[1]Tianquan Liu
[2]Shuiyang Pan
[3,*]Xingyuan Li

Analyzing the Efficacy of the Relative Strength Indicator of Capital Inflows and Outflows Based on Big Data Analysis in Achieving Abnormal Returns Evidence from the Chinese Stock Market

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Abstract: - This study originates from an analysis of market microstructure and introduces a novel statistical indicator of relative strength in capital flows through the application of big data analytics. This indicator effectively captures the impact of capital movements on future stock prices by integrating variations in stock prices with the volume of transactions within a corresponding timeframe. Building upon this foundation, the research develops an innovative momentum investment strategy based on the relative strength indicator of capital inflows and outflows, extending beyond the traditional fixed holding period momentum strategy framework. Empirical analysis reveals that this new indicator significantly demonstrates momentum effects in the Chinese A-share market; notably, in portfolios of stocks with smaller market capitalizations, the momentum strategy grounded on the new indicator achieves higher excess returns compared to traditional momentum strategies. These findings not only validate the efficacy of the new indicator but also underscore the critical role of big data analytics in enhancing the analysis of financial markets and the efficiency of investment decision-making.

Keywords: Momentum Effect, Strength Of Capital Inflows, Big Data, Data Analysis.

I. INTRODUCTION

The prediction of future stock returns based on historical performance remains a central endeavor for investors and a pivotal area of academic inquiry. In the era of big data, the evolution of data analytics has furnished novel viewpoints and methodologies for the scrutiny of financial markets. Particularly, the capability to manage and analyze voluminous and complex datasets with big data technologies and sophisticated analytical techniques has empowered investors and researchers to derive profound insights from historical data, thereby enhancing the accuracy of forecasts concerning stock market trends. Nonetheless, while momentum investment strategies have achieved notable success in forecasting future stock returns, traditional approaches frequently neglect the significance of trading volume and the inherent correlation between price fluctuations and trading volume. This oversight constrains the precision in quantifying the momentum effect of stocks. In response to this challenge, the present study innovatively leverages big data and advanced data analysis technologies, beginning with an examination of the market's microstructure, to introduce a novel indicator of the relative strength of capital inflows and outflows. This indicator is designed to more effectively harness the predictive capacity of capital movements on future stock prices by incorporating both the extent of stock price variations and the associated trading volume during the relevant period, thereby proposing an enhanced metric for assessing the momentum effect.

Regarding the measurement of the momentum effect, scholars at home and abroad have conducted extensive research. Jegadeesh and Titman (1993) conducted an empirical study on momentum investment strategies using stock return data from the New York Stock Exchange and the American Stock Exchange, finding that a momentum investment strategy with both observation and holding periods of six months could generate about 1% of abnormal returns per month [1]. Rouwenhorst (1998) examined momentum investment strategies using stock data from 12 European countries with observation and holding periods of 3, 6, 9, and 12 months, forming 16 trading combinations [2]. Using the same methodology as Jegadeesh and Titman (1993), Rouwenhorst found that the European stock market also exhibits momentum effects. Lee and Swaminathan (2000) found that stocks with higher turnover rates also had higher momentum returns [3]. Goçgür and Hwang (2004) constructed a momentum indicator based on the 52-week high price, finding its returns to be higher than those of traditional momentum strategies [4].

[1] College of Economics and Management, Hunan University of Arts and Science, Changde 415100, China
[2] School of Economics, Peking University, Beijing, China
[3] College of Economics and Management, Hunan University of Arts and Science, Changde 415100, China
*Corresponding author: Xingyuan Li

Several scholars have also conducted studies on the momentum effect phenomenon in the Chinese stock market. Wang Yonghong and Zhao Xuejun (2001) investigated the momentum effect in the Chinese stock market using all A-share data from 1993 to 2000 and found that the Chinese stock market does not exhibit a momentum effect [5]. Zhu Zhanyu, Wu Chongfeng, and Wang Chengwei (2004) conducted a monthly data analysis of price momentum in the Chinese stock market from the perspectives of returns and trading volume, discovering that stocks in low trading volume portfolios exhibit price momentum [6]. Xu Xinzhou and Zheng Chunyi (2006) analyzed data from all A-shares in the Shanghai and Shenzhen stock markets from 1995 to 2001, finding the existence of momentum effects in the Chinese stock market, albeit with holding periods significantly shorter than those in Western stock markets [7]. The authors focused on analyzing the reasons for this momentum phenomenon. Yan Taihua and Liang Lan (2011) used an overlapping sampling method to analyze data from all A-share stocks on the Shanghai Stock Exchange between 1995 and 2009, finding the existence of momentum effects in the Shanghai stock market, but with very short durations, with holding periods of 1-3 weeks [8]. Niu Fang (2014) introduced a new momentum strategy with random holding periods using the MACD indicator and found that this momentum strategy could achieve average returns significantly better than the broader market [9].

In summary, traditional research on the momentum effect has predominantly been grounded in the analysis of historical stock returns, neglecting the impact of trading volume and the potential for a combined metric of stock prices and trading volume to measure the momentum effect. The novelty of this paper originates from an analysis of market microstructure, innovatively proposing an indicator of the relative strength of capital inflows and outflows. Building on this, a new momentum strategy based on the indicator of capital flow strength was developed. The empirical findings reveal a significant momentum effect in the Chinese A-share market. Additionally, in portfolios of stocks with smaller market capitalizations, the new momentum strategy outperforms traditional momentum strategies in achieving higher excess returns, further substantiating the effectiveness of the proposed indicator in measuring the momentum effect.

II. DEFINITION OF THE RELATIVE STRENGTH INDICATOR OF CAPITAL INFLOWS AND OUTFLOWS

This section will define the strength of capital inflows, the strength of capital outflows, and the relative strength indicator of capital inflows and outflows, starting from the analysis of the market's microstructure.

The microstructure of the market has the following characteristics:

a) Stocks have a minimum price movement unit, and stock price changes are discrete.

b) The trading market is order-driven, where buyers and sellers continuously submit limit orders to the exchange, forming a bid-ask order book.

c) At any given moment, there are two types of traders differentiated by capital inflows and outflows. One is the capital inflow side, who actively accepts the seller's offer and buys stocks, leading to a rise in stock prices; the other is the capital outflow side, who actively accepts the buyer's offer and sells stocks, leading to a decline in stock prices.

We analyze the mechanism by which inflows (outflows) of capital impact stock price increases (decreases) through the lens of the order book. Figure 1 depicts the dynamic changes in the bid and ask order book caused by capital inflow shocks, where the x-axis represents the bid and ask prices, and the y-axis indicates the corresponding order volume. At moment t0, the capital inflow side actively accepts the seller's offer at the best ask price of 5.01 CNY, resulting in a transaction price of 5.01 CNY and a volume of 8. At moment t1, as the best ask price of 5.01 CNY at t0 has been accepted by the capital inflow side for purchase, the exchange's bid and ask prices in the order book change. Consequently, the capital inflow side continues to actively accept the seller's offer at the new best ask price, resulting in a transaction price of 5.02 CNY and a volume of 5. At moment t2, since the best ask price of 5.02 CNY at t1 has been accepted for the transaction, the exchange's bid and ask prices in the order book change again. The capital inflow side persists in actively accepting the seller's offer at the best ask price, resulting in a transaction price of 5.03 CNY and a volume of 5. From this analysis, it can be deduced that as the capital inflow side continuously actively accepts the seller's prices, it causes a successive rise in stock prices, with capital continuously flowing into the stock market.

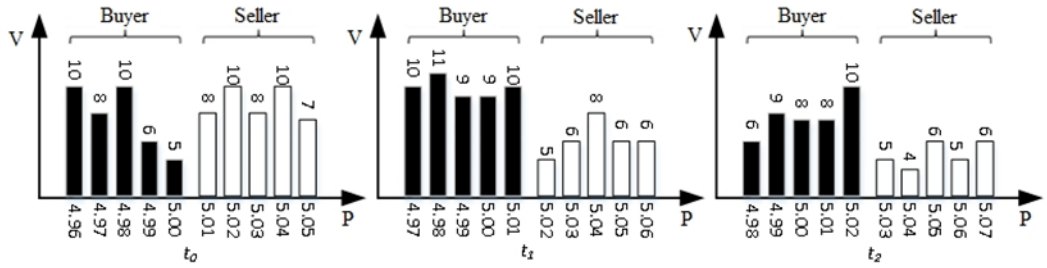

Figure 1: Capital Inflow Shock

Figure 2 illustrates the dynamic changes in the bid and ask order book caused by capital outflow shocks. At moment t0, the capital outflow side actively accepts the buyer's offer at the best bid price, resulting in a transaction price of 5.01 CNY and a volume of 4. At moment t1, since the best bid price of 5.01 CNY at t0 has been accepted by the capital outflow side for selling, the exchange's bid and ask prices in the order book undergo changes. Consequently, the capital outflow side continues to actively accept the buyer's offer at the new best bid price, resulting in a transaction price of 5.00 CNY and a volume of 9. At moment t2, as the best bid price of 5.00 CNY at t1 has been accepted for the transaction, the exchange's bid and ask prices in the order book change again. The capital outflow side persists in actively accepting the buyer's offer at the best bid price, leading to a transaction price of 4.99 CNY and a volume of 2. From this analysis, it can be inferred that as the capital outflow side continuously actively accepts the buyer's prices, it triggers a successive decline in stock prices, with capital continuously flowing out of the stock market.

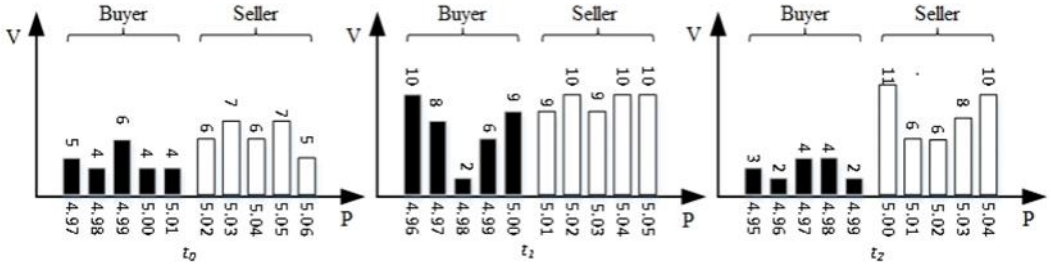

Figure 2: Capital Outflow Shock

Figures 3 and 4 respectively show the stock price rises and falls caused by capital inflow and outflow shocks.

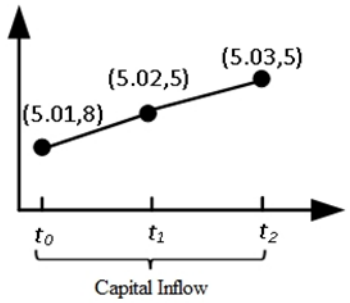

Figure 3: Price Rise Caused by Capital Inflow Shock

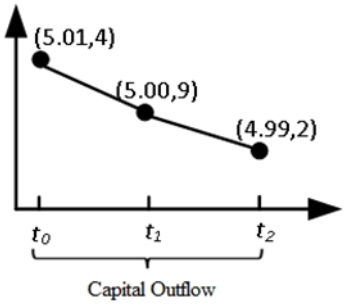

Figure 4: Stock Price Fall Caused by Capital Outflow Shock

Based on the above analysis, we define the Cash Inflow Strength (CIS)， for the i-th interval of the trading day as follows:

$$CIS_i = \frac{\Delta P_i}{P_i} * V_i \tag{1}$$

In formula (1), ΔPi represents the increase in stock price during the i-th consecutive rise within the intraday stock price time series, Pi represents the initial price of the i-th consecutive rise, and ΔPi/Pi actually indicates the percentage increase corresponding to the i-th consecutive rise. Vi represents the total trading volume within the time period of the i-th consecutive rise. For example, in Figure 3, ΔPi =5.03-5.01=0.02, Pi=5.01. Vi=8+5+5=18. CISi= (0.02/5.01)*18=0.0319. Formula (1) has clear economic significance: if ΔPi/Pi is large and Vi is also large, then the cash inflow strength is also significant; if ΔPi/Pi is small and Vi is also small, then the cash inflow strength is minor. This indicator, by linking the change in stock price with the trading volume within the time period of price change, can measure the momentum effect more effectively. Further analysis shows that for stocks with poor liquidity, only a small number of buy orders can cause a rapid increase in stock price, where ΔPi/Pi can be large (limited by the price limit mechanism, maximum 10%), but Vi might be small, indicating that the cash inflow strength is relatively low. Compared to traditional studies that only measure momentum effect through price, the cash inflow strength filters out false stock momentum effects.

The total cash inflow strength for each trading day is defined as:

$$\mathrm{TCIS} = \sum_{i=1}^{N} CIS_i \tag{2}$$

In formula (2), N represents the number of consecutive price increases within a day.

Similarly, we define the Cash Outflow Strength (COS) with an analysis akin to the above:

$$\mathrm{COS_i} = \frac{|\Delta P_i'|}{\mathrm{P_i'}} * V_i' \tag{3}$$

In formula (3), $\Delta P_i'$ represents the decrease in stock price during the i-th consecutive fall within the intraday stock price time series, P_i' represents the initial price of the i-th consecutive fall, and, $|\Delta P_i'| / P_i'$ actually indicates the percentage decrease corresponding to the i-th consecutive fall. V_i' represents the total trading volume within the time period of the i-th consecutive fall.

The total cash outflow strength for each trading day is defined as:

$$TCOS = \sum_{i=1}^{N'} COS_i \tag{4}$$

In formula (4), N' represents the number of consecutive price declines within a day.

Finally, we define the Cash Inflow and Outflow Relative Strength Index (CIORSI) over J trading days

$$CIORIS(J) = \frac{\sum_{j=1}^{J} TCIS_j}{\sum_{j=1}^{J} TCIS_j + \sum_{j=1}^{J} TCOS_j} * 100 \tag{5}$$

The definition of the Cash Inflow and Outflow Relative Strength Index (CIORSI) indicates that CIORSI ranges between [0, 100]. The economic significance represented by CIORSI is analyzed as follows:

When CIORSI(J) equals 100, it means that for J trading days, prices have consecutively risen every day. According to the definition of relative strength of capital inflows and outflows, the relative strength reaches its maximum.

When CIORSI(J) equals 0, it indicates that for J trading days, prices have consecutively declined every day. According to the definition of relative strength of capital inflows and outflows, the relative strength reaches its minimum.

When CIORSI(J) equals 50, it suggests that the strength of capital inflows and outflows has reached equilibrium over J trading days.

When CIORSI(J) is greater than 50, it indicates that over J trading days, the strength of capital inflows is greater than the strength of capital outflows.

When CIORSI(J) is less than 50, it means that over J trading days, the strength of capital inflows is less than the strength of capital outflows.

From the comprehensive analysis above, it is evident that the CIORSI provides a more precise description of the intrinsic driving forces behind stock price changes. Constructing new momentum strategies based on this indicator could potentially be more effective than traditional momentum strategies. This will be detailed in the next section.

III. Testing the Effectiveness of the Cash Inflow and Outflow Relative Strength Index

To test the effectiveness of the Cash Inflow and Outflow Relative Strength Index (CIORSI), we first construct a new momentum strategy based on CIORSI. We then examine whether the new strategy can achieve excess returns compared to the market portfolio, and finally, whether the new momentum strategy can outperform the traditional momentum strategy in achieving higher excess returns. To eliminate size effects, all stocks are divided into three groups based on market capitalization: large, medium, and small capitalization groups, with statistical tests performed for each group comparison.

(1) Study on Excess Returns of the New Momentum Strategy

The new momentum strategy based on CIORSI is described as follows:

a) Divide stocks into three groups based on market capitalization: large, medium, and small capitalization groups.

b) Calculate the CIORSI for each stock over an observation period of J trading days, based on formulas (1) to (5).

c) Sort stocks in the large, medium, and small capitalization groups according to their CIORSI, and select the top 20% of stocks in each group to form an equal-weighted portfolio. Purchase this portfolio and hold it for K trading days.

d) Use the overlapping sampling method proposed by Jegadeesh and Titman (1993) to calculate the average return of the purchased portfolio[1]:

$$\mathrm{R_i}(J,K)=\frac{1}{L-J+1}\sum_{l=J}^{L\text{-}K}\frac{1}{N^{(i,l)}}\sum_{n=1}^{N^{(i,J)}}\frac{p_{(i,\mathrm{l,n})}(l+K)-p_{(i,l,n)}(l)}{p_{(i,l.n)}(l)} \tag{6}$$

e) Calculate the average return of the market portfolio:

$$R_M(J,K)=\frac{1}{L-J+1}\sum_{l=J}^{L\text{-}K}\frac{p_M(l+K)-p_M(l)}{p_M(l)} \tag{7}$$

f) Compare $R_i(J,K)$ and $\mathrm{R_M}(J,K)$, using the t-test to statistically test whether the newly constructed momentum strategy can achieve significant excess returns compared to the market portfolio.

In formulas (6) and (7), J represents the observation period, and K represents the fixed holding period. Different combinations of J and K form different momentum strategies. The indicator i represents the capitalization group, where i=1 for large-cap stocks, i=2 for mid-cap stocks, and i=3 for small-cap stocks. L is the length of the trading days. $N^{(i,l)}$ denotes the total number of stocks in the i-th group that rank in the top 20% of the CIORSI during thel-th sampling. $p_{(i,l,n)}$ represents the price of the n-th stock that meets the top 20% CIORSI criteria in the i-th group during thel-th sampling. PM represents the price of the market portfolio.

(2) Comparative Study of the New Momentum Strategy and Traditional Momentum Strategy

To compare the ability of the new momentum strategy based on CIORSI to achieve excess returns with that of the traditional momentum strategy, we construct a traditional momentum strategy as follows:

a) Divide stocks into three groups based on market capitalization: large, medium, and small capitalization groups.

b) Calculate the average return of each stock over an observation period of J trading days.

c) Sort stocks in each capitalization group according to their average returns and select the top 20% of stocks to form an equal-weighted portfolio. Purchase this portfolio and hold it for K trading days.

d) Use the overlapping sampling method proposed by Jegadeesh and Titman (1993) to calculate the average return of the purchased portfolio[1].

e) Compare $R_i(J,K)$ and $r_i(J,K)$. Use the t-test to statistically test whether the newly constructed momentum strategy can achieve higher excess returns compared to the traditional momentum strategy. If the new momentum strategy achieves higher excess returns than the traditional strategy, it indicates that the new momentum strategy based on CIORSI proposed in this paper is more effective.

IV. Analysis of Empirical Results

The research data sample consists of all listed A-shares in the Shanghai and Shenzhen stock markets. The sample stocks meet the following conditions:

a) They have been listed for more than one year.

b) They are not ST, *ST, or suspended stocks.

The sample period is from January 2010 to March 2023, totaling 3181 trading days. Zhu Zhanyu, Wu Chongfeng, and Wang Chengwei (2003) believe that the selection period for stock samples should include a complete fluctuation cycle, encompassing both bull and bear markets to ensure more reliable analysis results[10]. The selected sample period clearly meets this condition. All stock trading data is sourced from the Wind database, with stock prices adjusted for dividends, rights issues, and additional issues on a forward basis.

Grouping by Market Capitalization: Download the full sample of stock circulating market values from the Wind database and sort them. The top 33.3% of stocks by ranking were included in the large-cap group, the bottom 33.3% were included in the small-cap group, and the remaining stocks were included in the mid-cap group. The grouping is updated every six months.

Market Portfolio Construction: A portfolio was constructed by equally weighting the full sample of stock, calculating the daily price of this portfolio from January 2010 to March 2023. This portfolio was defined as the market portfolio.

Parameter J and K Values: In past literature, the values of J and K are typically set at three months or longer. Considering that the participants in the Chinese stock market are mainly retail investors, characterized by frequent transactions and unwillingness to hold stocks for a long period, J and K were set to 10, 20, 30, 40, 50, 60, 70, 80, and 90 days, respectively. Combinations of J and K form 9×9 momentum strategies.

Calculation of the Cash Inflow and Outflow Relative Strength Index: Minute data time series from January 2010 to March 2023 for the full sample of stock were obtained from the Wind database. Daily cash inflow strength and daily cash outflow strength for each stock were calculated using formulas (1), (2), (3), and (4), respectively. Then, the cash inflow and outflow relative strength index was calculated using formula (5).

(1) Empirical Results of Excess Returns from the New Momentum Strategy

Table 1 presents the excess returns achieved by the new momentum strategy for the large-cap group. Table 2 presents the excess returns for the mid-cap group. Table 3 presents the excess returns for the small-cap group.

In the tables, R_1, R_2, and R_3 represent the average returns achieved under the new momentum strategy for the large-cap, mid-cap, and small-cap groups, respectively. R_M represents the average return of the market portfolio. R_1-R_M, R_2-R_M, and R_3-R_M represent the excess returns of the large-cap, mid-cap, and small-cap groups, respectively, compared to the market portfolio under the new momentum strategy. tstat is the t-statistic obtained from the t-test. It can be observed that when J and K take different parameters, the new momentum strategy consistently achieves positive excess returns compared to the market portfolio. This further illustrates that there is a significant momentum effect in the Chinese A-share market over short periods.

(2) Comparative Study Results Between the New Momentum Strategy and Traditional Momentum Strategy

Tables 4, 5, and 6 respectively present the excess returns achieved by the new momentum strategy for the large-cap, mid-cap, and small-cap groups compared to the traditional momentum strategy. In the tables, R_1, R_2, and R_3 respectively represent the average returns achieved under the new momentum strategy for the large-cap, mid-cap, and small-cap groups. r_1, r_2, and r_3 respectively represent the average returns achieved under the traditional momentum strategy for the large-cap, mid-cap, and small-cap groups. R_1-r_1, R_2-r_2, R_3-r_3 respectively represent the excess returns of the large-cap, mid-cap, and small-cap groups under the new momentum strategy compared to the traditional momentum strategy. tstat is the t-statistic obtained from the t-test. From Table 4, it can be observed that:

For the large-cap group, positive excess returns were achieved by the new momentum strategy only with parameter combinations of (J=30, K=10), (J=60, K=10), (J=60, K=20), (J=60, K=30), (J=60, K=40), (J=60, K=50), (J=70, K=20), (J=70, K=30), (J=80, K=10). When J and K take other parameter combinations, the new momentum strategy did not achieve excess returns compared to the traditional momentum strategy, indicating that the effectiveness of the new momentum strategy compared to the traditional strategy is not evident in the large-cap group.

For the mid-cap and small-cap groups, when J and K take different parameters, the new momentum strategy consistently achieved positive excess returns compared to the traditional momentum strategy. This further illustrates that in the context of mid and small market capitalizations, the momentum strategy constructed based on the Cash Inflow and Outflow Relative Strength Index proposed in this paper is more effective than the traditional momentum strategy.

These findings underscore the importance of considering market capitalization and the specific parameters of J and K when applying momentum strategies. The new momentum strategy's effectiveness is more pronounced in mid and small-cap groups, suggesting a nuanced approach to momentum investing, particularly in markets with diverse capitalization levels and investor behaviors.

Table 1: Excess Returns Statistical Test for the Large Cap Group New Momentum Strategy

		K=10	K=20	K=30	K=40	K=50	K=60	K=70	K=80	K=90
J=10	R_1	0.4281	0.4495	0.4317	0.4290	0.4492	0.4806	0.5024	0.5145	0.5159
	R_M	0.2214	0.2236	0.2261	0.2223	0.2398	0.2661	0.2823	0.2925	0.3008
	R_1-R_M	0.2067*	0.2259*	0.2056*	0.2067*	0.2094*	0.2145*	0.2201*	0.2220*	0.2150*
	tstat	10.3878	14.4587	14.0419	15.2650	16.6601	18.3422	19.3227	21.8925	24.2176
J=20	R_1	0.4648	0.4455	0.4251	0.4299	0.4515	0.4812	0.4975	0.5004	0.5047
	R_M	0.2213	0.2175	0.2202	0.2272	0.2491	0.2727	0.2888	0.2972	0.3053
	R_1-R_M	0.2435*	0.2280*	0.2049*	0.2027*	0.2024*	0.2085*	0.2087*	0.2031*	0.1994*
	tstat	11.5063	13.1982	13.7206	14.7347	16.3929	18.3847	20.0138	23.3435	23.3493
	R_1	0.4331	0.4065	0.4075	0.4167	0.4429	0.4723	0.4874	0.4929	0.4982
J=30	R_M	0.2092	0.2086	0.2268	0.2385	0.2565	0.2799	0.2940	0.3020	0.3084
	R_1-R_M	0.2239*	0.1979*	0.1808*	0.1781*	0.1864*	0.1925*	0.1935*	0.1909*	0.1898*
	tstat	9.4865	11.3989	11.8146	12.7389	14.9473	16.7642	18.6909	20.3492	19.8856
J=40	R_1	0.4146	0.4111	0.4161	0.4275	0.4522	0.4793	0.4887	0.4934	0.4995
	R_M	0.2039	0.2239	0.2454	0.2504	0.2671	0.2877	0.3010	0.3070	0.3131
	R_1-R_M	0.2106*	0.1872*	0.1707*	0.1771*	0.1851*	0.1916*	0.1877*	0.1863*	0.1864*
	tstat	9.2902	10.9748	11.6068	13.1160	15.4506	17.7884	18.3732	18.7813	18.0256
J=50	R_1	0.4226	0.4280	0.4310	0.4397	0.4603	0.4866	0.4952	0.5020	0.5091
	R_M	0.2394	0.2537	0.2627	0.2644	0.2770	0.2965	0.3073	0.3128	0.3183
	R_1-R_M	0.1832*	0.1743*	0.1682*	0.1753*	0.1833*	0.1902*	0.1879*	0.1892*	0.1908*
	tstat	8.8331	10.6642	11.9222	13.4123	15.5691	16.9589	16.7659	17.2262	16.8266
J=60	R_1	0.4384	0.4441	0.4527	0.4552	0.4768	0.4925	0.5013	0.5071	0.5128
	R_M	0.2645	0.2614	0.2690	0.2669	0.2791	0.2964	0.3075	0.3128	0.3213
	R_1-R_M	0.1739*	0.1827*	0.1838*	0.1884*	0.1977*	0.1961*	0.1939*	0.1942*	0.1915*
	tstat	8.8147	11.8735	13.5511	14.8632	16.7496	16.8968	16.6883	16.8921	16.1758
J=70	R_1	0.4392	0.4533	0.4520	0.4492	0.4672	0.4847	0.4975	0.5034	0.5090
	R_M	0.2533	0.2572	0.2628	0.2620	0.2725	0.2911	0.3027	0.3120	0.3215
	R_1-R_M	0.1859*	0.1961*	0.1892*	0.1872*	0.1947*	0.1936*	0.1948*	0.1913*	0.1875*
	tstat	9.5697	12.7608	13.6340	14.1906	15.2905	15.6106	15.7612	15.6328	14.7171
J=80	R_1	0.4521	0.4442	0.4410	0.4403	0.4538	0.4722	0.4863	0.4945	0.4974
	R_M	0.2562	0.2538	0.2604	0.2568	0.2684	0.2874	0.3034	0.3136	0.3219
	R_1-R_M	0.1959*	0.1904*	0.1806*	0.1835*	0.1855*	0.1848*	0.1829*	0.1808*	0.1754*
	tstat	9.9242	12.0054	12.2529	13.0371	13.6683	14.2570	14.2229	14.1269	13.3135
J=90	R_1	0.4303	0.4205	0.4179	0.4214	0.4367	0.4598	0.4765	0.4801	0.4905
	R_M	0.2461	0.2483	0.2522	0.2504	0.2628	0.2873	0.3045	0.3135	0.3229
	R_1-R_M	0.1842*	0.1722*	0.1656*	0.1710*	0.1738*	0.1725*	0.1720*	0.1667*	0.1675*
	tstat	8.9858	10.2189	10.5762	11.5324	12.3726	12.5351	12.5058	12.2793	11.8818

Note: * indicates a 1% statistical significance level, ** indicates a 5% statistical significance level, *** indicates a 10% statistical significance level.

Table 2: Excess Returns Statistical Test for the Mid Cap Group New Momentum Strategy

		K=10	K=20	K=30	K=40	K=50	K=60	K=70	K=80	K=90
J=10	R_2	0.4729	0.4774	0.4653	0.4629	0.4812	0.5155	0.5324	0.5372	0.5310
	R_M	0.2214	0.2236	0.2261	0.2223	0.2398	0.2661	0.2823	0.2925	0.3008
	R_2-R_M	0.2515*	0.2538*	0.2392*	0.2407*	0.2414*	0.2494*	0.2501*	0.2447*	0.2301*
	tstat	7.2650	9.9915	11.7992	14.0929	15.9248	18.8567	21.3821	24.3564	26.8415
J=20	R_2	0.4896	0.4665	0.4641	0.4624	0.4879	0.5191	0.5304	0.5321	0.5326

	R_M	0.2213	0.2175	0.2202	0.2272	0.2491	0.2727	0.2888	0.2972	0.3053
	R_2-R_M	0.2683*	0.2490*	0.2438*	0.2352*	0.2389*	0.2464*	0.2417*	0.2349*	0.2274*
	tstat	8.0296	10.1015	12.2641	14.0027	16.3459	19.0866	21.5363	24.1585	27.6778
	R_2	0.4513	0.4508	0.4611	0.4701	0.4897	0.5128	0.5214	0.5249	0.5288
J=30	R_M	0.2092	0.2086	0.2268	0.2385	0.2565	0.2799	0.2940	0.3020	0.3084
	R_2-R_M	0.2420*	0.2422*	0.2344*	0.2316*	0.2332*	0.2329*	0.2274*	0.2229*	0.2204*
	tstat	7.4224	10.3116	12.1557	14.6236	17.0899	19.8762	22.6737	26.4822	29.7842
	R_2	0.4526	0.4648	0.4762	0.4804	0.4972	0.5155	0.5292	0.5303	0.5317
J=40	R_M	0.2039	0.2239	0.2454	0.2504	0.2671	0.2877	0.3010	0.3070	0.3131
	R_2-R_M	0.2487*	0.2409*	0.2308*	0.2300*	0.2302*	0.2278*	0.2281*	0.2233*	0.2186*
	tstat	7.9788	10.4650	12.5136	14.8299	16.9443	19.6041	23.7242	27.2453	29.6653
	R_2	0.4713	0.4822	0.4916	0.4908	0.5043	0.5271	0.5366	0.5391	0.5348
J=50	R_M	0.2394	0.2537	0.2627	0.2644	0.2770	0.2965	0.3073	0.3128	0.3183
	R_2-R_M	0.2319*	0.2285*	0.2289*	0.2264*	0.2273*	0.2307*	0.2293*	0.2263*	0.2165*
	tstat	7.3271	10.1433	12.4342	14.7483	17.0761	20.2110	24.0404	27.3991	29.8180
	R_2	0.4964	0.4907	0.4958	0.4919	0.5100	0.5315	0.5403	0.5410	0.5441
J=60	R_M	0.2645	0.2614	0.2690	0.2669	0.2791	0.2964	0.3075	0.3128	0.3213
	R_2-R_M	0.2319*	0.2293*	0.2269*	0.2250*	0.2308*	0.2351*	0.2329*	0.2281*	0.2228*
	tstat	7.0306	9.8162	12.1063	14.6475	17.6837	20.3021	23.5847	27.2211	30.6537
	R_2	0.4815	0.4853	0.4872	0.4862	0.5065	0.5311	0.5398	0.5490	0.5564
J=70	R_M	0.2533	0.2572	0.2628	0.2620	0.2725	0.2911	0.3027	0.3120	0.3215
	R_2-R_M	0.2282*	0.2281*	0.2244*	0.2242*	0.2340*	0.2401*	0.2371*	0.2369*	0.2349*
	tstat	6.9706	9.6200	11.8005	14.7630	17.7981	20.7516	24.7319	29.0387	32.9153
	R_2	0.4833	0.4794	0.4829	0.4851	0.5083	0.5286	0.5457	0.5561	0.5579
J=80	R_M	0.2562	0.2538	0.2604	0.2568	0.2684	0.2874	0.3034	0.3136	0.3219
	R_2-R_M	0.2271*	0.2256*	0.2225*	0.2283*	0.2399*	0.2412*	0.2423*	0.2424*	0.2360*
	tstat	6.8177	9.4582	12.1429	15.5021	18.6833	21.7551	25.8340	30.5966	34.0313
	R_2	0.4689	0.4755	0.4872	0.4892	0.5049	0.5338	0.5506	0.5564	0.5572
J=90	R_M	0.2461	0.2483	0.2522	0.2504	0.2628	0.2873	0.3045	0.3135	0.3229
	R_2-R_M	0.2228*	0.2271*	0.2350*	0.2388*	0.2421*	0.2465*	0.2461*	0.2430*	0.2343*
	tstat	6.6653	9.8413	13.1057	16.3287	18.9356	21.9125	25.8881	30.7690	33.1046

Note: * indicates a 1% statistical significance level, ** indicates a 5% statistical significance level, *** indicates a 10% statistical significance level.

Table 3: Excess Returns Statistical Test for the Small Cap Group New Momentum Strategy

		K=10	K=20	K=30	K=40	K=50	K=60	K=70	K=80	K=90
	R_3	0.3852	0.3919	0.3926	0.3809	0.3987	0.4348	0.4530	0.4555	0.4510
J=10	R_M	0.2214	0.2236	0.2261	0.2223	0.2398	0.2661	0.2823	0.2925	0.3008
	R_3-R_M	0.1638*	0.1683*	0.1664*	0.1586*	0.1589*	0.1687*	0.1707*	0.1630*	0.1502*
	tstat	4.0546	5.6967	7.0423	7.7831	8.8332	10.5535	12.0691	12.7729	12.3239
	R_3	0.3648	0.3749	0.3778	0.3743	0.4058	0.4423	0.4576	0.4536	0.4484
J=20	R_M	0.2213	0.2175	0.2202	0.2272	0.2491	0.2727	0.2888	0.2972	0.3053
	R_3-R_M	0.1435*	0.1574*	0.1576*	0.1470*	0.1568*	0.1696*	0.1689*	0.1563*	0.1431*
	tstat	3.6107	5.4602	6.7472	7.4249	8.9572	10.9835	12.3030	12.4695	12.0623
	R_3	0.3446	0.3491	0.3685	0.3785	0.4110	0.4440	0.4510	0.4450	0.4432
J=30	R_M	0.2092	0.2086	0.2268	0.2385	0.2565	0.2799	0.2940	0.3020	0.3084
	R_3-R_M	0.1354*	0.1405*	0.1417*	0.1400*	0.1545*	0.1641*	0.1571*	0.1429*	0.1348*
	tstat	3.3796	4.9233	6.0758	7.1220	8.9488	10.6637	11.5768	11.5241	11.6881
	R_3	0.3246	0.3566	0.3910	0.4027	0.4270	0.4506	0.4565	0.4523	0.4496
J=40	R_M	0.2039	0.2239	0.2454	0.2504	0.2671	0.2877	0.3010	0.3070	0.3131
	R_3-R_M	0.1207*	0.1327*	0.1456*	0.1522*	0.1599*	0.1629*	0.1555*	0.1453*	0.1365*

	tstat	3.0252	4.6206	6.2243	7.6860	9.0170	10.3512	11.4462	11.9246	12.0560
J=50	R_3	0.3585	0.3923	0.4202	0.4229	0.4430	0.4613	0.4659	0.4617	0.4568
	R_M	0.2394	0.2537	0.2627	0.2644	0.2770	0.2965	0.3073	0.3128	0.3183
	R_3-R_M	0.1191*	0.1386*	0.1575*	0.1585*	0.1660*	0.1649*	0.1587*	0.1489*	0.1386*
	tstat	2.9357	4.7887	6.6310	7.7361	9.0978	10.2558	11.5649	12.0872	12.0059
J=60	R_3	0.3870	0.4179	0.4354	0.4317	0.4441	0.4648	0.4685	0.4615	0.4634
	R_M	0.2645	0.2614	0.2690	0.2669	0.2791	0.2964	0.3075	0.3128	0.3213
	R_3-R_M	0.1225*	0.1565*	0.1664*	0.1648*	0.1650*	0.1684*	0.1611*	0.1486*	0.1421*
	tstat	3.0178	5.4943	6.9929	8.0134	9.2178	10.7456	11.8660	12.2466	12.4632
J=70	R_3	0.4064	0.4227	0.4400	0.4289	0.4444	0.4621	0.4639	0.4652	0.4702
	R_M	0.2533	0.2572	0.2628	0.2620	0.2725	0.2911	0.3027	0.3120	0.3215
	R_3-R_M	0.1530*	0.1655*	0.1771*	0.1669*	0.1718*	0.1711*	0.1612*	0.1532*	0.1488*
	tstat	3.7797	5.7317	7.2787	8.1172	9.5515	10.8624	11.9630	12.5651	13.0743
J=80	R_3	0.4188	0.4252	0.4351	0.4290	0.4418	0.4586	0.4684	0.4721	0.4732
	R_M	0.2562	0.2538	0.2604	0.2568	0.2684	0.2874	0.3034	0.3136	0.3219
	R_3-R_M	0.1626*	0.1714*	0.1747*	0.1723*	0.1734*	0.1712*	0.1650*	0.1584*	0.1513*
	tstat	3.9308	5.8174	7.2319	8.4834	9.7683	11.1620	12.5757	13.3046	13.4246
J=90	R_3	0.4142	0.4201	0.4379	0.4275	0.4363	0.4579	0.4710	0.4753	0.4753
	R_M	0.2461	0.2483	0.2522	0.2504	0.2628	0.2873	0.3045	0.3135	0.3229
	R_3-R_M	0.1681*	0.1718*	0.1857*	0.1771*	0.1735*	0.1706*	0.1665*	0.1618*	0.1524*
	tstat	4.0723	5.8585	7.6973	8.6063	9.7298	11.0053	12.3661	13.4065	13.3319

Note: * indicates a 1% statistical significance level, ** indicates a 5% statistical significance level, and *** indicates a 10% statistical significance level.

Table 4: Excess Returns Statistical Test for the Large Cap Group New Momentum Strategy Compared to the Traditional Momentum Strategy

		K=10	K=20	K=30	K=40	K=50	K=60	K=70	K=80	K=90
J=10	R_1	0.4281	0.4495	0.4317	0.4290	0.4492	0.4806	0.5024	0.5145	0.5159
	r_1	0.5263	0.5093	0.4992	0.5046	0.5176	0.5324	0.5404	0.5576	0.5635
	R_1- r_1	-0.0982*	-0.0597*	-0.0675*	-0.0757*	-0.0685*	-0.0518*	-0.0381*	-0.0432*	-0.0477*
	tstat	3.9136	3.2434	4.2114	5.2394	5.1818	4.5022	4.1337	5.4040	6.3598
J=20	R_1	0.4648	0.4455	0.4251	0.4299	0.4515	0.4812	0.4975	0.5004	0.5047
	r_1	0.4651	0.4568	0.4756	0.4857	0.4961	0.5097	0.5308	0.5449	0.5543
	R_1- r_1	-0.0003***	-0.0113**	-0.0505*	-0.0557*	-0.0446*	-0.0285*	-0.0333*	-0.0445*	-0.0497*
	tstat	3.0867	2.5695	3.0159	3.5943	3.1897	2.6552	3.7305	5.5035	6.2234
	R_1	0.4331	0.4065	0.4075	0.4167	0.4429	0.4723	0.4874	0.4929	0.4982
J=30	r_1	0.4306	0.4485	0.4735	0.4775	0.4832	0.5066	0.5266	0.5414	0.5492
	R_1- r_1	0.0024***	-0.0419*	-0.0659*	-0.0608*	-0.0403*	-0.0342*	-0.0392*	-0.0485*	-0.0510*
	tstat	2.8075	2.0420	3.4804	3.5995	2.8409	3.0017	4.2587	5.7160	5.9702
J=40	R_1	0.4146	0.4111	0.4161	0.4275	0.4522	0.4793	0.4887	0.4934	0.4995
	r_1	0.4505	0.4713	0.4777	0.4681	0.4833	0.5054	0.5220	0.5355	0.5395
	R_1- r_1	-0.0360**	-0.0602*	-0.0617*	-0.0406*	-0.0311*	-0.0261*	-0.0333*	-0.0422*	-0.0401*
	tstat	2.3272	2.5246	3.0414	2.4415	2.3408	2.5686	3.7121	4.8900	4.6995
J=50	R_1	0.4226	0.4280	0.4310	0.4397	0.4603	0.4866	0.4952	0.5020	0.5091
	r_1	0.4642	0.4657	0.4595	0.4621	0.4828	0.5059	0.5219	0.5287	0.5355
	R_1- r_1	-0.0416**	-0.0377**	-0.0286**	-0.0223**	-0.0225**	-0.0193*	-0.0267*	-0.0267*	-0.0264*
	tstat	2.4075	3.0966	3.3318	3.6156	4.2345	2.0836	3.0290	3.3020	3.3144
J=60	R_1	0.4384	0.4441	0.4527	0.4552	0.4768	0.4925	0.5013	0.5071	0.5128
	r_1	0.4270	0.4278	0.4448	0.4530	0.4731	0.4960	0.5024	0.5103	0.5283

	R_1- r_1	0.0115***	0.0163***	0.0079***	0.0022**	0.0037**	-0.0035**	-0.0011**	-0.0032**	-0.0155*
	tstat	2.3409	2.9665	4.0760	2.4464	2.7681	3.6435	3.8361	4.1630	2.0252
J=70	R_1	0.4392	0.4533	0.4520	0.4492	0.4672	0.4847	0.4975	0.5034	0.5090
	r_1	0.4100	0.4308	0.4515	0.4593	0.4772	0.4907	0.4989	0.5195	0.5384
	R_1- r_1	0.0292	0.0224***	0.0006**	-0.0100**	-0.0100**	-0.0060**	-0.0015**	-0.0162**	-0.0294*
	tstat	1.7311	2.6618	2.1498	2.9950	3.3079	3.3928	3.3363	4.4770	2.7911
J=80	R_1	0.4521	0.4442	0.4410	0.4403	0.4538	0.4722	0.4863	0.4945	0.4974
	r_1	0.4452	0.4633	0.4730	0.4719	0.4765	0.4917	0.5153	0.5345	0.5496
	R_1- r_1	0.0069***	-0.0191**	-0.0320**	-0.0316**	-0.0226**	-0.0195**	-0.0291*	-0.0400*	-0.0522*
	tstat	2.1912	2.2981	3.3942	3.7998	3.5973	3.7275	2.2463	3.1309	4.1870
J=90	R_1	0.4303	0.4205	0.4179	0.4214	0.4367	0.4598	0.4765	0.4801	0.4905
	r_1	0.4473	0.4623	0.4656	0.4534	0.4628	0.4982	0.5231	0.5395	0.5539
	R_1- r_1	-0.0170***	-0.0418**	-0.0478*	-0.0320**	-0.0261**	-0.0384*	-0.0466*	-0.0593*	-0.0634*
	tstat	2.7030	2.9914	2.3057	3.5464	3.5135	2.4043	3.0118	4.0805	4.6703

Note: * indicates a 1% statistical significance level, ** indicates a 5% statistical significance level, *** indicates a 10% statistical significance level.

Table 5: Excess Returns Statistical Test for the Mid Cap Group New Momentum Strategy Compared to the Traditional Momentum Strategy

		K=10	K=20	K=30	K=40	K=50	K=60	K=70	K=80	K=90
J=10	R_2	0.4729	0.4774	0.4653	0.4629	0.4812	0.5155	0.5324	0.5372	0.5310
	r_2	0.4415	0.4420	0.4421	0.4470	0.4540	0.4774	0.4861	0.4946	0.4956
	R_2- r_2	0.0314***	0.0354****	0.0232**	0.0159**	0.0272**	0.0381*	0.0464*	0.0426*	0.0354*
	tstat	3.4762	4.5844	2.3771	3.2997	2.5436	3.6922	5.4504	5.4314	4.8541
J=20	R_2	0.4896	0.4665	0.4641	0.4624	0.4879	0.5191	0.5304	0.5321	0.5326
	r_2	0.3804	0.3863	0.4132	0.4157	0.4294	0.4512	0.4667	0.4724	0.4817
	R_2- r_2	0.1092*	0.0803*	0.0508*	0.0467*	0.0585*	0.0679*	0.0637*	0.0597*	0.0510*
	tstat	4.5794	4.8258	3.2881	3.3288	5.3002	7.1876	7.5480	8.5098	7.6015
	R_2	0.4513	0.4508	0.4611	0.4701	0.4897	0.5128	0.5214	0.5249	0.5288
J=30	r_2	0.3515	0.3763	0.3963	0.4050	0.4158	0.4414	0.4551	0.4684	0.4826
	R_2- r_2	0.0997*	0.0745*	0.0648*	0.0651*	0.0739*	0.0714*	0.0663*	0.0565*	0.0462*
	tstat	4.0147	4.0448	4.1782	5.1496	7.1484	7.5664	8.2431	7.3579	5.4573
J=40	R_2	0.4526	0.4648	0.4762	0.4804	0.4972	0.5155	0.5292	0.5303	0.5317
	r_2	0.3550	0.3748	0.4029	0.4025	0.4158	0.4407	0.4605	0.4758	0.4904
	R_2- r_2	0.0976*	0.0900*	0.0733*	0.0779*	0.0814*	0.0748*	0.0687*	0.0545*	0.0412*
	tstat	3.4722	4.4586	4.6417	6.2869	7.8252	8.0292	8.0286	6.1245	4.0411
J=50	R_2	0.4713	0.4822	0.4916	0.4908	0.5043	0.5271	0.5366	0.5391	0.5348
	r_2	0.3572	0.3799	0.4031	0.4062	0.4235	0.4534	0.4719	0.4872	0.5019
	R_2- r_2	0.1141*	0.1023*	0.0886*	0.0846*	0.0807*	0.0737*	0.0648*	0.0519*	0.0329*
	tstat	3.8231	5.0077	5.8721	6.8845	7.3912	7.2053	6.4239	5.0002	2.7701
J=60	R_2	0.4964	0.4907	0.4958	0.4919	0.5100	0.5315	0.5403	0.5410	0.5441
	r_2	0.3596	0.3760	0.4057	0.4132	0.4368	0.4676	0.4897	0.5034	0.5151
	R_2- r_2	0.1368*	0.1147*	0.0901*	0.0786*	0.0731*	0.0639*	0.0507*	0.0376*	0.0290*
	tstat	4.5426	5.4304	5.6745	5.8212	5.7690	5.2101	4.1302	2.9949	2.1625
J=70	R_2	0.4815	0.4853	0.4872	0.4862	0.5065	0.5311	0.5398	0.5490	0.5564
	r_2	0.3574	0.3856	0.4211	0.4358	0.4582	0.4898	0.5085	0.5186	0.5248
	R_2- r_2	0.1241*	0.0997*	0.0661*	0.0504*	0.0484*	0.0414*	0.0313*	0.0303*	0.0316*
	tstat	3.8526	4.4246	3.6931	3.0907	3.2671	2.8930	2.1099	2.2482	2.5378
J=80	R_2	0.4833	0.4794	0.4829	0.4851	0.5083	0.5286	0.5457	0.5561	0.5579
	r_2	0.3839	0.4019	0.4417	0.4559	0.4781	0.5074	0.5261	0.5314	0.5335

	R_2- r_2	0.0994*	0.0775*	0.0412***	0.0292***	0.0301***	0.0212**	0.0196**	0.0247**	0.0244**
	tstat	2.9006	3.2621	3.6008	5.0079	5.3559	2.4769	2.9316	2.6830	2.9551
J=90	R_2	0.4689	0.4755	0.4872	0.4892	0.5049	0.5338	0.5506	0.5564	0.5572
	r_2	0.3891	0.4161	0.4570	0.4741	0.4911	0.5238	0.5373	0.5403	0.5446
	R_2- r_2	0.0797*	0.0594*	0.0302***	0.0151**	0.0138**	0.0100**	0.0133**	0.0161**	0.0126**
	tstat	2.1539	2.2199	3.9830	2.2977	2.7142	3.4241	3.4906	3.4942	4.1145

Note: * indicates a 1% statistical significance level, ** indicates a 5% statistical significance level, *** indicates a 10% statistical significance level.

Table 6: Excess Returns Statistical Test for the Small Cap Group New Momentum Strategy Compared to the Traditional Momentum Strategy

		K=10	K=20	K=30	K=40	K=50	K=60	K=70	K=80	K=90
J=10	R_3	0.3852	0.3919	0.3926	0.3809	0.3987	0.4348	0.4530	0.4555	0.4510
	r_3	0.2051	0.2325	0.2765	0.2911	0.3194	0.3571	0.3757	0.3807	0.3796
	R_3- r_3	0.1801*	0.1594*	0.1161*	0.0898*	0.0793*	0.0777*	0.0773*	0.0748*	0.0714*
	tstat	10.0168	12.8614	11.6558	11.0469	10.8589	11.6483	13.1227	14.8522	16.0233
J=20	R_3	0.3648	0.3749	0.3778	0.3743	0.4058	0.4423	0.4576	0.4536	0.4484
	r_3	0.1247	0.1827	0.2380	0.2559	0.2903	0.3297	0.3531	0.3584	0.3564
	R_3- r_3	0.2401*	0.1922*	0.1398*	0.1184*	0.1155*	0.1127*	0.1045*	0.0952*	0.0920*
	tstat	12.1361	13.7487	12.8589	13.9290	15.1116	15.8016	16.0750	17.4610	18.8443
	R_3	0.3446	0.3491	0.3685	0.3785	0.4110	0.4440	0.4510	0.4450	0.4432
J=30	r_3	0.1147	0.1795	0.2242	0.2479	0.2864	0.3237	0.3406	0.3435	0.3484
	R_3- r_3	0.2299*	0.1696*	0.1443*	0.1306*	0.1247*	0.1203*	0.1105*	0.1015*	0.0948*
	tstat	10.7185	11.4685	13.5224	15.5104	16.1456	16.9726	17.2968	18.6565	17.5289
J=40	R_3	0.3246	0.3566	0.3910	0.4027	0.4270	0.4506	0.4565	0.4523	0.4496
	r_3	0.1032	0.1667	0.2261	0.2503	0.2842	0.3195	0.3350	0.3451	0.3479
	R_3- r_3	0.2214*	0.1899*	0.1649*	0.1524*	0.1428*	0.1311*	0.1215*	0.1072*	0.1018*
	tstat	10.2005	12.9728	15.4425	17.7711	18.4618	19.1130	20.4984	19.4262	17.8914
J=50	R_3	0.3585	0.3923	0.4202	0.4229	0.4430	0.4613	0.4659	0.4617	0.4568
	r_3	0.1097	0.1743	0.2356	0.2513	0.2852	0.3191	0.3425	0.3509	0.3546
	R_3- r_3	0.2488*	0.2180*	0.1846*	0.1717*	0.1579*	0.1423*	0.1235*	0.1107*	0.1022*
	tstat	11.4769	14.4662	15.8016	19.1107	20.3829	20.9486	20.4786	20.4188	18.4158
J=60	R_3	0.3870	0.4179	0.4354	0.4317	0.4441	0.4648	0.4685	0.4615	0.4634
	r_3	0.1308	0.1933	0.2484	0.2636	0.2934	0.3341	0.3566	0.3623	0.3682
	R_3- r_3	0.2562*	0.2246*	0.1870*	0.1681*	0.1507*	0.1307*	0.1119*	0.0991*	0.0952*
	tstat	10.8456	13.5905	15.8080	18.2899	19.0947	18.4564	18.2790	17.7636	17.2267
J=70	R_3	0.4064	0.4227	0.4400	0.4289	0.4444	0.4621	0.4639	0.4652	0.4702
	r_3	0.1330	0.2001	0.2549	0.2693	0.3042	0.3425	0.3608	0.3693	0.3745
	R_3- r_3	0.2734*	0.2226*	0.1850*	0.1596*	0.1402*	0.1196*	0.1031*	0.0959*	0.0957*
	tstat	10.9460	13.4277	15.0268	16.4483	17.1450	16.4766	15.7443	15.5503	16.8132
J=80	R_3	0.4188	0.4252	0.4351	0.4290	0.4418	0.4586	0.4684	0.4721	0.4732
	r_3	0.1420	0.2057	0.2584	0.2775	0.3086	0.3441	0.3644	0.3732	0.3762
	R_3- r_3	0.2768*	0.2195*	0.1766*	0.1515*	0.1332*	0.1144*	0.1040*	0.0988*	0.0971*
	tstat	11.1329	13.3562	14.0004	14.3545	14.3701	13.7282	14.0222	14.9061	15.9073
J=90	R_3	0.4142	0.4201	0.4379	0.4275	0.4363	0.4579	0.4710	0.4753	0.4753
	r_3	0.1548	0.2173	0.2756	0.2904	0.3164	0.3535	0.3767	0.3829	0.3832
	R_3- r_3	0.2594*	0.2029*	0.1624*	0.1371*	0.1199*	0.1044*	0.0943*	0.0923*	0.0921*
	tstat	10.3557	12.0193	12.2005	12.0312	11.6021	11.4532	11.7866	12.8796	14.3011

Note: * indicates a 1% statistical significance level, ** indicates a 5% statistical significance level, *** indicates a 10% statistical significance level.

(3) The Relationship Between Momentum Effect and Market Capitalization

Figures 5 and 6 illustrate the impact of parameters J and K, as well as market capitalization, on the new momentum strategy. Figure 5 shows the excess returns achieved by the new momentum strategy compared to the market portfolio across different market capitalizations. It was found that the mid-cap group achieved the highest excess returns with the new momentum strategy compared to the market portfolio, followed by the large-cap group, with the small-cap group achieving the lowest excess returns.

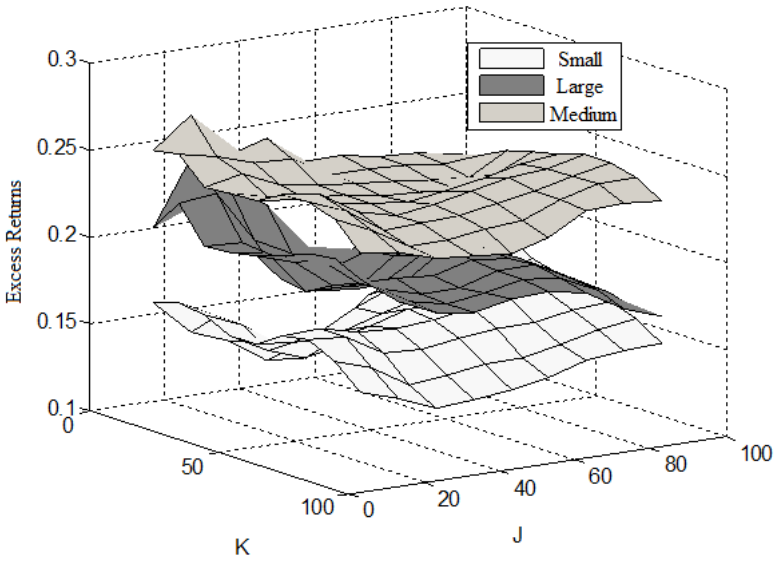

Figure 5: Excess Returns of the New Momentum Strategy Compared to the Market Portfolio

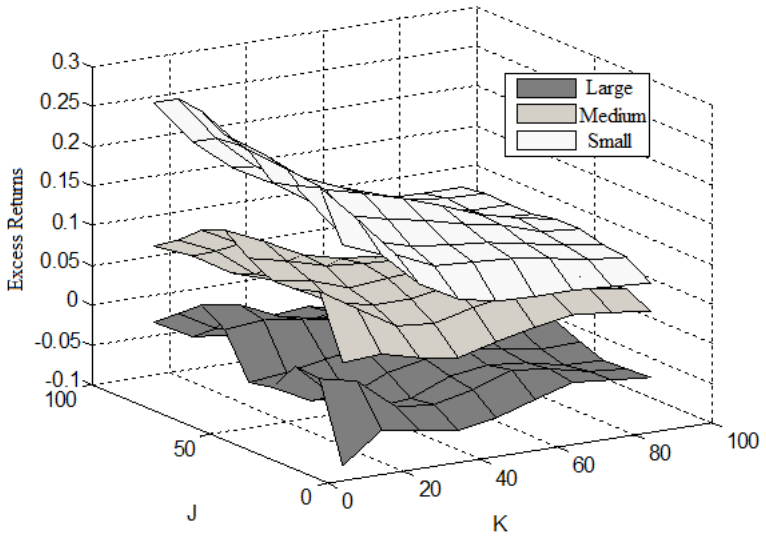

Figure 6: Excess Returns of the New Momentum Strategy Compared to the Traditional Momentum Strategy

Figure 6 shows the excess returns achieved by the new momentum strategy compared to the traditional momentum strategy across different market capitalizations. It was observed that in the large-cap group, the new momentum strategy did not achieve positive excess returns compared to the traditional momentum strategy. However, in the mid and small-cap groups, the new momentum strategy achieved positive excess returns compared to the traditional momentum strategy, with the small-cap group, in particular, achieving the highest excess returns. This further indicates that the new momentum strategy is more effective in capturing the momentum effect in mid and small-cap stock portfolios. The reason might be that the momentum strategy constructed based on the Cash Inflow and Outflow Relative Strength Index proposed in this paper can more effectively describe the intrinsic driving force behind stock price increases. For the main participants in the Chinese stock market, retail investors, they prefer to trade stocks with greater volatility in the mid and small-cap scales, because the same capital inflow shock results in larger price increases for mid and small-cap stocks compared to large-cap stocks.

V. CONCLUSION

This paper innovatively introduces a statistical indicator of the relative strength of capital inflows and outflows through the integration of big data analytics. This indicator, which utilizes data on price and volume changes, more accurately measures the impact of capital flows on future stock prices. Supported by big data analytics, we are capable of processing and analyzing vast amounts of market transaction data, thereby revealing the momentum effect in the stock market more comprehensively and precisely. Based on this indicator, we developed a new momentum investment strategy and empirically tested it using data from the Chinese A-share market. The results indicate that the new momentum strategy achieves excess returns over market benchmarks across large, medium, and small market capitalization stock portfolios, particularly achieving the highest excess returns in medium market capitalization portfolios, thereby validating the practical application value of big data analytics in enhancing the precision of momentum effect measurement and strategic investment decisions.

For portfolios of large, medium, and small market capitalization stocks, the new momentum strategy outperforms market benchmarks, achieving excess returns. This demonstrates the presence of a momentum effect in the Chinese A-share market in the short term (less than three months). Under medium market capitalization, the new momentum strategy secures the highest excess returns compared to the market benchmark, followed by large market capitalization, and the smallest excess returns were observed in small market capitalization portfolios.

Furthermore, the new momentum strategy surpasses traditional momentum strategy returns for medium and small market capitalization portfolios, further indicating that considering trading volume, the new momentum strategy more effectively measures the momentum effect within medium and small market capitalization stock portfolios.

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REFERENCES

[1] Jegadeesh N., and S. Titman,1993, “Returns to buying winners and selling losers: Implications for stock-market efficiency ”, Journal of Finance, 48(1),65-91.

[2] Rouwenhorst K.G.,1998, “International Momemtum Strategies”, Journal of Finance,53(2),267-284.

[3] Lee C., and B. Swaminathan, 2000, “Price Momentum and Trading Volume”, Journal of Finance ,55(7), 1217-1269.

[4] George T. J., and C. Y. Hwang, 2004, “The 52-week High and Momentum Investing”, Journal of Finance, 59 (5),2145-2176.

[5] Wang Yonghong, Zhao Xuejun: "Empirical Analysis of 'Inertia Strategy' and 'Reversal Strategy' in China's Stock Market", Economic Research, Issue 6, 2001.

[6] Zhu Zhanyu, Wu Chongfeng, Wang Chengwei: "The Relationship Between Stock Price Momentum and Trading Volume: An Empirical Study and International Comparison from China", Systems Engineering Theory and Practice, Issue 2, 2004.

[7] Xu Xinzhou, Zheng Chunyi: "Analysis of the Causes of Momentum Effects in the Chinese Stock Market", Economic Science, Issue 1, 2006.

[8] Yan Taihua, Liang Lan: "Study on the Momentum Effect in the Shanghai Stock Market - Based on Weekly Return Data from 1995-2009", Technology Economy, Issue 5, 2011.

[9] Niu Fang: "Empirical Study on the Momentum Effect in China's A-share Market", Macroeconomics, Issue 3, 2014.

[10] Zhu Zhanyu, Wu Chongfeng, Wang Chengwei: "Profitability Study of Price Momentum in the Chinese Stock Market Under Different Testing Periods", World Economy, Issue 8, 2003.