

价格“尾数效应”的实证与策略

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理论

本质是面对复杂决策时的思维捷径(Heuristic information process)和有限注意力(Inattention)

两种相反的行为机制：

1. 锚定效应(Reference Point)：价格跨越整数后被认为更值钱，3.99 上涨到 4.00 后被认为值更多钱；倾向于买入向上突破整数位(涨至 4.00)、卖出向下突破整数位(跌至 3.99)
2. 左位数偏差(Left-digit Bias)：认为价格 3.99 比价格 4.00 便宜很多；当价格为 4.00 时倾向于高位卖出，价格为 3.99 时倾向于低位买入

几个实证现象(观测期：2015-01-01 ~ 2022-12-31 日频；股票池：中证 500)

1. 市面上的股价多以 0 或 5 结尾【表 1、表 2、表 3】
2. 昨日收盘价尾数(“角”“分”位) 00-04 / 50-54，相比尾数 95-99 / 45-49：昨收-今开收益率平均更高，昨收-今收收益率平均更低【表 4】；只看“分”位，差异不明显【表 5】
3. 价格在当前时段内向上/向下突破(或即将向上/向下突破)整数价格，当前的平均价格收益率更高/更低。见回归结果【表 6】，回归表达式为：

$$R_{i,t} = \beta_{i,0} + \beta_{i,1}R_{i,t-1} + \beta_{i,2}AP_{i,t} + \beta_{i,3}AD_{i,t} + \beta_{i,4}BP_{i,t} + \beta_{i,5}BD_{i,t} + \varepsilon_{i,t}$$

简单的日频策略(只根据上述现象 2.)

根据昨日收盘尾数，在开盘时做多 45-49 和 95-99，做空 00-04 和 50-54 组，权重比例 [1/6, 1/3, -1/3, -1/6]



图 1：策略净值表现

表 1：样本数量及其分布（各指数）

| | CSI300 出现次数 | CSI300 频率 | CSI500 出现次数 | CSI500 频率 | CSI800 出现次数 | CSI800 频率 | CSI1000 出现次数 | CSI1000 频率 |
|----|----------------|--------------|----------------|--------------|----------------|--------------|-----------------|---------------|
| DP | | | | | | | | |
| 0 | 161362 | 13.8% | 242304 | 12.4% | 403666 | 13.0% | 482074 | 13.0% |
| 1 | 106582 | 9.1% | 177686 | 9.1% | 284268 | 9.1% | 330364 | 8.9% |
| 2 | 105514 | 9.0% | 176254 | 9.1% | 281768 | 9.0% | 330478 | 8.9% |
| 3 | 102878 | 8.8% | 175436 | 9.0% | 278314 | 8.9% | 327468 | 8.9% |
| 4 | 101866 | 8.7% | 172730 | 8.9% | 274596 | 8.8% | 318548 | 8.6% |
| 5 | 119772 | 10.3% | 196308 | 10.1% | 316080 | 10.1% | 374994 | 10.1% |
| 6 | 102642 | 8.8% | 174706 | 9.0% | 277348 | 8.9% | 328688 | 8.9% |
| 7 | 103340 | 8.8% | 174506 | 9.0% | 277846 | 8.9% | 323696 | 8.7% |
| 8 | 115844 | 9.9% | 192994 | 9.9% | 308838 | 9.9% | 366564 | 9.9% |
| 9 | 117982 | 10.1% | 193950 | 10.0% | 311932 | 10.0% | 361196 | 9.8% |
| 缺失 | 30418 | 2.6% | 70126 | 3.6% | 100544 | 3.2% | 155482 | 4.2% |
| 总计 | 1168200 | 100.0% | 1947000 | 100.0% | 3115200 | 100.0% | 3699552 | 100.0% |

表 2：样本数量及其分布（2015-2018）

| | 出现次数 2015 | 频率 2015 | 出现次数 2016 | 频率 2016 | 出现次数 2017 | 频率 2017 | 出现次数 2018 | 频率 2018 |
|----|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| DP | | | | | | | | |
| 0 | 30656 | 12.6% | 28516 | 11.7% | 28220 | 11.6% | 27690 | 11.4% |
| 1 | 19910 | 8.2% | 21776 | 8.9% | 21842 | 9.0% | 22672 | 9.3% |
| 2 | 20016 | 8.2% | 21654 | 8.9% | 21860 | 9.0% | 21322 | 8.8% |
| 3 | 19092 | 7.8% | 21110 | 8.7% | 21612 | 8.9% | 22622 | 9.3% |
| 4 | 19170 | 7.9% | 21364 | 8.8% | 21492 | 8.8% | 21672 | 8.9% |
| 5 | 22512 | 9.2% | 23818 | 9.8% | 23710 | 9.7% | 23936 | 9.9% |
| 6 | 19082 | 7.8% | 21490 | 8.8% | 21468 | 8.8% | 21624 | 8.9% |
| 7 | 19916 | 8.2% | 21826 | 8.9% | 22020 | 9.0% | 21312 | 8.8% |
| 8 | 21990 | 9.0% | 23694 | 9.7% | 23934 | 9.8% | 24292 | 10.0% |
| 9 | 23408 | 9.6% | 23786 | 9.7% | 24546 | 10.1% | 23968 | 9.9% |
| 缺失 | 28248 | 11.6% | 14966 | 6.1% | 13296 | 5.4% | 11890 | 4.9% |
| 总计 | 244000 | 100.0% | 244000 | 100.0% | 244000 | 100.0% | 243000 | 100.0% |

表 3：样本数量及其分布（2019-2022）

| | 出现次数 2019 | 频率 2019 | 出现次数 2020 | 频率 2020 | 出现次数 2021 | 频率 2021 | 出现次数 2022 | 频率 2022 |
|----|--------------|------------|--------------|------------|--------------|------------|--------------|------------|
| DP | | | | | | | | |
| 0 | 30532 | 12.5% | 32196 | 13.2% | 32900 | 13.5% | 31594 | 13.1% |
| 1 | 23010 | 9.4% | 22842 | 9.4% | 22908 | 9.4% | 22726 | 9.4% |

| | | | | | | | | |
|----|--------|--------|--------|--------|--------|--------|--------|--------|
| 2 | 22880 | 9.4% | 22992 | 9.5% | 22686 | 9.3% | 22844 | 9.4% |
| 3 | 23084 | 9.5% | 22682 | 9.3% | 22484 | 9.3% | 22750 | 9.4% |
| 4 | 22720 | 9.3% | 21844 | 9.0% | 22096 | 9.1% | 22372 | 9.2% |
| 5 | 25318 | 10.4% | 25922 | 10.7% | 25454 | 10.5% | 25638 | 10.6% |
| 6 | 23402 | 9.6% | 22122 | 9.1% | 22722 | 9.4% | 22796 | 9.4% |
| 7 | 22698 | 9.3% | 22320 | 9.2% | 22212 | 9.1% | 22202 | 9.2% |
| 8 | 25182 | 10.3% | 24770 | 10.2% | 24496 | 10.1% | 24636 | 10.2% |
| 9 | 24680 | 10.1% | 24848 | 10.2% | 24654 | 10.1% | 24060 | 9.9% |
| 缺失 | 494 | 0.2% | 462 | 0.2% | 388 | 0.2% | 382 | 0.2% |
| 总计 | 244000 | 100.0% | 243000 | 100.0% | 243000 | 100.0% | 242000 | 100.0% |

表 4：价格尾数（角、分位）与随后的股票收益率

| DP | 观测数 | C2C_均值 | C2C_中位数 | C2C_t 值 | C2O_均值 | C2O_中位数 | C2O_t 值 |
|----|---------|---------|---------|---------|--------|---------|---------|
| 0 | 7748160 | -0.021% | -0.235% | -24.34 | 0.025% | -0.001% | 65.87 |
| 1 | 5681280 | -0.008% | -0.225% | -8.79 | 0.037% | 0.001% | 85.24 |
| 2 | 5635136 | -0.003% | -0.237% | -2.63 | 0.030% | -0.003% | 68.31 |
| 3 | 5606912 | -0.012% | -0.233% | -12.06 | 0.030% | -0.004% | 67.24 |
| 4 | 5521408 | -0.029% | -0.240% | -30.05 | 0.016% | -0.011% | 36.99 |
| 5 | 6275008 | -0.012% | -0.222% | -13.62 | 0.017% | -0.009% | 41.03 |
| 6 | 5583744 | -0.017% | -0.228% | -17.35 | 0.024% | -0.002% | 53.5 |
| 7 | 5578176 | -0.020% | -0.228% | -21.12 | 0.018% | -0.006% | 41.25 |
| 8 | 6171392 | -0.023% | -0.235% | -25.21 | 0.012% | -0.007% | 29.21 |
| 9 | 6201984 | -0.020% | -0.228% | -21.33 | 0.019% | -0.006% | 44.65 |

表 5：价格尾数（分位）与随后的股票收益率

| DP2 | 观测数 | C2C_均值 | C2C_中位数 | C2C_t 值 | C2O_均值 | C2O_中位数 | C2O_t 值 |
|-------|---------|---------|---------|---------|--------|---------|---------|
| 00~04 | 3337536 | -0.022% | -0.245% | -17.14 | 0.051% | 0.011% | 87.34 |
| 05~09 | 3118016 | -0.026% | -0.223% | -20.15 | 0.028% | 0.006% | 48.79 |
| 10~14 | 3085440 | -0.015% | -0.232% | -11.7 | 0.041% | 0.003% | 68.85 |
| 15~19 | 3227584 | -0.024% | -0.221% | -19.09 | 0.030% | 0.006% | 55.11 |
| 20~24 | 2940864 | -0.008% | -0.234% | -5.69 | 0.029% | 0.003% | 48 |
| 25~29 | 3081472 | -0.042% | -0.244% | -32.62 | 0.010% | -0.010% | 17.4 |
| 30~34 | 2955136 | 0.005% | -0.238% | 3.88 | 0.031% | -0.004% | 51.37 |
| 35~39 | 2994176 | -0.001% | -0.234% | -0.58 | 0.016% | -0.010% | 25.19 |
| 40~44 | 2902592 | 0.010% | -0.229% | 7.51 | 0.036% | -0.001% | 57.13 |
| 45~49 | 2783616 | 0.004% | -0.221% | 2.82 | 0.013% | -0.007% | 20.92 |
| 50~54 | 3001728 | -0.009% | -0.234% | -6.78 | 0.021% | -0.007% | 33.96 |
| 55~59 | 2801536 | -0.020% | -0.242% | -14.25 | 0.021% | -0.009% | 32.74 |
| 60~64 | 2888192 | -0.027% | -0.236% | -19.43 | 0.023% | -0.002% | 37.19 |
| 65~69 | 2902784 | -0.043% | -0.235% | -31.99 | 0.011% | -0.008% | 18.97 |

| | | | | | | | |
|-------|---------|---------|---------|--------|--------|---------|-------|
| 70~74 | 2916224 | -0.015% | -0.227% | -10.79 | 0.015% | -0.010% | 24.66 |
| 75~79 | 2937792 | -0.006% | -0.212% | -4.84 | 0.021% | -0.012% | 33.59 |
| 80~84 | 3078272 | -0.040% | -0.239% | -30.96 | 0.013% | -0.011% | 21.62 |
| 85~89 | 3028736 | -0.012% | -0.223% | -8.94 | 0.011% | -0.007% | 18.26 |
| 90~94 | 3086912 | -0.026% | -0.229% | -20.24 | 0.015% | -0.016% | 24.86 |
| 95~99 | 2934592 | -0.014% | -0.229% | -10.04 | 0.015% | -0.012% | 24.85 |

表 6：回归系数

| 对应系数 | N | 均值 | t 值 | 备注 |
|---------|------|--------|--------|-------------------|
| AP | 1132 | 0.029 | 95.12 | 时间 t 价格向上跨越整数价位 |
| AD | 1132 | -0.021 | -90.71 | 时间 t 价格向下跨越整数价位 |
| BP | 1132 | 0.006 | 34.8 | 时间 t+1 价格向上跨越整数价位 |
| BD | 1132 | -0.004 | -29.25 | 时间 t+1 价格向下跨越整数价位 |
| R_{t-1} | 1132 | 0.019 | 10.15 | 时间 t-1 期的收益率 |



图 2：每日相关个股数量（00 附近）



图 3：每日相关个股数量（50 附近）

表 7：策略各半年度收益表现

| SemiYear | Date | UnitVal | TRet | PRet | PSharpe | PMaxDD | PCalmar | PWinR | TMaxDD | TSharpe | TCalmar | TWinR | TAnnRet |
|----------|------------|---------|-------|--------|---------|--------|---------|-------|--------|---------|---------|-------|---------|
| 2015-H1 | 2015-06-30 | 1.009 | 0.009 | 0.009 | 0.427 | -0.022 | 0.436 | 0.513 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2015-H2 | 2015-12-31 | 1.017 | 0.017 | 0.008 | 0.292 | -0.048 | 0.165 | 0.536 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2016-H1 | 2016-06-30 | 1.035 | 0.035 | 0.017 | 1.107 | -0.013 | 1.284 | 0.483 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2016-H2 | 2016-12-30 | 1.071 | 0.071 | 0.035 | 2.763 | -0.013 | 2.748 | 0.556 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2017-H1 | 2017-06-30 | 1.136 | 0.136 | 0.061 | 4.597 | -0.007 | 9.016 | 0.603 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2017-H2 | 2017-12-29 | 1.185 | 0.185 | 0.043 | 2.723 | -0.014 | 3.141 | 0.568 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2018-H1 | 2018-06-29 | 1.222 | 0.222 | 0.032 | 2.382 | -0.023 | 1.404 | 0.538 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2018-H2 | 2018-12-28 | 1.224 | 0.224 | 0.001 | 0.115 | -0.021 | 0.065 | 0.468 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2019-H1 | 2019-06-28 | 1.246 | 0.246 | 0.019 | 1.416 | -0.016 | 1.191 | 0.517 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2019-H2 | 2019-12-31 | 1.238 | 0.238 | -0.006 | -0.506 | -0.044 | -0.149 | 0.444 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2020-H1 | 2020-06-30 | 1.243 | 0.243 | 0.004 | 0.275 | -0.025 | 0.161 | 0.470 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2020-H2 | 2020-12-31 | 1.229 | 0.229 | -0.011 | -0.773 | -0.032 | -0.360 | 0.500 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2021-H1 | 2021-06-30 | 1.309 | 0.309 | 0.065 | 4.257 | -0.042 | 1.554 | 0.576 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2021-H2 | 2021-12-31 | 1.326 | 0.326 | 0.013 | 0.810 | -0.026 | 0.486 | 0.496 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2022-H1 | 2022-06-30 | 1.308 | 0.308 | -0.014 | -1.089 | -0.043 | -0.320 | 0.513 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |
| 2022-H2 | 2022-12-30 | 1.325 | 0.325 | 0.013 | 0.926 | -0.052 | 0.252 | 0.488 | -0.052 | 1.127 | 21.578 | 0.518 | 0.036 |

参考文献

- 岳衡, & 赵龙凯. (2007). 股票价格中的数字与行为金融. *金融研究*, 5, 98 - 107.
- 赵龙凯, & 岳衡. (2006). 关于我国股指心理关口的实证研究. *金融研究*, 2, 61 - 69.
- Chague, F. D., Bueno, R. de L. da S., & Giovannetti, B. C. (2018). *Individuals neglect the informational role of prices: Evidence from the stock market* [Working Paper]. <http://bibliotecadigital.fgv.br:80/dspace/handle/10438/20182>
- Dellavigna, S., & Pollet, J. M. (2009). Investor Inattention and Friday Earnings Announcements. *The Journal of Finance*, 64(2), 709 - 749. <https://doi.org/10.1111/j.1540-6261.2009.01447.x>
- Fraser-Mackenzie, P., Sung, M., & Johnson, J. E. V. (2015). The prospect of a perfect ending: Loss aversion and the round-number bias. *Organizational Behavior and Human Decision Processes*, 131, 67 - 80. <https://doi.org/10.1016/j.obhdp.2015.08.004>
- Kansara, A. P., Sung, M.-C., Ma, T., & Johnson, J. E. V. (2020). Towards a better understanding of the full impact of the left digit effect on individual trading behaviour: Unearthing a trading profit effect. *The European Journal of Finance*, 26(9), 874 - 891. <https://doi.org/10.1080/1351847X.2020.1717976>
- Lacetera, N., Pope, D. G., & Sydnor, J. R. (2012). Heuristic Thinking and Limited Attention in the Car Market. *American Economic Review*, 102(5), 2206 - 2236. <https://doi.org/10.1257/aer.102.5.2206>
- Michael, R., Rubin, A., & Vadrashko, A. (2013). Firm Heterogeneity and Investor Inattention to Friday Earnings Announcements. *Working Paper*, 41.
- Wang, A. L. Q. (2011). *Investor psychological bias towards number preferences in stock price endings: Rationality vs irrationality: a research thesis submitted in fulfillment of the requirement of the degree of Masters in Business Studies (Fin) at Massey University* [Thesis, Massey University]. <https://mro.massey.ac.nz/handle/10179/2695>