have been 0.9 FF under the previous tick size, it is now forced to 1 FF. The 0.1 FF are interpreted as an exogenous transaction tax for the trade initiator (market order trader). A second effect is the competitive effect of smaller tick size. As argued in Section 2, smaller tick size can increase quote competition and therefore move the entire spread distribution.

The data are publicly available from the 'Société des Bourse Françaises' (SBF) and comprises information on the limit order book of the electronic trading system for a large sample of stocks over the 4 year period from January 1, 1995 to December 31, 1998. Four complete years of order book data is obtained for 180 stocks.[9] They allow the reconstruction of the continuous bid-ask spread for all trading days. Most all stock prices are in the range from 100 FF to 5000 FF. While the tick sizes of 0.01 FF and 0.05 FF and 10 FF formally exist, only about 8 percent of the observations concern these regimes.[10] Our study therefore focuses on the discontinuity in the tick size at 500 FF. We also have to determine the price interval over which to measure the tick size change. A larger price interval increases the number of observations, but dilutes the effect of the discontinuity measured by tick size over stock price. A 0.1 FF tick size for a stock valued 400 FF corresponds to a 1 FF tick size for the stock valued 4000 FF. We choose a 100 FF price interval around the threshold value of 500 FF.[11] Figure 1 illustrates this jump in the minimal tick size. Plotted are average half-hour quoted spreads for stocks in the price range between 400 and 600 FF. The solid line represents the average spread in the range of 400 to 500 FF and 500 to 600 FF, respectively. The minimal tick size regime change visibly changes the distribution of average half-hour quoted spreads.

Table 1 provides the summary statistics on the selected stocks. The full sample comprises 180 stocks for which 4 years (1995-1998) of quote and transaction data is available. We define

[9] Block trades executed outside the electronic trading system do not enter into our data set. For a documentation of block trade execution at the SBF see Riva (1999).

[10] On stock was subjected to the 0.01 FF regime, 14 stocks were found in the 0.05 FF regime and 1 stock was in the 10 FF regime.

[11] We explored the robustness of this choice and find that a smaller or larger interval does not changed the qualitative outcome of the analysis.

two price intervals $\Delta_1 = [400, 500)$ and $\Delta_2 = [500, 600)$ around the threshold value of 500 FF. The price interval Δ_1 correspond to the minimal tick size of 0.1 FF (regime 1) and the price interval Δ_2 has a 1 FF (regime 2) tick size. Type 1 stocks have a price history for which the mid stock price is continuously in the price interval Δ_1 for at least one month and type 2 stocks are priced in the price interval Δ_2 for at least one month. We obtain 33 type 1 stocks and 32 type 2 stocks. The number of stocks with a price history subjected (alternately) to both regimes is 11. These stocks are referred to as type 3 stocks. Table 1 suggests that the selected stocks are a representative subsample in terms of capitalization, average daily turnover and monthly returns. Stock selection based on the two price interval amounts to random choice of stocks.

Table 2 presents the summary statistics for the individual asset periods in the two regimes. The entire 4 year sample period is divided into time intervals s, corresponding to a day ($f = d$), a week ($f = w$), or a month ($f = m$). Let H_j^f be the set of all asset periods (i, s) in which the midprice P_{it} of asset i is continuously in the price interval Δ_j of regime j. Table 2 states the number of asset periods H_j^f for the three different sampling intervals. We also provide a breakdown of the observations into three size quantiles (small, medium, large) based on the original 180 stocks and measure size by initial stock market capitalization at the beginning of our sample period in January 1995. There are more observations from medium size firms in our two subsamples compared to entire set of stocks. But observations from medium size firms are overrepresented in both regimes subsamples in a similar proportion. Only for large firms do we find relatively more observations in regime 1 compared to regime 2. We also reports the mean and standard deviation of the quoted and effective spread for the two regimes. Both the quoted and effective spreads are more than two times as large for stocks in regime 2 compared to stocks in regime 1. The following section examines these important transaction cost differences in more detail.

4 Bid-Ask Spreads and Tick Size

Our statistical approach is based on the idea that the average transaction spread is artificially inflated by a minimal tick size imposed by the quoting trading mechanism. This section provides evidence that the increase in the minimal tick size for 0.1 FF to 1 FF increases the average percentage spread. Let P_{it} denote the mid price in stock i between the best bid and ask price. Let P_{it}^Q denote the best quoted bid or ask price for asset i. These prices are continuously observed whenever the market order book is open. The (percentage) quoted spread $S_{it}^{Q} = 2\left|P_{it}^{Q} - P_{it}\right|/P_{it}$ denotes the percentage costs of an instantaneous round trip for a small (unit) volume. Let S_{is}^{Q} denote the average percentage quoted spread in period s of length $\Delta T = t_{s+1} - t_s$. Formally,

$$S_{is}^{Q} = \frac{1}{\Delta T}\int_{t_s}^{t_{s+1}} S_{it}^{Q} dt.$$

We also calculate the volume-weighted effective spread S_{is}^{E} based on a actual transactions. Let a transaction r (at a given time) be executed partially at n different prices $P_{ir}^{1}, P_{ir}^{2}...P_{ir}^{n}$ with quantities $V_{ir}^{1}, V_{ir}^{2}...V_{ir}^{n}$. We denote the transaction volume as $V_{ir} = \sum_{j=1}^{n} V_{ir}^{j}$, the mid price prior to execution as P_{ir}, the effective price as $P_{ir}^{E} = \sum_{j=1}^{n} P_{ir}^{j} V_{ir}^{j}/V_{ir}$, and the effective percentage spread of transaction r as $S_{ir}^{E} = 2\left|P_{ir}^{E} - P_{ir}\right|/P_{ir}$. For the m transactions for stock i in period s we obtain the effective volume weighted spread as

$$S_{is}^{E} = \frac{1}{\sum_{r=1}^{m} V_{ir}} \sum_{r=1}^{m} S_{ir}^{E} V_{ir}.$$

Table 3 describes the distribution of both quoted and effective spreads for the two regimes over hourly time intervals. We report the 5, 25, 50, 75 and 95 percent quantile of the spread observations for all stocks as well as for the three subsamples of small, medium and large stocks. The quoted and effective spread quantiles are uniformly larger in regime 2 compared to the corresponding quantiles in regime 1. This indicates that the entire distribution of spreads is shifted by the increase in the tick size. But the increase in transaction costs is clearly most visible for the lower tail of the spread distribution. This is explained by the censoring effect of the minimum tick size which technically eliminates the lowest spreads. Columns (5) and (6) state the p-values of a Wilcox rank test for equality. Equality of the quantiles is clearly rejected for the 5 percent quantile on a 5 percent level and for the 25 and 50 percent quantile on a 10 percent level. Similar results are obtained for the three subsamples of small, medium and large stocks.

We can also capture the regime effect on spreads in a linear regression model. This provides a convenient quantitative assessment of the average effect of the regime change on spreads. Let $S_{is}^{Q/E}$ denote the average hourly bid-ask (quoted or effective) spread of asset i and H_j the set of all hourly spread periods (i, s) for which the mid price P_t of asset i is continuously within one of the two price interval Δ_j $(j = 1, 2)$. Observation periods for which the price crosses into or out of the two price interval are discarded. We define a dummy variable

$$D_{is} = \begin{cases} 1 & \text{if } (i,s) \in H_2 \\ 0 & \text{if } (i,s) \in H_1 \end{cases},$$

which marks all asset periods of the high tick size regime 2. To verify that tick size regime is an important determinant of both the quoted and effective hourly spread we estimate the following linear regression model given by

$$S_{is}^{Q/E} = \alpha D_{is} + \beta X_{is} + \mu_t + \epsilon_{is}. \tag{1}$$

The effect of the tick size regime is measured by the coefficient α. The control variables X_{is} include a constant, dummies for spread periods which are opening hour (10.00 AM to 11.00 AM), dummies for service sector and financial sector assets, and a size measure of stock capitalization at the beginning of the sample period. Opening hours have notoriously higher spreads and this effect is captured by the morning hour dummy. Dummies for different industrial sector are included to capture sector specific spread effects. Industry sectors might for example differ in the degree of asymmetric information among investors reflected in spreads. We examine two different regression specifications. The first specification excludes fixed time effects, while the second specification includes separate fixed effects μ_t for each time period.

Table 4 reports the regression results. The regressions without fixed time effects in columns (1) and (2) have and R-square of approximately 19 percent. Controlling for fixed time effects in columns (3) and (4) increases the R-square to 33 percent for quoted spreads and 37 percent for the effective spreads. All four regression specifications give a similar coefficients for the regime dummy. The regression with the fixed time effects shows a slightly more significant p-values for the regime dummy since time specific spread outliers are wipe out. The dummy variables for the two sectors indicate no statistically significant role for asset sector in the spread determination. However, spreads are negatively correlated with stock capitalization. Controlling for sector effects and market capitalization, we find that the average effective spread based on hourly time intervals (excluding fixed effects) is 60 basis points for the stocks in regime 1, while stocks in regime 2 have an average spread which is approximately twice as large. We conclude that the tick size regime has an economically important and statistically significant impact on both the quoted and effective spread and therefore on transaction costs. We note also that previous proposals for a security transaction tax suggested 50 basis points as a benchmark value for such a tax.

Before presenting the volatility evidence we should emphasize that neither quoted nor effective spreads provide a complete picture of effective execution costs when it comes to large transactions. Traders might divide large trades into a sequence of smaller trades. Any price impact from a sequence of trades is ignored by our transaction cost measure.[12] Our evidence on the difference in the average spread for the two regimes is therefore primarily evidence for execution costs differences for small and medium size orders and may not capture similar changes in execution costs for large orders with a sequential price impact.

5 Volatility Effects of Tick Size

The following section documents the volatility of returns for the two regimes. Distinguished are daily ($f = d$), weekly ($f = w$) and monthly ($f = m$) returns. Formally, let R^f_{is} denote the return of asset i in period s and $\overline{R^f_i}$ the mean asset return for asset i. We only consider asset periods (i, s) for which the mid price P_{it} was continuously in one of the two regimes. We use the following simple linear regression model

$$\left| R^f_{is} - \overline{R^f_i} \right| = \alpha D^f_{is} + \beta X^f_{is} + \mu^f_t + \epsilon^f_{is}, \tag{2}$$

where D^f_{is} is again the dummy variable which marks all observations falling into regime 2. The coefficient α captures the regime and tick size effect on return deviations. The variables X^f_{is} represents a set of independent control variables. These include a constant term, the two sectorial dummies and the market capitalization of each stock at the beginning of the data period. The fundamentals for stocks in different sectors might be characterized by different levels of volatility. Similarly, we do not impose identical volatility levels for stocks of different stock market capitalization.

Table 5 present the regression results under two specifications, namely with and without fixed time effects μ^f_t. Including fixed time effects increases the regression fit considerably. The regime dummy is significant at a 1 percent level for daily and weekly return deviations and at a 3 percent level for monthly return changes. Higher transaction costs therefore decrease both short term and long-run return volatility. The two sectorial dummies are not significantly correlated with average return deviations from their mean. Also stock market capitalization shows only a weak correlation with absolute return changes. [13] But while

[12] Jones and Lipson (1999) argue that decreased tick size at the NYSE in fact increased the effective execution costs for large institutional investors with orders above 100,000 shares.

[13] Suppressing the sector dummies or the measure for stock market capitalization in the regression does not qualitatively change the results for the regime dummy and the constant.

the volatility reduction due to transaction costs is qualitatively unambiguously positive, it is quantitatively small. The constant term provides the measure of the average absolute return deviation form its mean. The estimated regime dummy coefficients imply a volatility reduction of around 6 percent for daily and weekly returns, and 9 percent of monthly returns. In consideration of the relatively large increase of the average spread of approximately 100 percent (or 60 basis points), we can evaluate this as an economically insignificant reduction in return volatility.

The regression in Table 5 compares return volatility across two different subsamples of stocks. One alternative explanation remains a hidden selection bias in the choice of these two stock subsamples. To eliminate the effect of such a hidden selection bias we repeat the regression for the subsample of stocks (type 3 stocks) which produce observations periods in both regimes. The regression coefficient for the regime dummy then picks up only the change in the volatility measure as the same stock switches from one regime to the other. The results are presented in Table 6, which drops the previously insignificant sector dummies as controls. The regime dummy is now significant at an even higher significance levels. The point estimates for the volatility reduction increased somewhat and raise to approximately 12 percent for daily and weekly return deviations and 15 percent for monthly return changes. We consider this still as a modest decrease in volatility in consideration of the large average transaction cost increase.

6 Conclusions

Unlike much of the previous literature we analyze the linkage between transaction costs and return volatility through a cross sectional identification of the transaction costs differences based on exogenous tick size regulation. We show that an increase in the tick size regime at the threshold of 500 FF in the French stock market increases the average quoted and effective spread and therefore the roundtrip costs by approximately 100 percent. While quantitatively large, this finding corresponds to qualitatively similar results in the existing literature. In a second step we use the cross sectional difference in transaction costs induced by tick size regulation to explore the volatility implications. This aspect has not received much attention in previous research in spite of the obvious relationship to the policy debate on the stabilization of asset prices through higher transaction costs. We find that higher transaction costs indeed reduce the stock return volatility. This finding holds for daily, weekly, and monthly measures of returns. However, the volatility reduction is economically small and amounts to only 6 to 15 percent of the average return deviation. This can be considered as an economically insignificant volatility reduction. Furthermore we argue that any security transaction tax does not produce the additional profitability for the liquidity providers which the tick size increase generates. Such a tax should therefore be less effective in reducing volatility than tick size regulation. We draw the conclusion that a security transaction tax is not a suitable policy instrument to reduce return volatility.

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Table 1: Summary Statistics on Stock Selection

The full sample of 180 stocks in Paris stock market is used to select two subsamples. Type 1 stocks have a price history for which the stock price is continuously in the price interval $\Delta_1 = [400, 500)$ (regime 1) for at least one month from 1995 to 1998 and type 2 stocks are priced for at least one month in the interval $\Delta_2 = [500, 600)$ (regime 2). Type 3 stocks are those which have observations in both regimes. The Paris order quotation applies a minimal tick size of 0.1 FF to stocks in regime 1, while stocks in regime 2 are traded with a minimal tick size of 1 FF. For the two stock types we report sector affiliation and market capitalization in January 1995 (in millions of FF). The average daily turnover (in millions of FF) and the monthly return statistics are calculated for those months only in which the stock was priced in the respective regime.

Stock Sampling	All (1)	Type 1 (2)	Type 2 (3)	Type 3 (4)
Stocks by Sector				
Industrial	85	14	9	3
Service	51	13	9	6
Financial	44	6	14	2
All	180	33	32	11
Capitalization				
Mean	28.4	48.5	9.5	17.9
Std. Dev.	60.2	117.5	15.1	61.4
Median	7.0	9.1	5.4	6.3
Av. Turnover				
Mean	0.81	0.71	0.61	0.63
Std. Dev.	0.16	0.15	0.10	0.15
Median	0.76	0.66	0.57	0.58
Return				
Mean	16.11	15.36	14.35	14.39
Std. Dev	0.83	0.71	0.61	0.63
Median	15.00	13.94	12.88	12.98

Table 2: Summary Statistics on Asset Periods

We distinguished stocks price regime 1 with prices (in FF) in the interval $\Delta_1 = [400, 500)$ and stocks price regime 2 with price in the range $\Delta_2 = [500, 600)$. The Paris order quotation applies a minimal tick size of 0.1 FF to stocks in regime 1, while stocks in regime 2 are traded with a minimal tick size of 1 FF. The 4 year sample period (1995-1998) is divided into different time intervals s, corresponding to a day ($f = d$), a week ($f = w$), or a month ($f = m$). Let H_j^f be the set of all asset periods (i, s) in which the mid price P_{it} of asset i is continuously in the price interval Δ_j of regime j. We reports the number of daily, weekly and monthly asset periods H_j^f in each of the two regimes for three different sectors (industrial, service, financial) and three size quantiles (small, medium, large) based on stock capitalization in 1995. Moreover we provides summary statistics (mean, standard deviation, median) for the average quoted spread and the trade-weighted effective spread (in percentage of the asset price) for the asset periods of the two tick size regimes.

Sampling	Daily		Weekly		Monthly	
	Regime 1 (1)	Regime 2 (2)	Regime 1 (3)	Regime 2 (4)	Regime 1 (5)	Regime 2 (6)
Obs. by Sector						
Industrial	4370	3287	863	644	211	156
Service	6134	6605	124	131	293	324
Financial	2814	2071	552	386	134	92
All	13318	11963	2626	2341	638	572
Obs. by Stock Size						
Small	2404	2657	470	514	111	124
Medium	6811	6749	1348	1326	331	328
Large	4103	2557	808	501	196	120
All	13318	11963	2626	2341	638	572
Quoted Spreads						
Mean	0.63	1.23	0.63	1.23	0.63	1.23
Std. Dev.	4.21	3.05	4.13	2.96	4.04	2.91
Median	0.68	1.27	0.67	1.27	0.65	1.25
Effective Spreads						
Mean	0.61	1.16	0.61	1.16	0.61	1.16
Std. Dev.	4.02	3.01	3.97	2.92	3.88	2.87
Median	0.66	1.21	0.66	1.20	0.64	1.19

Table 3: Spread Quantiles Across Tick Size Regimes

The distribution of percentage quoted spreads and (trade-weighted) effective spreads measured over hourly trading intervals is documented in columns (1) to (4). We report the 5, 25, 50, 75 and 95 percent quantiles for the two tick size regimes and both spread measures. Columns (5) and (6) state the p-values of a Wilcox rank test for equality of the quantiles across the two regimes.

	Quoted Spreads		Effective Spreads		Difference Test	
	Regime 1	Regime 2	Regime 1	Regime 2	Quoted	Effective
	(1)	(2)	(3)	(4)	(5)	(6)
All Stocks					p-value	p-value
Q5 (95%)	2.01	2.65	1.98	2.78	0.18	0.20
Q4 (75%)	0.70	1.61	0.70	1.65	0.21	0.23
Q3 (50%)	0.65	1.12	0.66	1.05	0.08	0.07
Q2 (25%)	0.20	0.64	0.24	0.70	0.09	0.09
Q1 (5%)	0.04	0.22	0.04	0.28	0.03	0.04
Small Stocks						
Q5 (95%)	2.14	2.47	2.09	2.82	0.11	0.21
Q4 (75%)	0.71	1.58	0.71	1.67	0.22	0.25
Q3 (50%)	0.65	1.20	0.67	1.05	0.15	0.16
Q2 (25%)	0.24	0.60	0.26	0.73	0.05	0.08
Q1 (5%)	0.05	0.17	0.06	0.30	0.03	0.04
Medium Stocks						
Q5 (95%)	1.82	2.19	1.78	2.71	0.06	0.23
Q4 (75%)	0.70	1.56	0.70	1.64	0.20	0.24
Q3 (50%)	0.65	1.20	0.67	1.05	0.14	0.07
Q2 (25%)	0.20	0.57	0.23	0.70	0.07	0.08
Q1 (5%)	0.04	0.15	0.05	0.28	0.02	0.03
Large Stocks						
Q5 (95%)	2.27	2.70	2.26	2.91	0.15	0.14
Q4 (75%)	0.71	1.59	0.71	1.69	0.07	0.11
Q3 (50%)	0.66	1.22	0.68	1.07	0.02	0.00
Q2 (25%)	0.21	0.58	0.24	0.72	0.03	0.04
Q1 (5%)	0.04	0.15	0.05	0.29	0.01	0.02

Table 4: Quoted and Effective Spreads Across Tick Size Regimes

The percentage quoted spreads S_{is}^{Q} and (trade-weighted) effective spreads S_{is}^{E} measured over hourly trading intervals are regressed on a regime dummy D_{is}, which marks observations subjected to the increased minimal tick size regime of 1 FF (regime 2), and a set of independent variables X_{is} consisting of a constant, two dummies for the industrial sector of the stock, the relative (log) stock market capitalization in January 1995 and dummy for the spread periods in opening hour (10.00 AM to 11.00 AM). We use two specification without and with fixed time effects μ_t for each time interval given by

$$S_{is}^{Q/E} = \alpha D_{is} + \beta X_{is} + \epsilon_{is} \qquad \text{and} \qquad S_{is}^{Q/E} = \alpha D_{is} + \beta X_{is} + \mu_t + \epsilon_{is},$$

respectively. The p-values for the coefficients under a FGLS procedure are indicated in brackets.

	No Fixed Time Effects		Fixed Time Effects	
Spread Type (Dependent Variable)	Quoted (1)	Effective (2)	Quoted (3)	Effective (4)
Dummy Regime 2	0.7969	0.6962	0.8002	0.7516
	(0.0273)	(0.0260)	(0.0201)	(0.0249)
Constant	0.6457	0.5910	0.6501	0.5994
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Dummy Service Sector	−0.0503	−0.0618	−0.0649	−0.0637
	(0.1220)	(0.0941)	(0.1080)	(0.0906)
Dummy Financial Sector	−0.0041	−0.0084	−0.0092	−0.0097
	(0.0748)	(0.0516)	(0.0495)	(0.0511)
Dummy Morning Hour	0.0945	0.0994	0.0860	0.991
	(0.0012)	(0.0008)	(0.0009)	(0.0008)
Capitalization	−0.0089	−0.0090	−0.0092	−0.0093
(in logs relative to mean)	(0.0746)	(0.0701)	(0.0301)	(0.0487)
Observations	151686	151686	151686	151686
Adjusted R^2	0.1842	0.1984	0.3306	0.3680

Table 5: Return Volatility Across Tick Size Regime

We measure the deviation of period s return R_{is}^f from the mean asset return $\overline{R_i^f}$ in asset i for daily, weekly and monthly intervals ($f = d, w, m$). The absolute value of the return deviations are regressed on a regime dummy D_{is}^f, which marks observations subjected to the increased minimal tick size regime of 1 FF (regime 2), and a set of independent variables X_{is}^f consisting of a constant, two dummies for the industrial sector of the stock and the relative (log) stock market capitalization in January 1995. We use two specifications without and with fixed time effects μ_t for each time interval given by

$$\left| R_{is}^f - \overline{R_i^f} \right| = \alpha D_{is}^f + \beta X_{is}^f + \epsilon_{is}^f \qquad \text{and} \qquad \left| R_{is}^f - \overline{R_i^f} \right| = \alpha D_{is}^f + \beta X_{is}^f + \mu_t^f + \epsilon_{is}^f,$$

respectively. The p-values for the coefficients under a FGLS procedure are indicated in brackets.

	No Fixed Time Effects			Fixed Time Effects		
Sampling	Daily (1)	Weekly (2)	Monthly (3)	Daily (4)	Weekly (5)	Monthly (6)
Dummy Regime 2	−0.0133	−0.0136	−0.0265	−0.0133	−0.0155	−0.0297
	(0.0215)	(0.0382)	(0.0531)	(0.0085)	(0.0024)	(0.0301)
Constant	0.1749	0.1921	0.3616	0.2156	0.2541	0.3283
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0004)
Dummy Service Sector	0.0022	0.0030	0.0081	0.0025	0.0032	0.0087
	(0.1649)	(0.1718)	(0.1702)	(0.1345)	(0.1426)	(0.1400)
Dummy Financial Sector	−0.0087	−0.0102	−0.0116	−0.0091	−0.0104	−0.0122
	(0.1311)	(0.1522)	(0.1575)	(0.1302)	(0.1441)	(0.1351)
Capitalization	−0.0009	−0.0015	−0.0032	−0.0013	−0.0019	−0.0035
(in logs relative to mean)	(0.2659)	(0.2027)	(0.1234)	(0.1146)	(0.1005)	(0.0921)
Observations	25281	4967	1210	25281	4967	1210
Adjusted R^2	0.0847	0.0890	0.1465	0.2130	0.2148	0.2421

Table 6: Return Volatility for Regime Switching Stocks

We measure the deviation of period s return R_{is}^f from the mean asset return $\overline{R_i^f}$ in asset i for daily, weekly and monthly intervals ($f = d, w, m$). In this table we consider only the type 3 stocks which switch between regime 1 and 2. The absolute value of the return deviations are regressed on a regime dummy D_{is}^f, which marks observations subjected to the increased minimal tick size regime of 1 FF (regime 2), and a set of independent variables X_{is}^f consisting of a constant, a dummy for the relative (log) stock market capitalization in January 1995. We use two specifications without and with fixed time effects μ_t for each time interval given by

$$\left|R_{is}^f - \overline{R_i^f}\right| = \alpha D_{is}^f + \beta X_{is}^f + \epsilon_{is}^f \qquad \text{and} \qquad \left|R_{is}^f - \overline{R_i^f}\right| = \alpha D_{is}^f + \beta X_{is}^f + \mu_t^f + \epsilon_{is}^f,$$

respectively. The p-values for the coefficients under a FGLS procedure are indicated in brackets.

	No Fixed Time Effects			Fixed Time Effects		
Sampling	Daily	Weekly	Monthly	Daily	Weekly	Monthly
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy Regime 2	−0.0261	−0.0280	−0.0401	−0.0278	−0.0293	−0.0488
	(0.0093)	(0.0142)	(0.0380)	(0.0061)	(0.0084)	(0.0266)
Constant	0.1892	0.2005	0.3210	0.2300	0.2701	0.3314
	(0.0000)	(0.0001)	(0.0002)	(0.0000)	(0.0002)	(0.0006)
Capitalization	−0.0010	−0.0021	−0.0053	−0.0028	−0.0030	−0.0054
(in logs relative to mean)	(0.1516)	(0.1299)	(0.0865)	(0.1301)	(0.0803)	(0.0761)
Observations	4097	801	196	4097	801	196
Adjusted R^2	0.0599	0.0638	0.1011	0.1916	0.2009	0.2314

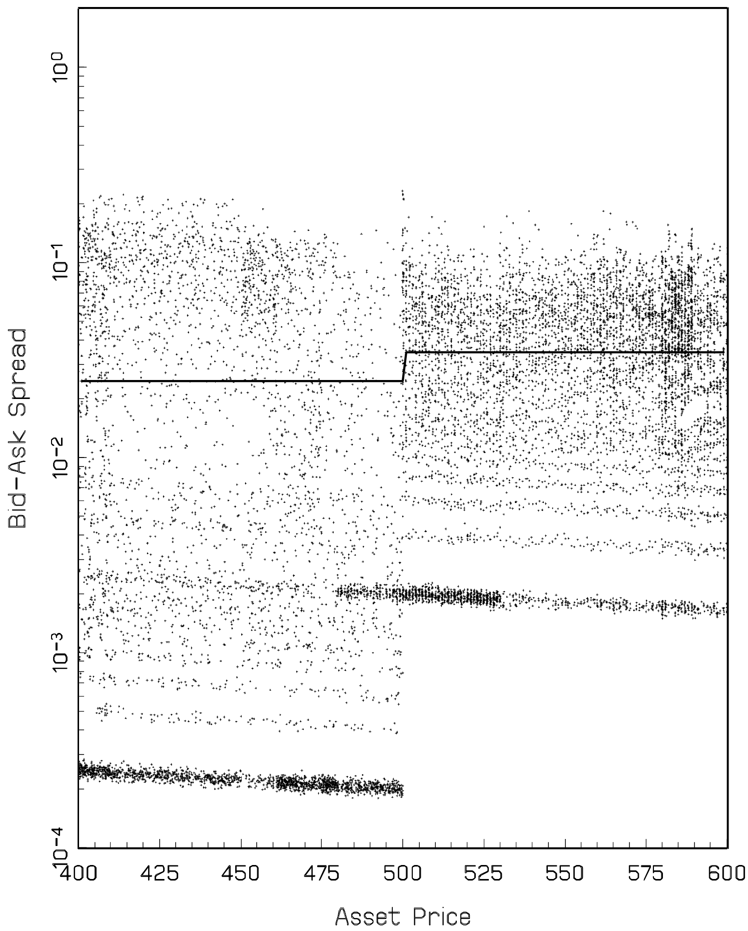

Figure 1: Average quoted spreads (as percentage of the stock price) are plotted for 10,000 randomly sampled halfhour periods among all stocks in the price range from 400 FF to 600 FF. The solid line indicates the average spread for regime 1 with a tick size of 0.1 FF and regime 2 with a tick size of 1 FF. The stock price of 500 FF is the threshold value marking the limit between regime 1 and regime 2. We add a small amound to noise to each observation to render identical points visually distinguishable.