



Do Computerized Traders Follow Social Norms? Evidence from the Holocaust Remembrance Moment of Silence

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Abstract Our paper employs a unique social setting, in which human activity halts during a siren alarm for two minutes to commemorate the Israeli Holocaust Remembrance Day. When the siren sounds, the social norm is to cease all activity and stand still for two minutes. The memorial siren occurs during the trading hours of the stock market, which remains open during the two-minute period. This creates a quasi-natural experiment to examine how computerized traders react when most human activity has ceased. As expected, we document a significant decline in human trading activity during the siren. Remarkably, however, computerized traders decrease their trading activity as well. Moreover, their share as takers does not significantly increase. Our findings suggest that computers alter their trading patterns in sync with humans who are affected by various norms; hence, bias-free computerized trading should not be taken for granted.

Research Questions:

What happens in a market in which human traders (or at least most of them) cease to trade?

CTs should not be influenced by the social norms that apply to human traders. Do they respond by changing their behavior or trading strategy?

Descriptive Statistics for the Entire Data Set

Periods	(1)	(2)	(3)	(4)	(5)
	Holocaust Remembrance Day	3-trading days prior	3-trading days post	3-months prior	3-months post
	Average	Average	Average	Average	Average
(1) Number of daily transactions	52,708.3	55,997.2	52,893.3	54,361.5	53,569.4
(2) Number of daily transactions by trader group					
AT	18,862.3	19,912.5	18,989.2	19,141.4	19,018.9
Human Inst'	11,386.6	11,440.4	11,108.5	11,466.5	11,475.5
Other Human	22,459.5	24,644.2	22,795.6	23,753.6	23,075.0
(3) Average daily trading volume (NIS millions)	1,026.2	1,072.6	1,017.0	1,018.1	1,024.2
(4) Average daily trading volume (NIS millions) by trader group					
AT	368.0	393.5	386.4	367.0	365.8
Human Inst'	283.1	265.0	251.4	260.3	255.5
Other Human	375.1	414.1	379.1	390.8	402.9
(5) Average daily number of orders	840,121.9	835,416.2	816,725.8	822,944.4	857,310.1
(6) Average daily number of orders by trader group					
AT	717,038.2	710,139.3	697,721.9	688,087.8	728,441.6
Human Inst'	50,817.7	48,934.0	46,965.1	59,289.0	51,291.7
Other Human	72,266.1	76,342.9	72,038.8	75,567.6	77,576.9

Appendix. The table presents the average number of daily transactions on the TASE (row 1), the average daily trading volume on the TASE (in NIS millions) (row 3), and the average daily number of orders (row 5) on Holocaust Remembrance Day (column 1) for the period from 2008 to 2020. The data are then compared to the daily average of the three full trading days prior (column 2) and post (column 3) Holocaust Remembrance Day and three calendar months' average prior (column 4) and post (column 5) the day. Columns 2, 3, 4, 5 present the average figures and the z-value of the difference (Prob > |z|). We used the Wilcoxon signed rank test to test the null hypothesis that there is no difference in the average number of daily transactions, the average daily trading volume (NIS millions), or the average daily number of orders that result from decisions taken due to an exogenous factor (the siren). The average number of daily transactions is presented by trader group (AT, Human Institutional, and Other) in absolute terms (row 2). The average daily trading volume is presented by trader group in absolute terms (row 4). The average daily number of orders is presented by trader group in absolute terms (row 6). Note that each counterparty in a trade is recorded as having performed one-half of the trade, so that the total across counterparties sums to the total number of trades.

Change in Overall Orders Submitted

	(1)	(2)	(3)	(4)
Siren1	-701.75*** (107.51)	-524.83*** (100.66)	-51.06*** (10.30)	-126.08*** (9.55)
Siren2	-1010.09*** (168.04)	-792.92*** (163.83)	-62.14*** (10.21)	-155.24*** (12.66)
Day fixed effects	YES	YES	YES	YES
Observations	890	890	889	889
Adjusted R ² (%)	70.62	71.78	28.32	16.09

Table.2. reports the results of OLS panel regressions that test whether there is an appreciable change in orders submitted during the Remembrance Day two-minute siren. The sample consists of all traded equities on the TASE during the continuous trading phase between 09:45 and 11:00. The dependent variable is the total number of orders in each minute during the period. Siren1, Siren2 are dummy variables indicating the first and the second minutes of the siren respectively. Columns 2, 3, and 4, each restrict the sample for the specific trading group – AT, human institutional, other human respectively. *** indicates statistical significance at the 0.001 level. Robust standard errors, clustered at the Remembrance Day level, appear in parentheses below the coefficients.

Descriptive Statistics for the Two-Minute Siren

	(1)	(2)	(3)	(4)	(5)
	10:00	10:01	9:45-11:00	z-value of the (3) – (1) difference (Prob > z)	z-value of the (3) – (2) difference (Prob > z)
(1) Number of transactions per Minute	37.6	11.7	122.6	5.180 (<0.001)	5.925 (<0.001)
(2) Number of transactions per minute by trader group					
AT	14.3	4.2	45.1	4.485 (<0.001)	5.865 (<0.001)
Human Inst'	5.9	1.4	17.4	4.166 (<0.001)	5.865 (<0.001)
Other Human	17.5	6.1	60.2	5.404 (<0.001)	5.921 (<0.001)
(3) Average trading volume per minute (NIS)	602,034.3	152,729.0	2,148,788.6	4.800 (<0.001)	5.906 (<0.001)
(4) Average trading volume (NIS) by trader group					
AT	223,135.1	52,801.4	765,575.5	4.306 (<0.001)	5.858 (<0.001)
Human Inst'	91,468.3	15,730.6	427,382.4	4.269 (<0.001)	5.739 (<0.001)
Other Human	287,430.9	84,197.0	955,830.7	4.553 (<0.001)	5.830 (<0.001)
(5) Average number of orders per minute	1,846.1	1,537.8	2,569.0	1.826 (0.0678)	2.554 (0.0106)
(6) Average number of orders per minute by trader group					
AT	1,745.6	1,477.5	2,291.5	1.420 (0.1556)	2.182 (0.0291)
Human Inst'	45.3	34.3	96.6	3.074 (0.0021)	3.798 (0.001)
Other Human	55.2	26.0	180.9	5.772 (<0.001)	5.952 (<0.001)
(7) Average share of 'Takers' per minute by type of trader					
AT	25.7%	42.2%	32.7%	0.513 (0.608)	-0.699 (0.484)
Human Inst'	14.5%	10.0%	15.0%	0.046 (0.964)	0.485 (0.628)
Other Human	59.8%	47.8%	52.3%	-0.514 (0.607)	0.312 (0.755)

Table 1. The table presents the average number of transactions per minute on the TASE (row 1), the average trading volume per minute on the TASE (in NIS millions) (row 3) and the average number of orders per minute (row 5) on the Holocaust Remembrance. The data are compiled for the first minute of the siren (10:00) (column 1), the second minute of the siren (column 2) (10:01), and the control period (09:45-11:00 excluding the two-minute siren time frame) (column 3). Wilcoxon signed rank was employed to test the null hypothesis that there is no difference in the average number of transactions per minute, the average trading volume per minute (NIS) and the average number of orders per minute on the Holocaust Remembrance Day in comparison to the control period (columns 4, 5). The average number of transactions per minute, average trading volume per minute and the average number of orders per minute by trader type are shown in absolute terms (rows 2, 4, 6, respectively). The average share of Takers per minute by trader group (row 7) is an indicator of the change in active trading activity of the respective groups of traders. It is calculated by taking the mean over years of the minute percent of taker trades for each trader category on each period. Note that each counterparty in a trade is recorded as having executed one-half of the trade, so that the total across counterparties sums to the total number of trades.

Taker-Maker Matrix in the Control Period by Share of Trading

Activity per Minute

Makers	AT	Human Inst'	Other	Sum of Takers
AT	12.6%	4.7%	16.7%	34.1%
Human Inst'	6.8%	2.1%	6.5%	15.4%
Other	20.1%	6.0%	24.4%	50.5%

Table 3 (a). shows the respective shares of transactions completed by each pair of traders by group of all transactions completed per minute in the control period [9:45-11:00 excluding the two-minute siren time frame] on Holocaust Remembrance Day in the period from 2008 to 2020, in a Taker-Maker matrix. The columns show each trader group acting as Makers for the trades in the sample. The rows show each trader group acting as Takers for the trades in the sample. To illustrate, ATs acted as Makers with institutional traders acting as Takers in 6.81% of all trades in this period.

Taker-Maker Matrix During the Two-Minute Siren, by Share of

Trading Activity per Minute

Makers	AT	Human Inst'	Other	Sum of Takers	z-value of the (3b) – (3a) Sum of Takers difference (Prob > z)
AT	13.3%	7.6%	19.4%	40.3%	0.3213 (0.748)
Human Inst'	5.1%	1.7%	5.2%	12%	-0.2468 (0.805)
Other	16.2%	8.3%	23.1%	47.6%	-0.1408 (0.888)

Table 3 (b). shows the respective shares of transactions completed by each pair of traders by group per minute in the two-minute siren time frame, in a Taker-Maker matrix. The columns show each trader group acting as Makers for the trades in the sample. The rows show each trader group acting as Takers for the trades in the sample. To illustrate, the share of trades in which ATs acted as Makers with ATs acting as Takers is 13.3%.

Conclusions – Using proprietary trading data, we find that not only human traders cease their trading activities During the moment of silence, machines seem to halt their activity as well. Moreover, CTs that continue to trade do not seem to benefit from doing so. This project introduces the novel idea that human norms may be infused within CTs' algorithms.