Round-number biases and informed trading in global markets☆

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A B S T R A C T

This paper investigates whether informed trading matters to round-number biases. We document the global presence of round-number biases by showing excessive buying (selling) pressure immediately below (above) a rounded threshold. Additionally, we demonstrate that trades surrounding 0-ending prices are likely to be initiated by informed traders who tend to buy (sell) at 9-ending (1-ending) prices. Moreover, small-sized (medium-sized) trades with 1-ending or 9-ending prices are revealed to be more informative and conducted persistently. Collectively, these findings seem to suggest that informed investors strategically engage in stealth trading by leveraging round-number biases of liquidity traders, which indirectly drives this anomaly in global markets.

The stock market has raced to record highs this year, but your portfolio may not show it. "The greatest risk is not the volatility of the market but the volatility of your own behavior," says Daniel Crosby, a behavioral finance expert and founder of the investment management firm Nocturne Capital…

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1. Introduction

Research has identified a variety of psychological factors that are most likely to drag down our investment returns. One of them is cognitive limitation, which affects individual trading behaviors on top of the full rationality of the agents (Simon, 1995). To simplify an investment decision, people often develop the heuristics by taking round numbers as reference points for value comparison. This is consistent with Wieseke, Kolberg, and Schons (2016) arguing round numbers as cognitive shortcuts due to the convenience effect. If so, a small decrease (9-ending prices) or increase (1-ending prices) from round-number (0-ending) prices would alter traders' perception on costs, subsequently triggering waves of buying or selling. Such irrational behavior, dubbed round-number biases in this paper, would cause a sizable wealth transfer of liquidity traders, which approximates to -$813 million per year in U.S. (Bhattacharya, Holden, & Jacobsen, 2012). Given the heavy price paid by retail investors subject to round-number heuristics, it is worth exploring whether this psychological bias prevails in the international market rather than U.S. alone.

Numerous marketing literature uncovers that round-number biases extensively happen in the market of commercial goods and services, such as used car markets (Lacetera, Pope, & Sydnor, 2012). However, limited work on this topic is done in financial markets where only Bhattacharya et al. (2012) show the excess buying (selling) at all prices one penny below (above) round numbers in U.S. and Kuo, Lin, and Zhao (2015) identify a disproportionately large volume of limit orders submitted at round numbers in Taiwan. Although both papers explain why such anomaly arises, the question as to who can benefit from the loss of liquidity traders remains unanswered. Therefore, we are motivated to look for evidence to ascertain whether informed investors gain by taking advantage of this biased behavior of uninformed traders, a relatively untapped area in the literature.

Specifically, the informed may tend to favor the stealth trading with 1-ending (9-ending) prices because doing so allows them to camouflage their trades effectively among the uninformed. As a result, informed investors are able to make profit from round-number biases of retail traders conditional on their private information. Meanwhile, informed trading at 1-ending (9-ending) prices would intensify the manifestation of round-number anomalies in stock markets. In this sense, the round-number bias is attributable, at least in part, to the actions of informed traders capitalizing on the irrational behavior of liquidity traders. Such indirect interpretation is somewhat distinct from Bhattacharya et al. (2012) who link round-number biases with left-digit effects, threshold effects, and cluster undercutting effects.

Our development of the information-based story is in line with several related studies on informed trading. First, as documented by

Table 1
Sample selection and distribution.

Panel A: Sample selection

		Country	Stock	Obs
Initial sample during Jan-Mar 2016, extracted from Bloomberg		62	3827	361,700,000
Less:	Stocks with daily trades < 10	(10)	(1052)	(157,520)
	Stocks without all ending digits from 0 to 9	(11)	(146)	(2,422,838)
Final Sample		41	2629	359,136,765

Panel B: Sample distribution and trading-activity statistics by countries

	Obs	Stock	Days	Trades	Price	Size	Volume
Argentina	216,690	10	60	361	70	2209	41,006
Australia	42,617,213	199	61	3526	11	777	2815
Austria	1,082,424	20	61	887	25	408	4590
Brazil	45,827,437	61	60	12,521	19	348	4350
Canada	37,985,415	240	62	2556	32	243	4932
Chile	386,218	29	63	231	3088	90,726	6,451,495
Colombia	98,389	22	60	78	14,143	9834	60,581,607
Czech	133,099	11	62	195	1765	477	148,678
Egypt	914,904	37	63	393	12	8713	29,396
Germany	12,160,172	30	62	6538	67	430	13,904
Greece	1,331,388	47	60	473	4	1487	1327
Hong Kong	13,739,777	50	59	4661	34	5599	75,392
Hungary	231,724	11	60	351	4338	1117	1,118,911
Indonesia	7,256,963	38	61	3131	7430	7351	17,275,986
Ireland	529,145	25	62	342	11	3645	4682
Israel	1,572,822	26	64	945	16,955	1508	1,599,537
Japan	67,903,443	225	61	4948	2090	2615	1,485,107
Jordan	151,158	51	65	47	2	1521	2133
Kenya	36,394	11	62	53	54	13,489	603,184
Kuwait	145,784	59	63	40	152	33,379	3,158,461
Mexico	10,034,257	36	60	4647	88	697	28,435
Nigeria	43,144	14	62	50	4	345,427	1,132,245
Norway	4,715,372	25	61	3094	110	870	31,409
Oman	40,136	17	65	39	0	20,351	4305
Pakistan	1,443,699	78	63	294	160	3692	233,540
Philippines	1,785,518	30	60	992	278	3728	82,872
Poland	4,277,417	279	61	252	52	681	3760
Qatar	192,823	20	63	156	67	1719	70,230
Romania	22,468	3	64	117	6	13,846	16,798
Saudi	4,409,863	166	65	409	29	3335	58,236
Singapore	7,103,458	30	61	3882	6	2448	4959
Spain	12,361,398	35	62	5696	17	913	4970
Sri Lanka	198,286	110	61	32	77	2719	76,906
Taiwan	4,084,476	50	56	1460	128	7361	421,168
Thailand	6,906,927	41	63	2677	71	8607	177,444
Tunisia	72,413	34	63	35	10	381	2448
Turkey	16,859,142	97	64	2716	25	2007	8563
UAE	356,280	25	65	220	2	60,069	80,466
UK	38,082,315	99	62	6311	1388	651	400,989
US	9,292,015	30	61	5078	81	219	15,095
Vietnam	2,534,799	208	59	207	24,916	1589	27,868,450

Notes: This table reports the screening procedure on the sample in Panel A and the country distribution of observations and stocks, along with trading-activity statistics in Panel B. The sample period spans from Jan to Mar 2016. The statistics include the number of observation (*Obs*), number of stock (*Stock*), number of trading days (*Days*), average trade per day (*Trades*), average price per trade in local currency (*Price*), average size per trade (*Size*), and average volume per day in local currency (*Volume*).

Admati and Pfleiderer (1988), informed investors prefer to trade whenever plenty of uninformed traders actively participate in transactions, in the hope of being undetected. Second, small-sized (O'Hara, Yao, & Ye, 2014) and medium-sized (Alexander & Peterson, 2007) tactics are usually employed to cover up informed trades, which yields the observed informativeness of such trades. Third, to implement stealth trading, informed investors are shown to split large orders and then trade small ones over time (Keim & Madhavan, 1996). Lastly, a theoretical model is built by Chordia and Subrahmanyam (2004) to expound that orders would be broken up and submitted persistently by the informed if certain conditions are met. Taken together, these

researches emphasize that informed traders have a strong incentive to look for or create a favorable environment where their trades can be disguised easily and performed secretly. Along with this reasoning, round-number biases of liquidity traders naturally provide an ideal backdrop against which informed investors may explore.

The intraday data used in this study cover 41 stock markets, which are collected from the tick-by-tick database in Bloomberg. The cross-country sample enables us to first validate and extend the finding of Bhattacharya et al. (2012) in the global context. Concretely, after applying the *OLS* and discontinuity design regressions, we document a higher (lower) buy-sell order imbalance at prices ending in 9 (1).