



# Pan European Tick Size Pilot

## An analysis of results

1 July 2009

## **Introduction**

The proliferation of pan European trading has highlighted a number of areas where market participants can work collaboratively to improve the pan European trading structure, such as rationalisation of the various tick size regimes across European trading venues. In December 2008, BATS Europe, in conjunction with Chi-X, Nasdaq OMX Europe and Turquoise, developed a proposal for standardising tick sizes for pan European trading. This proposal was presented to the BATS Europe advisory board, which invited BATS Europe to work with the London Investment Banking Association (LIBA) to bring the proposal to the incumbent stock exchanges in Europe. After lengthy discussions with LIBA, the LSE Group, NYSE Euronext, Deutsche Börse and the above-named MTFs, a number of standard tables were developed, which have since become known as Tables 1, 2, 3 and 4 (see Appendix 1). In March, the Federation of European Stock Exchanges (FESE) joined the discussions, and its members have been polling their customers regarding their preferences. The results of this survey are due on 30 June. Starting on 1 June 2009, Chi-X, followed by Turquoise, then BATS Europe, and finally the LSE and Nasdaq OMX Europe changed tick sizes for a number of European stocks. The changes initiated by Turquoise and BATS Europe were constructed as a pilot on a group of representative FTSE 100 and S&P/MIB stocks considered most in need of tick size reform. This pilot aimed to study the effect of a change in tick size based on actual market data. A description of the market quality metrics used and the analysis performed to date is presented below. It is anticipated that this empirical data will be considered in conjunction with the views of market participants and the results of the FESE consultation.

## **Methodology**

### **Stock selection**

Stocks were selected based on Spread Leeway<sup>1</sup> measurements; Spread Leeway was used by Deutsche Börse as a metric to analyse the FESE tables.<sup>2</sup> In short, a low Spread Leeway suggests that the spread of a stock is being constrained by the tick size while a high Spread Leeway suggests an inability to form price levels on the order book. Spread Leeway offers a starting point to analyse tick sizes, but it does not account for depth, whereas the analysis done by BATS Europe looks at both spread and depth. The Deutsche Börse analysis worked from the premise that the ideal Spread Leeway was between 5 and 19; our analysis uses a more conservative premise that the ideal Spread Leeway is between 3 and 10. A breakdown of observed Spread Leeway across major European indices is shown in Appendix 4. Based on this metric, the Nordic markets as well as constituents of the FTSE 100 and S&P/MIB indices show a very high proportion of stocks with a Spread Leeway less than 3 under the tick schemes of the primary market, making them prime candidates for change. Pilot stocks were chosen from the FTSE 100 and S&P/MIB indices based on having a very low Spread Leeway, in most cases less than 1.

### **Stock grouping**

Measurements were confined to stocks listed on the London Stock Exchange (LSE) and Borsa Italiana (Milan). Stocks were divided into six groups, each consisting of approximately five stocks. There are two control groups, consisting of stocks listed on the LSE and Milan for which no tick size changes were made during the period. There are three additional groups of LSE stocks and one additional group of Milan stocks, each of which had tick size changes during the period. The groupings are shown in Appendix 2; a full chronology of tick size changes is given in Appendix 3.

---

<sup>1</sup> Spread Leeway = (Inside Spread / Tick size) – 1

<sup>2</sup> See email from Dr Miroslav Budimir on 27 March 2009

Broadly, the groupings are as follows:

LSE Special 1: Stocks for which Turquoise changed ticks on 8 June and BATS Europe changed ticks on 15 June

LSE Special 2: Stocks for which BATS Europe changed ticks on 15 June

LSE Special 3: Stocks for which Turquoise changed ticks on 16 June and BATS Europe changed ticks on 22 June

Milan Special: Stocks for which BATS Europe changed ticks on 15 June

Various metrics regarding the spread and depth of the BATS Europe order book were studied, along with average trade sizes for the four largest markets trading the stocks in question; the primary, BATS Europe, Chi-X and Turquoise. The metrics are presented in tabular and graphical form as equal weighted averages for the stocks in each group. Whiskers are presented on the spread graphs, showing the upper and lower quartile boundaries of the datasets.

## Order book quality

Order book quality is studied for the BATS Europe order book, metrics are presented for the inside market (Inside Spread and Inside Depth) and also the Effective Spread for hypothetical orders representing various multiples of Retail Market Size (RMS)<sup>3</sup>. For reference, the average size of an aggressive order in a FTSE 100 stock on entry to BATS Europe is between one and two times RMS.

Samples of the BATS Europe order book are taken every second, recording the following information:

- **Inside Spread** – (offer – bid)/midpoint expressed in basis points.
- **Inside Depth** – The total size available at the best bid and best offer expressed in notional terms and converted to Euros where necessary.
- **Effective Spread** – The Effective Spread is calculated for multiples of RMS. For example, the 4 x RMS Spread is derived as follows:
  - Use the previous close price to determine the number of shares equivalent to €30,000 (4 x €7,500).
  - For each side of the BATS Europe book calculate the Volume Weighted Average Price (VWAP) you would receive for a market order of this many shares.
  - Effective Spread = (VWAP buy – VWAP sell)/midpoint of the inside market.

Unlike the Inside Spread the Effective Spread is a measurement of the **quality of the BATS Europe order book in depth**. If the required size is not available on either side of the book then no spread is recorded for that sample.

Each sample is rolled up into one minute averages for each stock and further rolled up into daily averages for the above mentioned stock groupings.

## Average Trade Size

Average trade sizes (notional traded/number of trades) for continuous market trading on the primary, BATS Europe, Chi-X and Turquoise are presented. Executions from primary market auctions are excluded from the calculation.

---

<sup>3</sup> The Retail Market Size (RMS) is defined as the number of shares equivalent to €7,500 rounded to the nearest share.

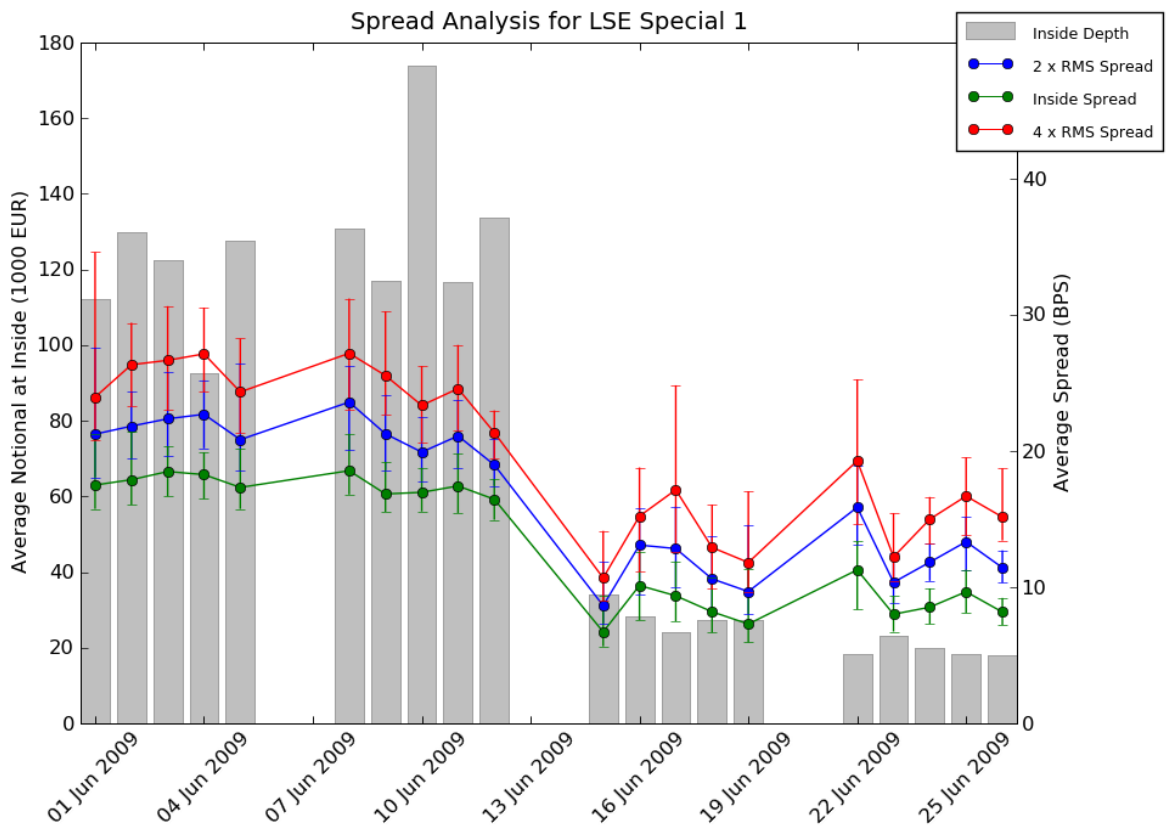
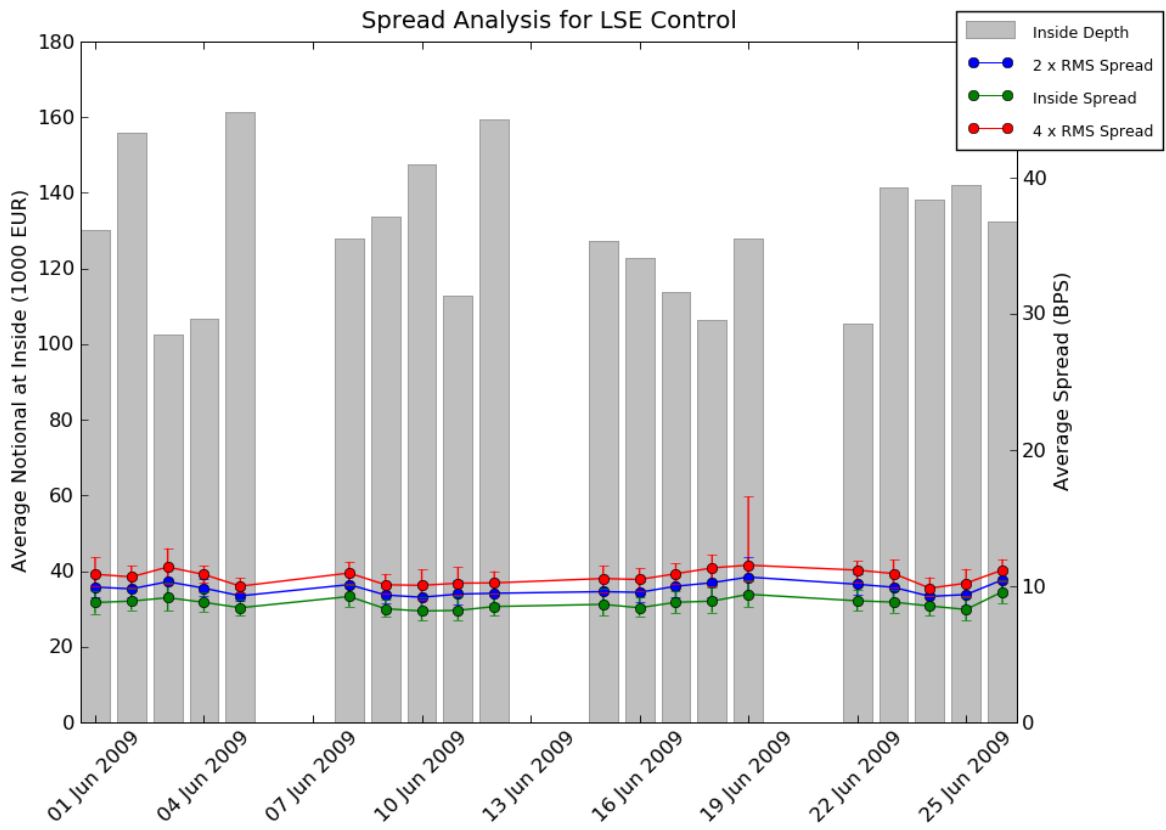
## Results

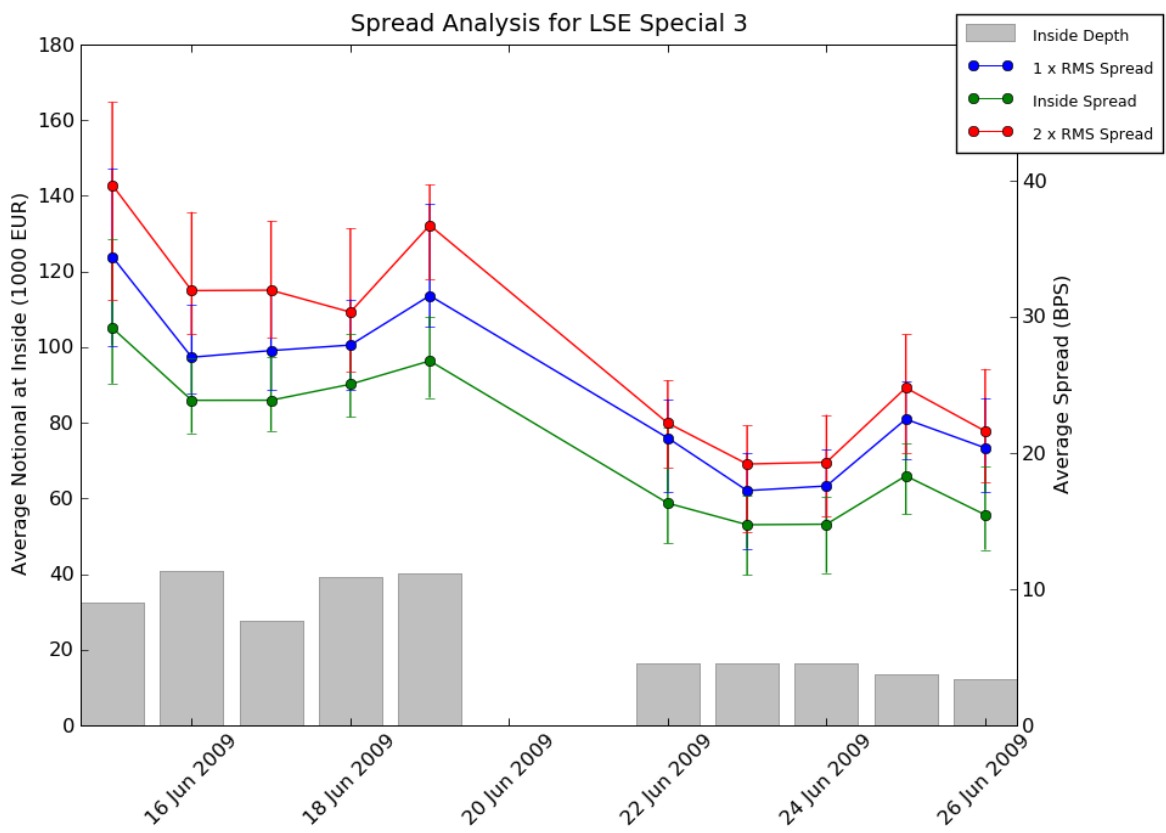
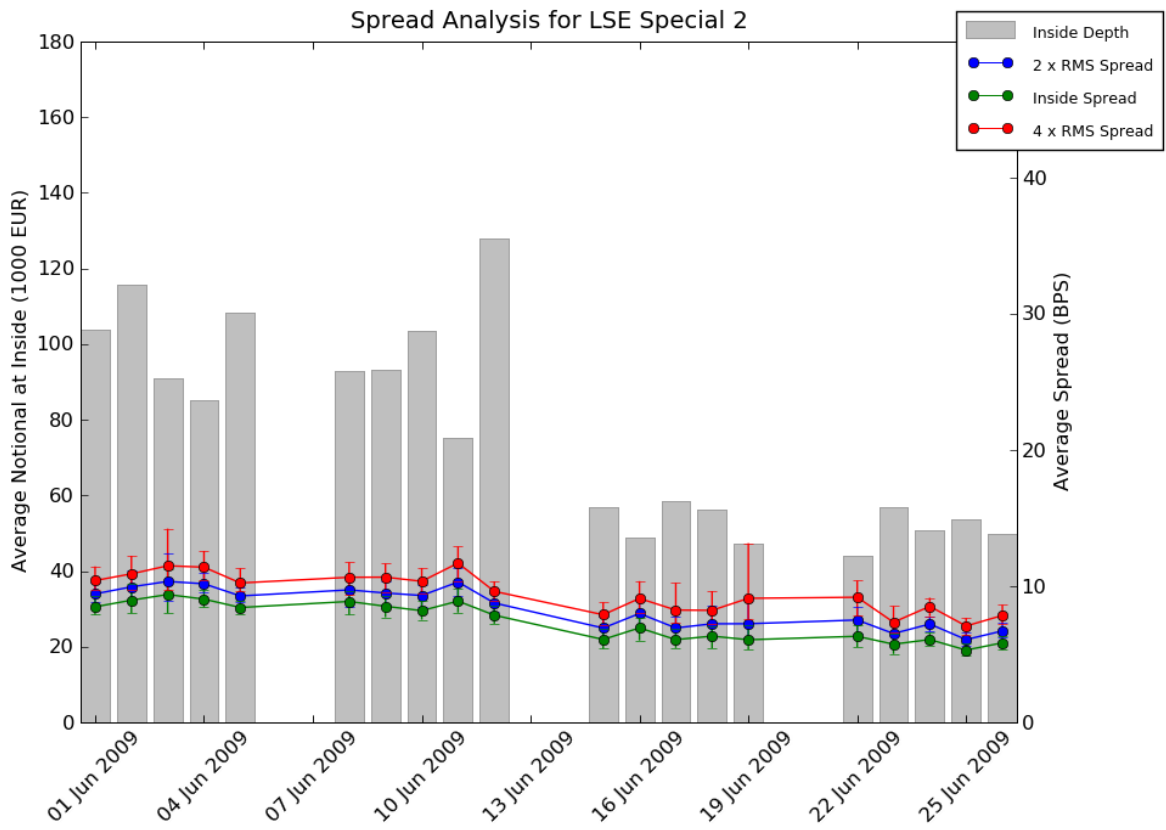
	Week Prior				Pilot Period				Change relative to control			
	Spread (bps)	Inside Depth	2 x RMS Spread (bps)	4 x RMS Spread (bps)	Spread (bps)	Inside Depth	2 x RMS Spread (bps)	4 x RMS Spread (bps)	Spread (bps)	Inside Depth (as %)	2 x RMS Spread (bps)	4 x RMS Spread (bps)
LSE Control	8.5	€ 136,282	9.5	10.3	8.8	€ 125,779	9.9	10.8				
LSE Special 1	17.3	€ 134,406	21.0	24.4	8.7	€ 23,921	11.8	14.6	-8.9	-74%	-9.6	-10.3
LSE Special 2	8.5	€ 98,568	9.5	10.6	6.1	€ 52,303	7.0	8.3	-2.7	-39%	-2.9	-2.8
LSE Special 3	25.8	€ 36,001	29.7	N/A	15.9	€ 14,941	21.4	N/A	-10.2	-51%	-8.7	
Milan Control	13.6	€ 57,645	17.3	21.7	14.1	€ 55,093	16.7	20.4				
Milan Special	10.6	€ 144,801	11.5	12.6	8.2	€ 64,225	9.0	9.9	-2.9	-51%	-1.9	-1.5

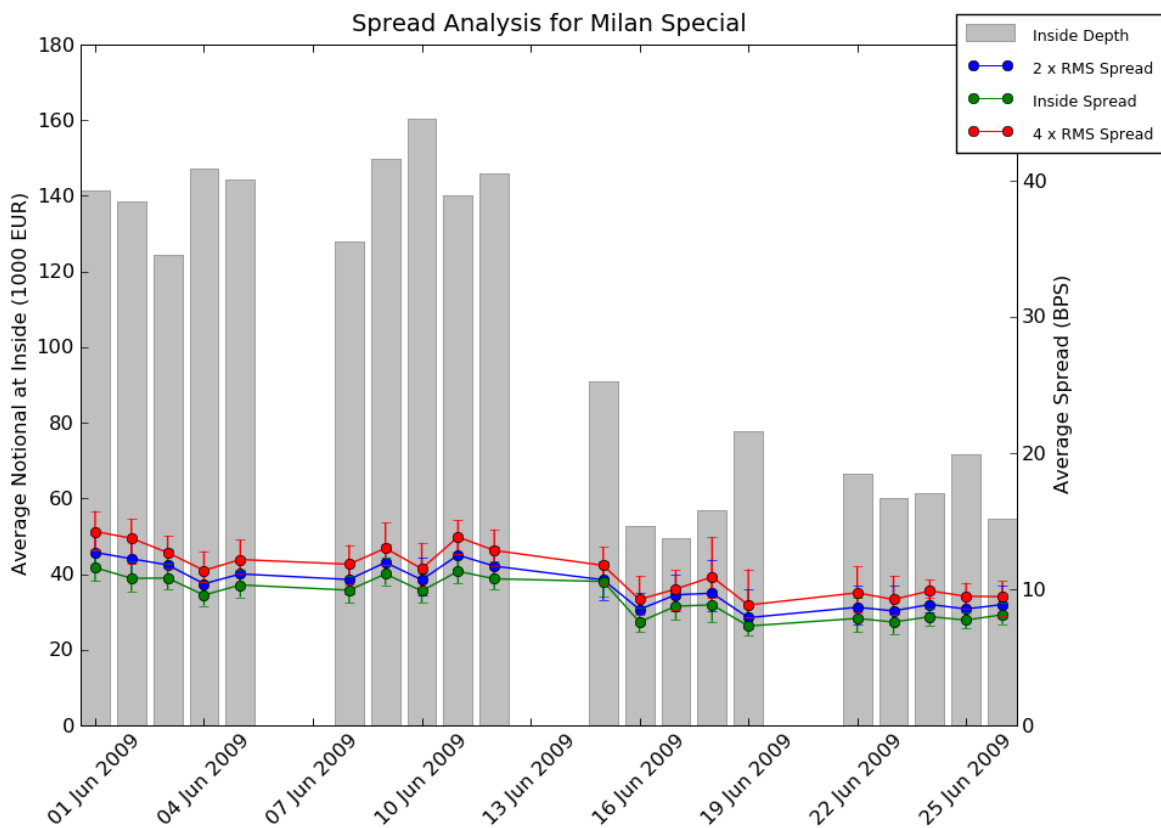
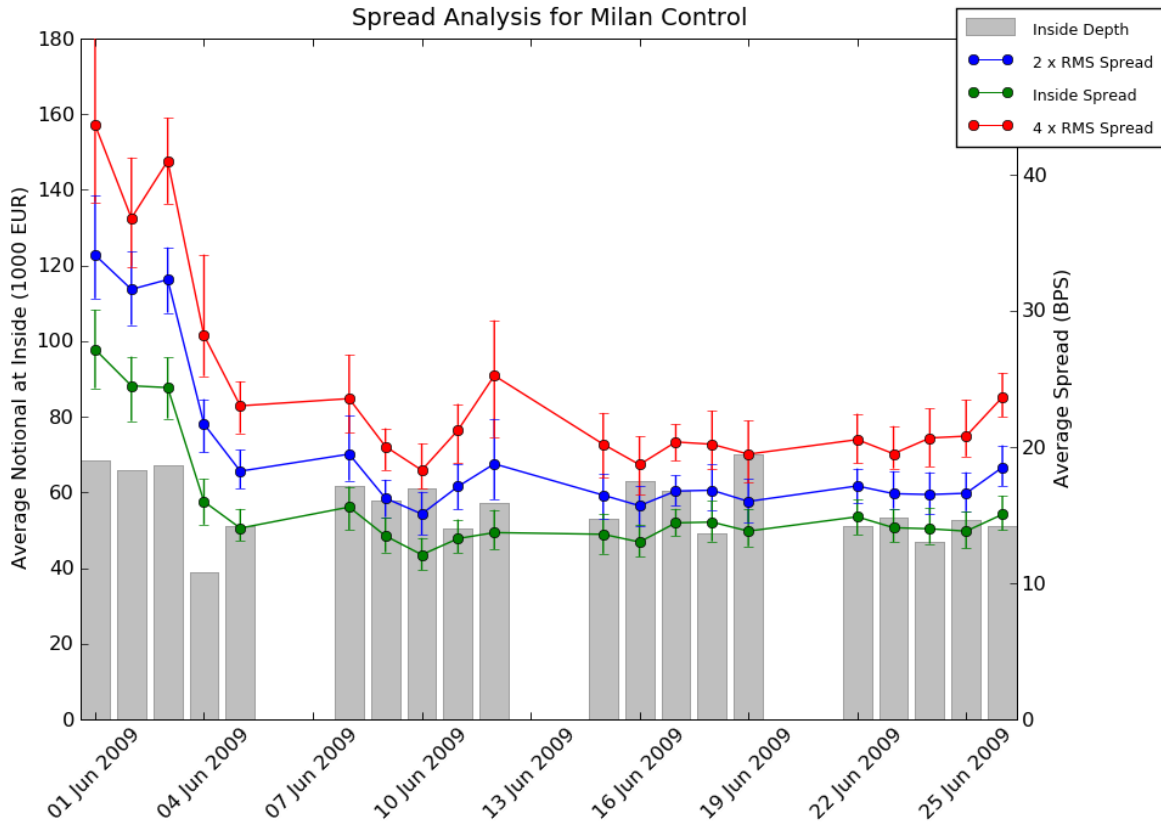
**Table 1: Spread and Depth changes**

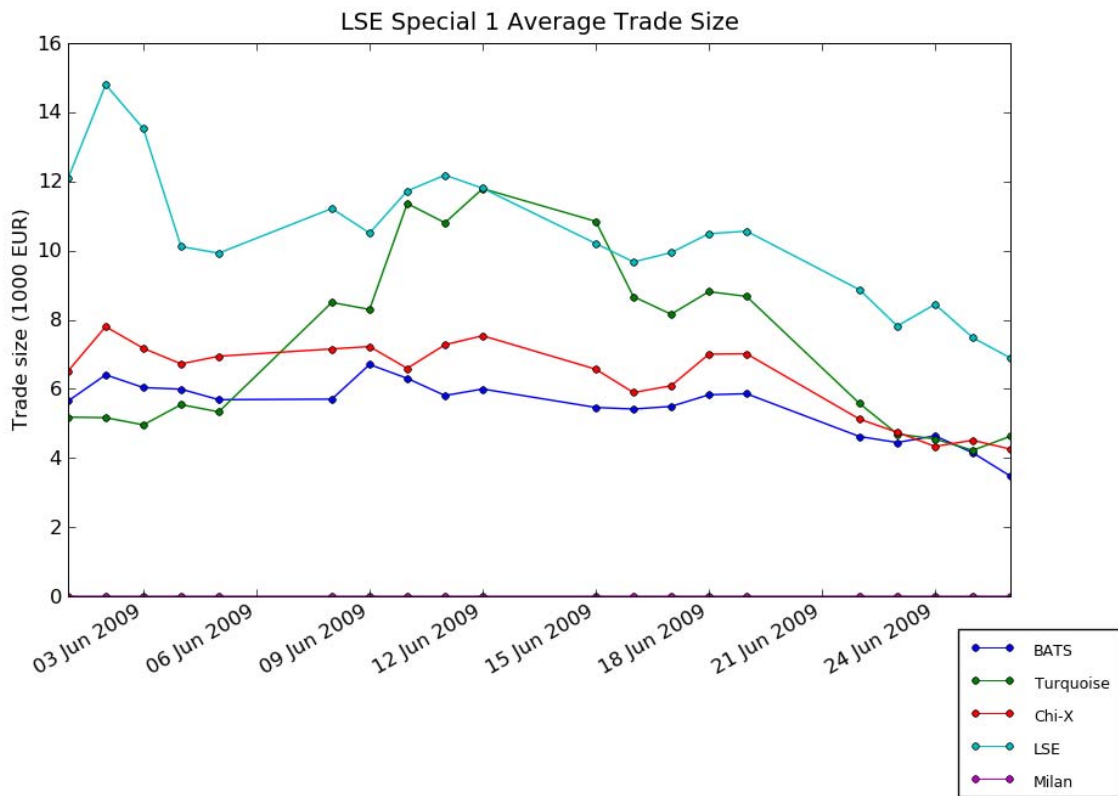
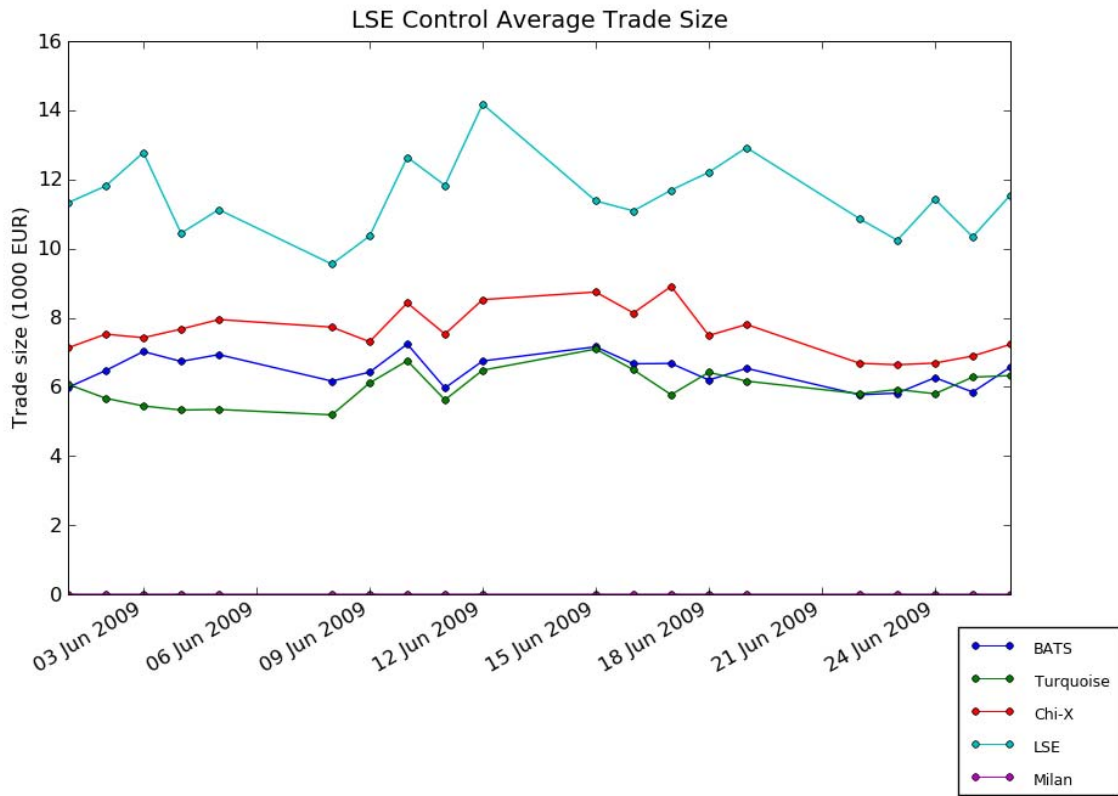
	First week in June				Pilot Period				Change relative to control			
	BATS	Turquoise	Chi-X	Primary	BATS	Turquoise	Chi-X	Primary	BATS	Turquoise	Chi-X	Primary
LSE Control	€ 6,628	€ 5,572	€ 7,537	€ 11,495	€ 6,350	€ 6,148	€ 6,825	€ 10,882				
LSE Special 1	€ 5,952	€ 5,236	€ 7,029	€ 12,088	€ 4,938	€ 7,971	€ 4,594	€ 7,900	-13%	42%	-25%	-29%
LSE Special 2	€ 8,299	€ 7,228	€ 8,322	€ 14,364	€ 7,591	€ 7,623	€ 7,248	€ 12,526	-4%	-5%	-3%	-7%
LSE Special 3	€ 3,164	€ 3,892	€ 3,398	€ 5,145	€ 2,686	€ 4,272	€ 2,621	€ 4,283	-11%	-1%	-13%	-11%
Milan Control	€ 5,506	€ 5,841	€ 6,668	€ 10,411	€ 6,210	€ 7,012	€ 6,243	€ 10,383				
Milan Special	€ 9,271	€ 10,384	€ 11,657	€ 16,394	€ 9,965	€ 10,522	€ 8,721	€ 17,090	-5%	-19%	-19%	5%

**Table 2: Average Trade Size changes**

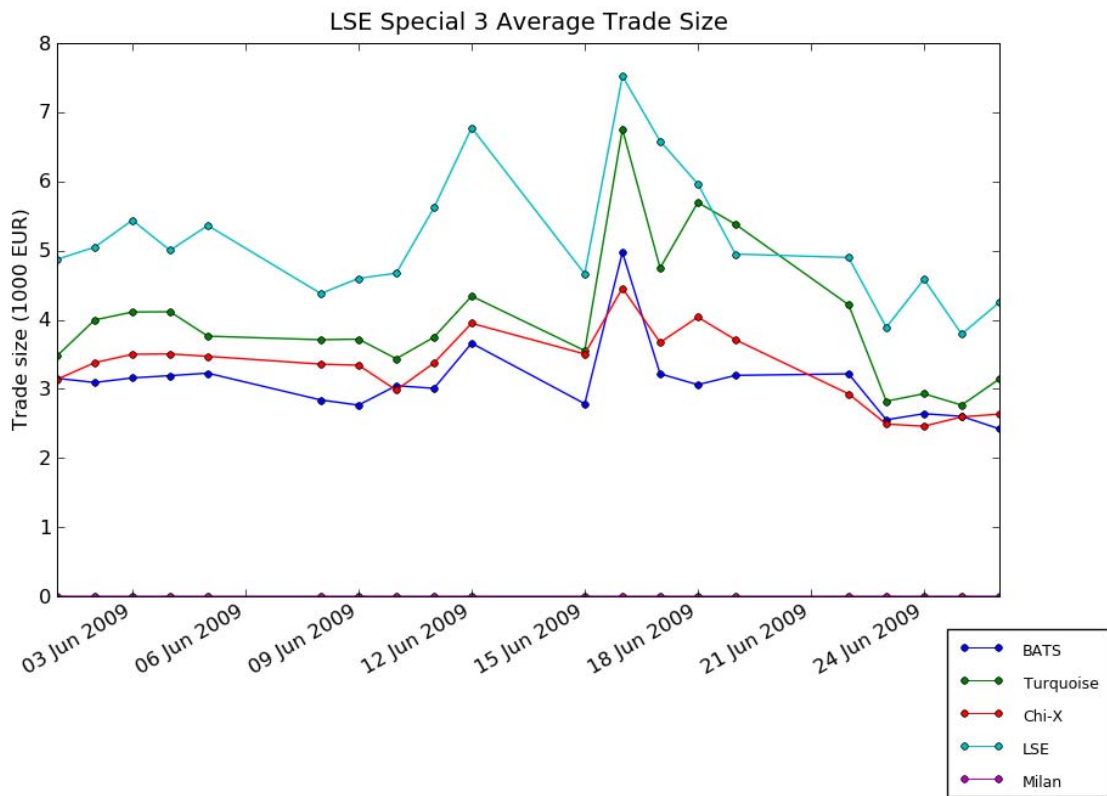
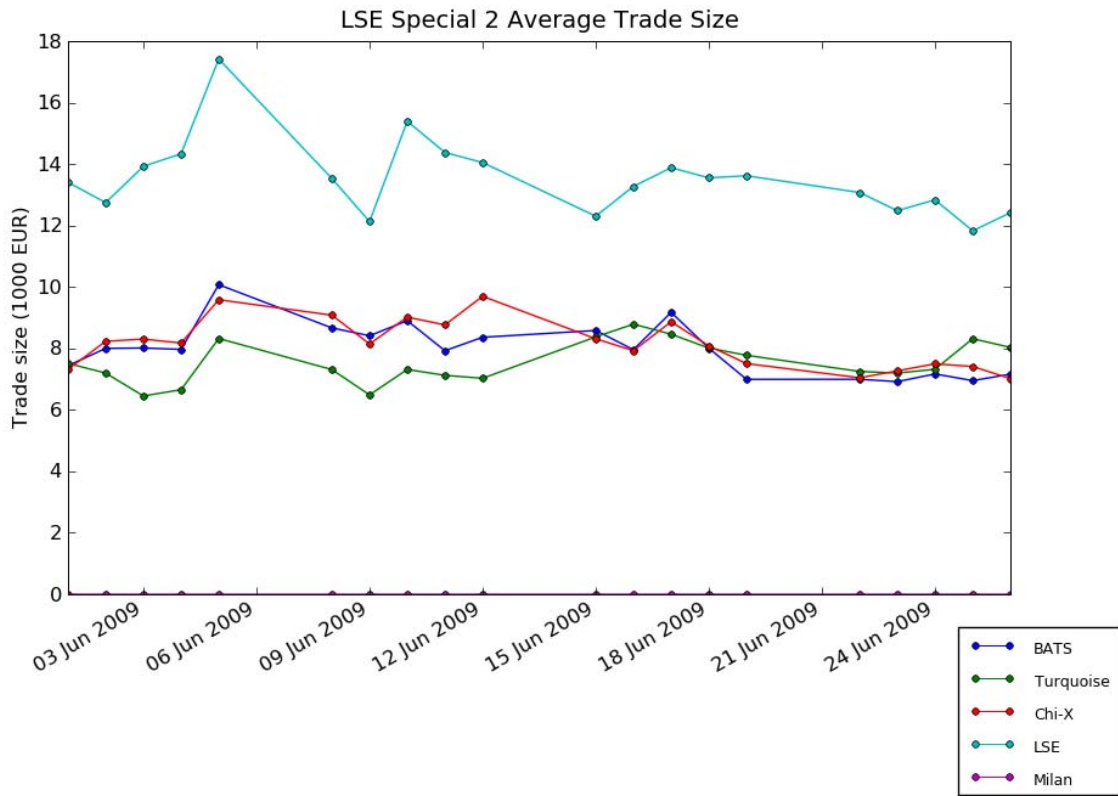


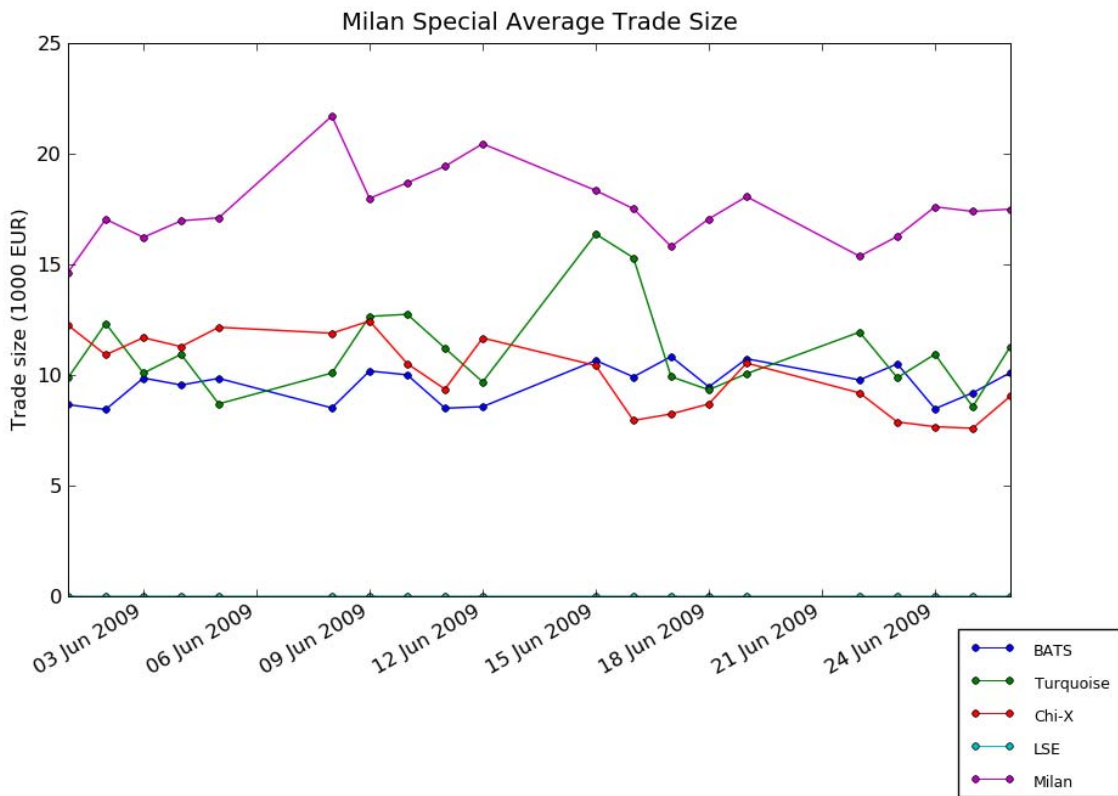
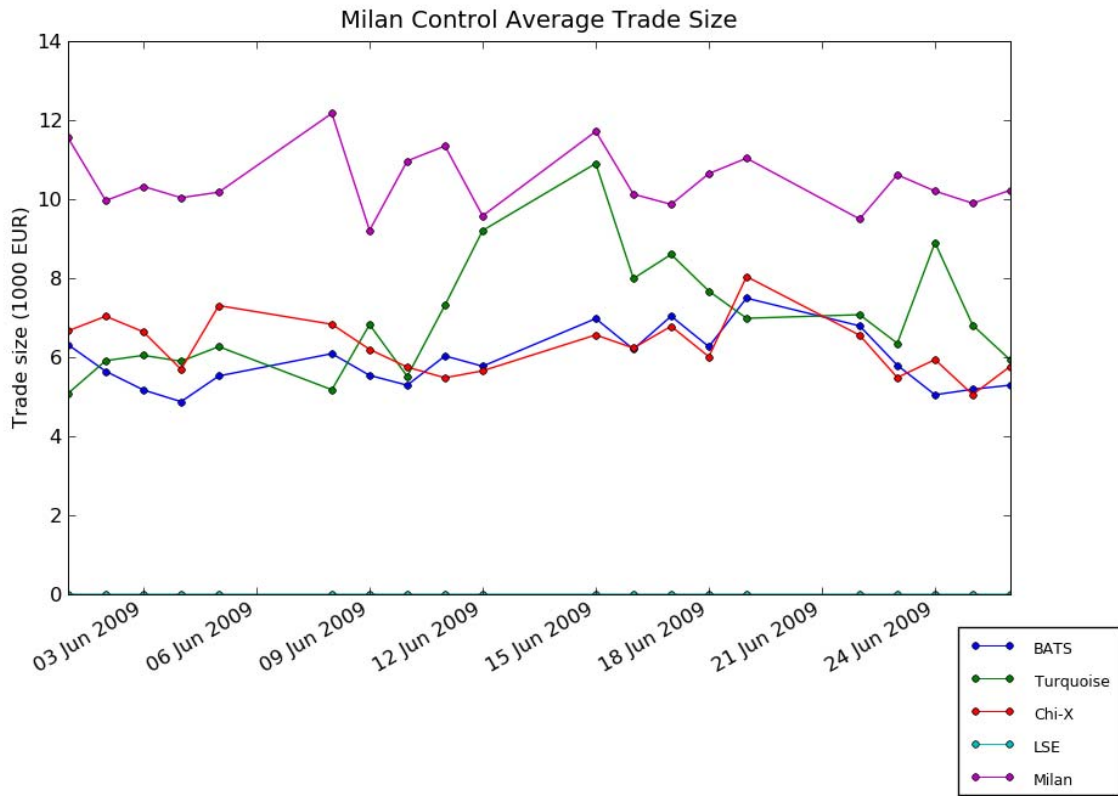












## **Conclusions**

Changes in spread, depth and average trade size were seen for all groups with changed tick sizes, the most dramatic changes being 'LSE Special 1' and 'LSE Special 3'. This is most likely explained by the fact that these two groups had the lowest Spread Leeway prior to the pilot and the largest increase in Spread Leeway during the pilot.

Broadly speaking, the changes across all pilot groups can be summarised as follows:

### *No change in control stocks*

None of the observed metrics changed significantly for the control stocks during the pilot.

### *Reduction in Effective Spread*

There were dramatic reductions in Effective Spread for all pilot groups, corresponding to decreased spread costs borne by investors. The smallest reduction in 2 x RMS Effective Spread was 1.9 bps in the 'Milan Special' group, and the largest was an Effective Spread reduction of 10 bps in the 'LSE Special 1' group. As 2 x RMS is larger than the average aggressive order size entering BATS Europe, these savings were seen generally by price taking participants.

### *Reduction in Inside Spread*

The spread at the inside reduced for all pilot groups, most dramatically in 'LSE Special 1' and 'LSE Special 3', supporting the hypothesis that low Spread Leeway is indicative of the spread being constrained by the tick size.

### *Reduction in Inside Depth*

The notional available at the inside also reduced for all pilot groups, most dramatically in 'LSE Special 1' and 'LSE Special 3'. This metric should be read in conjunction with the reduction in Effective Spread, which suggests that liquidity did not disappear, but rather rested at more price points.

### *Average trade size*

Average trade sizes changed relative to the control groups during the pilot period. The most surprising result was an initial dramatic increase in average trade size on Turquoise for the stocks in 'LSE Special 1', although this has since reverted to be in line with other MTFs. BATS Europe saw small decreases in average trade sizes for all pilot groups, with the LSE and Chi-X seeing significant reductions in average trade sizes for 'LSE Special 1' and 'LSE Special 3'. The largest reduction in average trade size was 'LSE Special 1', driven almost entirely by RBSI and LLOYI, which under Table 1 have a Spread Leeway of respectively 21.6 and 13.9. This observation supports the hypothesis that a Spread Leeway of less than 10 is preferred.

It is worth noting that while these trade size reductions have a direct impact on clearing costs, the clearing cost increase is orders of magnitude smaller than the reduction in Effective Spread.

## Appendix 1: FESE Tables

	Stock Prices		Table 1	Table 2	Table 3	Table 4
	Lower Limit	Upper Limit	Tick Size	Tick Size	Tick Size	Tick Size
Band 1	-	0.4995	0.0001	0.0001	0.0005	0.001
Band 2	0.5	0.999	0.0001	0.0005	0.001	0.001
Band 3	1	4.995	0.0005	0.001	0.005	0.001
Band 4	5	9.99	0.001	0.005	0.01	0.001
Band 5	10	49.95	0.005	0.01	0.05	0.005
Band 6	50	99.9	0.01	0.05	0.1	0.01
Band 7	100	499.5	0.05	0.1	0.5	0.05
Band 8	500	999	0.1	0.5	1	0.05
Band 9	1,000	4,995.00	0.5	1	5	0.05
Band 10	5,000	9,990.00	1	5	10	0.05
Band 11	10,000	99,950.00	5	10	50	0.05
Band 12	100,000		10	50	100	0.05

## Appendix 2: Stock universe

Grouping	Ticker	Price (vwap 8/6/2009)	Inside Spread (bps)	Primary tick	Primary Spread Leeway	Pilot tick	Pilot Spread Leeway
LSE Control	GSKI	1,022.99	4.9	0.5	0.5	0.5	0.5
	VODI	113.08	4.4	0.05	0.7	0.05	0.7
	RDSBI	1,679.40	6.0	1	0.5	0.5	2.0
	BATSI	1,689.13	5.9	1	0.4	0.5	1.8
	BGI	1,122.98	8.9	1	0.4	0.5	1.8
Average			6.0		0.5		1.4
LSE Special 1	BPI	520.22	4.8	0.25	0.4	0.05	6.1
	BARCI	260.78	9.6	0.25	0.3	0.05	5.6
	XTAI	739.91	6.8	0.5	0.8	0.1	7.9
	RBSI	36.50	27.4	0.1	0.1	0.005	21.6
	LLOYI	66.77	15.0	0.1	0.5	0.01	13.9
Average			12.7		0.4		11.0
LSE Special 2	RIOI	2,971.81	3.4	1	1.4	0.5	3.8
	BLTI	1,506.56	6.6	1	0.5	0.5	2.0
	HSBAI	522.90	4.8	0.25	0.6	0.05	6.9
	AALI	1,801.89	5.5	1	0.8	0.5	2.5
	AZNI	2,495.22	4.0	1	1.1	0.5	3.3
Average			4.9		0.9		3.7
LSE Special 3	BTI	91.95	10.9	0.1	0.2	0.01	11.1
	FPI	68.43	14.6	0.1	1.6	0.01	25.4
	LGENI	63.50	15.7	0.1	0.5	0.01	14.2
	OMLI	72.62	13.8	0.1	0.5	0.01	13.7
Average			13.8		0.7		16.1
Milan Control	ISPM	2.53	9.9	0.0025	0.5	0.0005	6.3
	Gm	16.01	6.2	0.01	0.6	0.005	2.2
	TITm	0.97	5.1	0.0005	1.1	0.0001	9.6
	A2Am	1.36	7.3	0.001	0.7	0.0005	2.4
	TRNm	2.58	9.7	0.0025	0.4	0.0005	6.2
Average			7.7		0.7		5.3
Milan Special	ENELm	3.71	6.7	0.0025	0.3	0.0005	5.7
	UCGm	1.94	5.1	0.001	0.4	0.0005	1.8
	ENIm	17.55	5.7	0.01	0.5	0.005	2.1
	SPMm	19.12	5.2	0.01	1.0	0.005	2.9
	Fm	7.75	6.5	0.005	0.7	0.001	7.5
Average			5.9		0.6		4.0

### Appendix 3: Dates

**1 June 2009** – Chi-X changes tick sizes for Danish, Norwegian, Spanish and Swedish stocks to their ‘Eurozone’ tick band.

**8 June 2009** – Turquoise changes tick sizes for Danish, Norwegian, Spanish and Swedish stocks, as well as 5 London stocks (‘Special 1’), all to Table 1.

**15 June 2009** – BATS Europe changes tick sizes for Danish, Norwegian, Spanish and Swedish stocks, as well as 10 London stocks (‘LSE Special 1’ and ‘LSE Special 2’), and 5 Milan stocks (‘Milan Special’), all to Table 1, with the exception of BPI and HSBAL, set to 0.05.

**16 June 2009** - Turquoise changes tick sizes for 5 London stocks (‘LSE Special 3’) to Table 1, changes the tick for BPI and HSBAL to 0.05 and changes ticks for 5 Milan stocks (not tracked in the analysis) to Table 1.

**22 June 2009** –BATS Europe, Chi-X, LSE Nasdaq OMX Europe and Turquoise standardise to the same ticks for 14 London stocks (‘Special 1’, ‘Special 2’ and ‘Special 3’). Turquoise modifies its Milan pilot stocks to match BATS Europe.

### Appendix 4: Spread Leeway of various indices

Index	Primary				Table 1				Table 2			
	Average	Count			Average	Count			Average	Count		
	Spread Leeway	Too small	Optimal	Too large	Spread Leeway	Too small	Optimal	Too large	Spread Leeway	Too small	Optimal	Too large
AEX	5.3	10	12	3	4.2	11	12	2	0.9	23	2	0
AMX	13.4	0	13	11	21.9	0	8	16	8.2	7	10	7
BEL	14.9	4	12	6	8.8	3	15	4	2.4	17	4	1
CAC	4.7	10	23	2	3.7	11	24	0	1.0	35	0	0
CACNX	17.3	3	9	8	8.8	3	10	7	2.7	14	5	1
DAX	3.3	19	10	1	4.6	8	22	0	1.1	27	3	0
FTSE100	1.0	99	3	0	7.6	20	57	25	2.2	75	26	1
FTSE250	4.7	135	72	32	31.6	1	36	202	11.5	31	119	89
MDAX	5.9	24	19	7	15.0	0	22	28	5.3	16	27	7
MIB	1.1	38	2	0	7.0	10	20	10	2.0	32	8	0
OBX	0.9	24	1	0	14.5	0	7	18	3.9	14	10	1
OMXC	0.5	20	0	0	15.4	0	7	13	5.9	3	14	3
OMXH	1.2	25	0	0	11.4	6	12	7	3.1	22	0	3
OMXS	1.8	26	3	0	19.5	1	6	22	4.8	9	18	2

This table shows the average Spread Leeway for major European Indices, as well as a count of the number of stocks in the index with an ‘optimal’ leeway (between 3 and 10) as well the number of stocks with a Spread Leeway that is too small or too large. The analysis is shown using current (pre-pilot) primary exchange ticks, as well as current spread information, but with tick sizes taken from Table 1 and Table 2.