

Research Article

Does Market Timing Work Well in China's Mature and Emerging Stock Markets

Yan He* 

School of Business, Indiana University Southeast, New Albany, The United States

Abstract

China's Hang Seng Index (HSI) represents the mature market, and its Shanghai Stock Exchange Composite Index (SSE), the emerging market. I utilize six market timing (MT) methods and one dollar cost average (DCA) method to invest in the two stock indexes respectively. It is assumed that investors make a series of monthly cash contributions to an equity index in the long term. They do not possess lump-sum cash and cannot borrow cash. They buy and hold equity till the end of an investment period. The DCA method is simple, and it is to invest every monthly cash contribution immediately in an equity index. The six MT methods are complicated, and they are to invest more (less) than the monthly cash contribution, under the cash constraint, if the equity price has declined (risen). Empirical tests have been conducted for the 5-year, 10-year, and 20-year rolling investments during 1991-2022. My findings show that for both the HSI and SSE, the net returns generated by the six MTs are similar to those created by the DCA. In addition, the differences (MT-DCA) in the average monthly returns and modified Sharpe ratios are either statistically insignificant or negative and significant. Therefore, regardless the differences between the Hong Kong and mainland China markets, the complicated MTs do not outperform the simple DCA in China's mature and emerging stock indexes.

Keywords

Market Timing, Dollar Cost Averaging, Hang Seng Index, Shanghai Stock Exchange Composite Index

1. Introduction

Market timing (MT) and dollar cost averaging (DCA) are the major approaches to long-term stock investments. The MT tends to be time-consuming, complicated to use, and hard to operate by computer algorithms. In contrast, the DCA is simple to implement, and it can be set up easily and processed automatically. According to the existing literature, the comparisons of the MT and DCA give rise to various conclusions. In this paper, I investigate whether the MT is effective for the long-term investment in China's mature and emerging stock markets.

I select the Hong Kong and Shanghai stock exchanges from

China because their developmental stages vary distinctively. The former is a mature market, formally set up in 1891, symbolized by the Hang Seng Index (HSI), and denominated in the Hong Kong Dollar (HKD). The latter is an emerging market, established in 1990, represented by the Shanghai Stock Exchange Composite Index (SSE), and denominated in the Chinese Yuan (CNY). In general, the mature-market participants are mostly institutions, while the emerging-market participants are typically retail investors. The different features between the mature and emerging markets may have different implications for the investment methods.

*Corresponding author: yanhe@iu.edu (Yan He)

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In detail, my study investigates six MT methods (MT1, MT2, MT3, MT1R, MT2R, and MT3R) in comparison to the DCA. The investment performance is measured by the net return and two reference variables. It is assumed that investors make a series of monthly cash contributions to an equity index in the long term. They do not possess lump-sum cash and cannot borrow cash. They buy and hold equity till the end of an investment period. The equity index refers to the HSI as a mature market of China, or the SSE as an emerging market of China. My sample period is from January 1991 to December 2022, and my empirical tests are done for the 5-year, 10-year, and 20-year rolling investments respectively.

I summarize the key result in the following. For both the HSI and SSE, the six MTs produce statistically indifferent net returns from the DCA. So, the complicated MTs do not outperform the simple DCA in China's mature and emerging stock markets.

2. Literature Review

2.1. Literature on the MT and Other Methods

The existing literature has explored various MT methods, including augmented DCA, enhanced DCA, modified DCA, rebalancing, value averaging, etc. Overall, it is uncertain whether the MTs are more profitable than the DCA. For example, if equity prices are volatile, the MTs might outperform the DCA because the MTs buy more shares at lower prices. However, if equity prices increase continually for a long time, the MTs might underperform the DCA because the MTs buy fewer shares at rising prices.

First, some studies find that the MT methods are better than the DCA. The market timing of [32] augments the DCA by investing more in the month following a down market and less in the month following an up market. Similarly, the market timing of [12] enhances the DCA by investing a fixed additional amount after a down month and reducing the investment by a fixed amount after an up month. In addition, the modified DCA of [26] times the market returns, and it outperforms the traditional DCA across all the international stock markets investigated. The augmented DCA of [18] conditions the investment strategy to the market environment, and it works better than the traditional DCA. Finally, the rebalancing and value averaging strategies may beat the DCA, but they are not used in this paper because they violate my assumptions of no borrowing and no selling. Please see Appendix I for the literature on rebalancing and value averaging methods.

Second, other studies claim that the MT methods do not outperform the DCA. As mentioned by [19], the MT is difficult to achieve even for professional or experienced investors, while the DCA is appealing for ordinary investors. As reported by [15], the MT and DCA methods deliver statistically indifferent performances in both the U.S. and Japanese markets. As stated by [17], the non-DCA equity

fund investors, some of which are market timers, earn a lower average return than their DCA counterparts, based on a research report provided by some fund companies in China.

Third, besides the MT and DCA, the lump sum (LS) and asset allocation (AA) methods are also examined in the current literature. The LS and AA would require 100% and 50% respectively of total cash contributions invested at the beginning, which are against my assumptions of monthly cash contributions and no borrowing. Hence, this paper does not involve them. Please see Appendix I for the literature on LS and AA methods.

2.2. Literature on China's Stock Markets and Funds

I review the features of China's stock markets as well as the performance of China's stock funds. Specifically, the different features of the Hong Kong and Shanghai stock markets may suggest different investment approaches; and the performance of stock mutual funds may expose the market timing ability of fund managers.

The Hong Kong Stock Exchange is a mature market, and it has the following three characteristics. First, the Hong Kong stock market is mainly traded by institutional investors, who are more likely (than individual investors) to have different beliefs and rely on their private information to make investment decisions [39]. Second, the Hong Kong stock index is significantly integrated with the U.S. and the Asia indexes [5]. Furthermore, the Hong Kong stock market is cointegrated with the mainland Chinese market in the long run [21]. Third, when Hong Kong was reunited with China in 1997, it accounted for 13% of China's GDP; but in 2019, only 2.6%; and Hong Kong's overall standing as a global financial center has slipped [24].

The Shanghai Stock Exchange is an emerging market, and it has the following five attributes. First, the mainland Chinese market is actively traded by individual investors [29, 39, 16]. Retail investors in mainland China hold 58% of the market and account for 80% of trading volume [6]. Second, the U.S. stock market has return spillover effects on the mainland Chinese stock market, but no volatility spillover effect [23]. At the beginning of China's membership in the World Trade Organization, there was no significant short-term interaction between the U.S. and Chinese stock markets. Since then, some policies have been implemented to open up the Chinese capital market, and the linkage between the U.S. and China has become stronger. Third, the mainland Chinese stocks have a division between floatable and nonfloatable shares, known as the split-share structure, which has been largely dismantled by the 2005 reform [31]. The mean (median) percentage of shares that are nonfloatable has reduced from 60.33% (62.12%) in 2003 to 20.96% (8.94%) in 2015 [16]. Fourth, the mainland Chinese market demonstrates some unique calendar anomalies. One example is the March political window-dressing effect, plausibly caused by political

maneuver by the Chinese government [41]. Another example is the monthly mutual fund DCA investment in the first 5 days of each month, which tends to generate a higher return than the investment in the remaining days [17]. Fifth, domestically listed Chinese (A-share) firms encounter some regulatory and management challenges, such as institutional deficiencies in listing and delisting processes as well as weak corporate governance in terms of shareholder value creation [1].

The performance of China's stock mutual funds demonstrates mixed results on fund managers' market timing ability. First, as [38] and [25] document, Chinese mutual fund managers have the ability to time the market returns. Second, according to [40], only growth-oriented funds are able to successfully time the market returns. Third, as [14] reports, China's mutual fund industry is about one-tenth the size of the U.S. market; and less than 5% of the actively managed funds in China show significant market timing ability. In addition, based on [34], Chinese investment funds do not possess significant and positive market-timing skill on average, and the majority of them are negative market timers.

3. Data, Methods, and Measures

3.1. Data Sample and Conditions

The data sample includes monthly prices of the HSI and SSE. The entire period is from January 1991 to December 2022. In addition, the month-by-month rolling 5-year, 10-year, and 20-year periods are also examined.

I assume the following conditions for investing monthly cash contributions in HSI and SSE respectively.

For the entire period (January 1991 to December 2022), the investment horizon is 32 years. For every 5-year (10-year, or 20-year) rolling period, the investment horizon is 5 years (10 years, or 20 years).

An investor contributes 10,000 cash every month, in the same currency as the equity index. Each contribution can be invested in the equity index immediately, saved as cash, or partially invested and partially saved.

Investors use the cash contributions currently received and previously saved to buy the equity index. They cannot borrow cash to invest.

Investors buy and hold the equity index. They cannot sell the equity index before the end of an investment period.

The interest rate paid on cash savings is 0%.

3.2. Methods

I utilize the DCA and MT investment methods in this study. Please note that I do not employ the rebalancing, value averaging, LS, and AA methods since they are inconsistent

with the conditions mentioned above. Following the market timing literature, I specify the DCA, MT1, MT2, and MT3 methods. Furthermore, in order to avoid certain extreme situations, I have developed three revised MT methods (MT1R, MT2R, and MT3R).

The DCA method is simple to use. Under the DCA, an investor contributes 10,000 in an equity index every month, where the cash contribution and the equity index are in the same currency. Thus, each cash contribution is invested entirely and immediately, which makes the cash savings to stay at zero.

The MT methods tend to be more difficult in execution, but they might deliver higher returns. The six MTs (MT1, MT2, MT3, MT1R, MT2R, and MT3R) deviate from the DCA by investing less (more) than the monthly cash contribution if the equity index has risen (declined). These MT methods are subject to the constraint of available cash. They are to invest a varying amount of cash in an equity index every month, but they calculate the monthly investment with different formulas. The MT1 calculation of the monthly investment is defined as follows.

$$\text{Maximum} \{ \text{Minimum} [10,000+s, (1-r_m)*10,000], 0 \}, \quad (1)$$

where s is the cumulative cash savings from the previous months, and r_m is the monthly return of the equity index. The first term, $10,000+s$, denotes the cash constraint. The second term, $(1-r_m)*10,000$, represents the potential amount that could be invested without any cash constraint. The minimum of the two terms is selected; if positive, it is the invested amount; otherwise, zero is the invested amount since investors are not allowed to sell within the investment horizon. In specific, if the equity index has risen and the monthly return is positive, the invested amount will be less than 10,000, but more than or equal to zero. If the equity index has stayed the same and the monthly return is zero, the amount invested will be equal to 10,000. If the equity index has declined and the monthly return is negative, the amount invested, which is constrained by the amount of cash currently received and previously saved, will be more than or equal to 10,000.

The MT2 and MT3 methods distinguish the first month from the following months in a year. For the amount invested in the first month of the year, the MT2 computation is the same as that of the MT1. The MT3 computation of the investment in the first month of the year is stated as follows.

$$\text{Maximum} \{ \text{Minimum} [10,000+s, (1-r_a)*10,000], 0 \}, \quad (2)$$

where r_a is the annual return of the equity index. For the amount invested in each following month of the year, the MT2 and MT3 calculations are the same, and they are defined as:

$$\text{Maximum} \{ \text{Minimum} [10,000+s, (1-r_m)*\text{previous investment}], 0 \}. \quad (3)$$

According to the above definitions of MT1, MT2, and MT3, the invested amount will be zero if r_m (or r_a) is higher than 100%. To avoid such extreme situations, I reduce the scale of r_m (or r_a) by multiplying a coefficient of 0.1 to it. Thus, I end up with three revised MT measures: MT1R, MT2R, and MT3R. The MT1R calculation of the monthly investment is defined as:

$$\text{Maximum \{Minimum [10,000+s, (1-0.1*r}_m\text{)*10,000], 0\}. \quad (4)$$

For the amount invested in the first month of a year, the MT2R computation is the same as that of the MT1R. The MT3R computation of the investment in the first month of the year is defined as:

$$\text{Maximum \{Minimum [10,000+s, (1-0.1*r}_a\text{)*10,000], 0\}. \quad (5)$$

For the amount invested in each following month of the year, the MT2R and MT3R calculations are the same, and they are defined as:

$$\text{Maximum \{Minimum [10,000+s, (1-0.1*r}_m\text{)*previous investment], 0\}. \quad (6)$$

In sum, the investment of each MT method changes from month to month, whereas the investment of the DCA method is fixed every month. Appendix II demonstrates the examples

of monthly investments during the first 24 months (January 1991 to December 1992) for the six MTs. Table A1 of Appendix II reports the monthly investments in the HSI, and Table A2, the SSE.

3.3. Measures

For either the HSI or SSE, the total cash contributions to an equity index are 3.84 million in the entire period of 32 years. At the end, investors will hold a portfolio of equity and cash, or a portfolio of equity only. The ending value of the portfolio may be above, below, or equal to 3.84 million, depending on both the equity performance and the investment method.

For the rolling period investments, the total cash contributions to an equity index are 0.6 million in every 5-year period, and the ending value of the portfolio may be different from or equal to 0.6 million. Likewise, in every 10-year (or 20-year) period, the total cash contributions to an equity index are 1.2 million (or 2.4 million), and the ending value of the portfolio may be different from or equal to 1.2 million (or 2.4 million).

In line with the market timing literature, I set up one key measure and two reference measures for investment performance. My key measure is the Net Return, that is, the excess ending value in percentage over an investment period. It is defined as follows.

$$(\text{Ending Value} - \text{Total Cash Contributions}) / \text{Total Cash Contributions}, \quad (7)$$

where the Ending Value is calculated as the sum of the ending equity value and ending cash.¹ In addition, my two reference measures of investment performance are the Average Monthly Return and the Modified Sharpe Ratio. The Average Monthly Return represents the mean of monthly portfolio returns. The Modified Sharpe Ratio refers to the risk-adjusted average monthly return, calculated as the Average Monthly Return divided by the standard deviation of monthly portfolio returns.

4. Empirical Results

4.1. Results of the Entire Period (1991-2022)

Both Hong Kong and Shanghai stock indexes have appreciated substantially in the last three decades. As Figures 1 and 2 display, the monthly prices of the HSI and SSE largely move upward, with considerable volatility. For the HSI, the minimum monthly price during the sample period is HKD 3,024, which happened in January 1991; and the maximum is HKD32,887, which happened in January 2018. For the SSE, the minimum monthly price during the sample period is CNY114, which occurred in April 1991; and the maximum is CNY5,955, which occurred in October 2007.

I present the summary statistics for the HSI and SSE during the entire period in Table 1. First, I note that for each index, the Average Index Price in Table 1 is higher than the Average Cost per Share in Table 2. For example, the Average Index Price of the HSI is HKD17,112, while the Average Cost per Share of purchasing the HSI is HKD13,353 (based on the MT1 method), HKD13,547 (MT2), HKD13,719 (MT3), HKD13,332 (MT1R), HKD13,352 (MT2R), HKD13,364 (MT3R), and HKD13,329 (DCA). Similarly, the Average Index Price of the SSE is CNY2,076, while the Average Cost per Share of purchasing the SSE is CNY1,223 (MT1), CNY1,278 (MT2), CNY1,221 (MT3), CNY1,212 (MT1R), CNY1,218 (MT2R), CNY1,217 (MT3R), and CNY1,211 (DCA). Therefore, the average cost of purchasing an equity index is lower than the average price of the index, highlighting a nice attribute of all the MT and DCA methods.

Second, the SSE has both higher return and higher risk than the HSI. The %Change in Price is 554.15% for the HSI and 2320.86% for the SSE over the entire period. In addition, the Mean of Monthly Returns is 0.7380% for the HSI and 1.6137% for the SSE. Hence, the emerging market (SSE) has higher returns than the mature market (HSI). Furthermore, the SD of Monthly Returns is 7.0731% for the HSI and 14.9007% for the SSE. So, the emerging market (SSE) has higher volatility than the mature market (HSI).

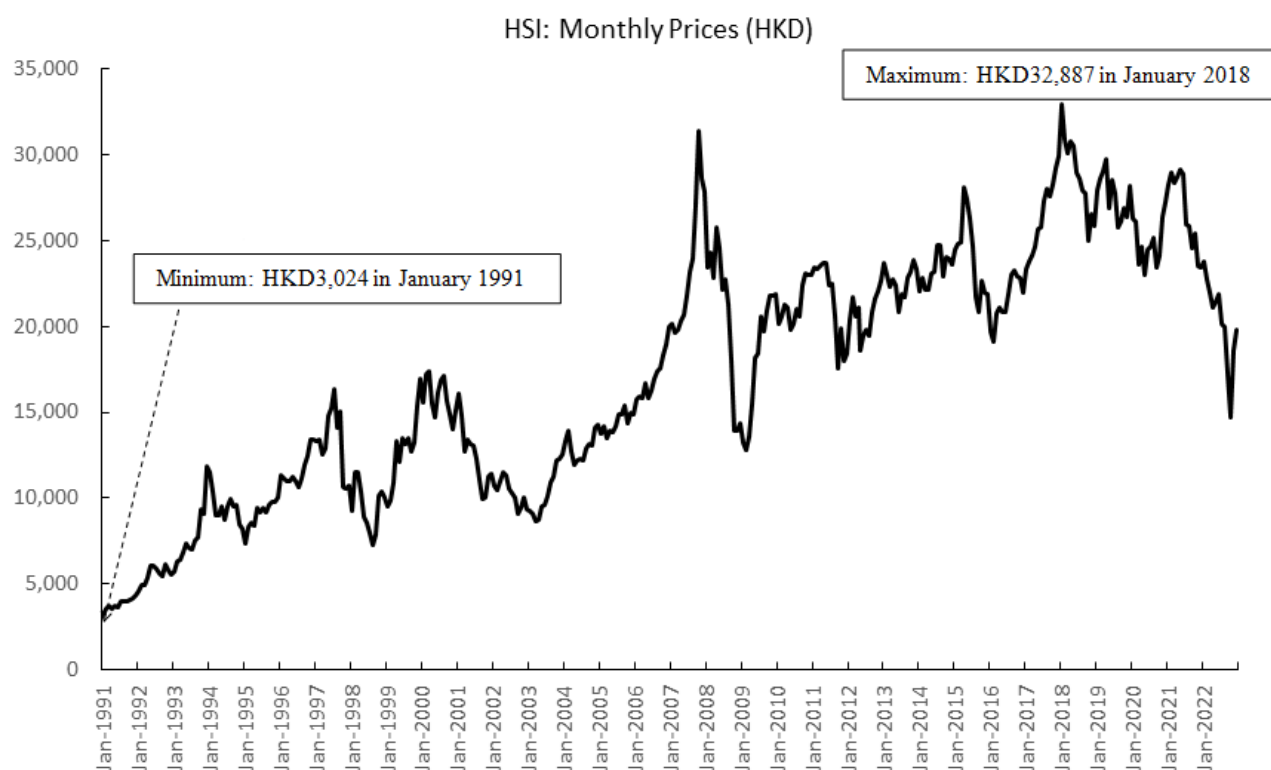


Figure 1. Monthly Prices of the HSI.

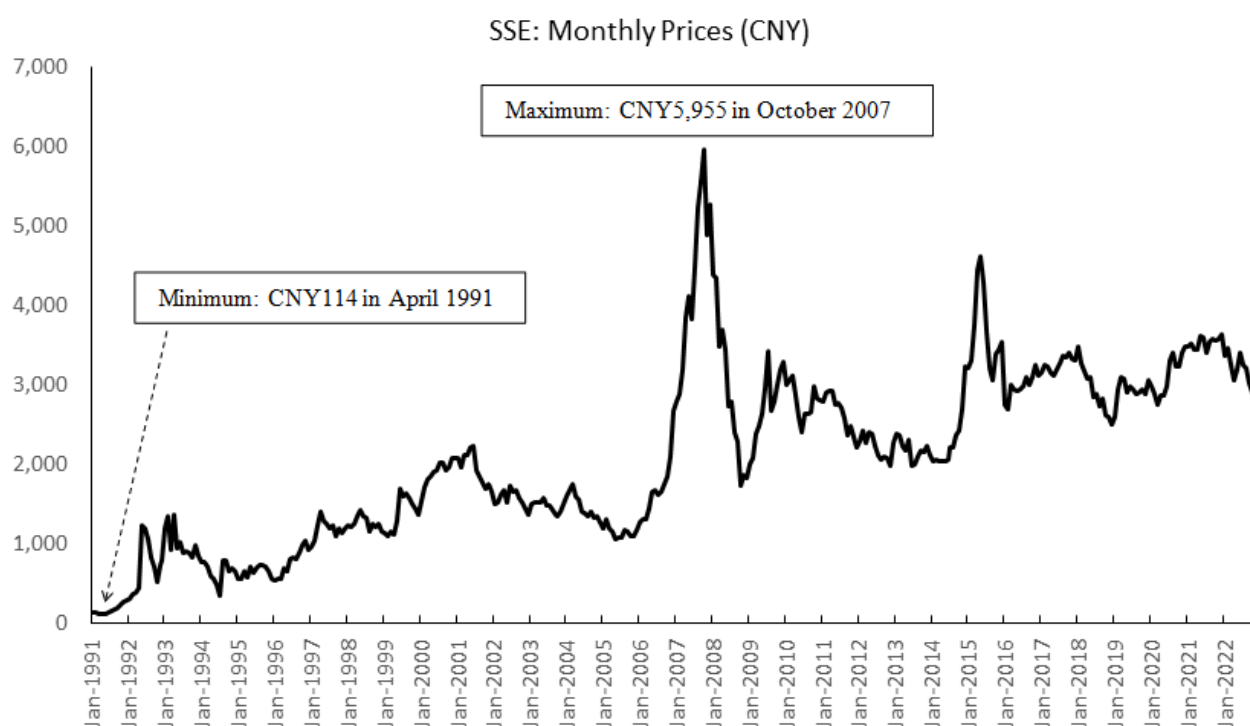


Figure 2. Monthly Prices of the SSE.

Third, the monthly returns of the HSI and SSE are weakly correlated (0.2040). Although both indexes represent the stocks in China, they may reflect different conditions and

stages of the markets. Therefore, it is necessary to investigate them separately and compare their results.

Table 1. Summary Statistics of the HSI and SSE.

	HSI	SSE
Average Index Price	HKD17,112	CNY2,076
Minimum Index Price	HKD3,024	CNY114
Maximum Index Price	HKD32,887	CNY5,955
Beginning Index Price (January 1991)	HKD3,024	CNY128
Ending Index Price (December 2022)	HKD19,781	CNY3,089
%Change in Price from Jan 1991 to Dec 2022	554.15%	2320.86%
Mean of Monthly Returns	0.7380%	1.6137%
SD of Monthly Returns	7.0731%	14.9007%
Median of Monthly Returns	1.0017%	0.6077%
Minimum of Monthly Returns	-29.4067%	-31.1529%
Maximum of Monthly Returns	30.2810%	177.2262%
Correlation of HSI and SSE Monthly Returns	0.2040	

The table presents summary statistics of the HSI and SSE. Monthly data are used, ranging from January 1991 to December 2022.

I show the summary results based on the MT and DCA methods during the entire period in Table 2. Panel A reports the summary results of the HSI, and Panel B, the SSE. First, the Total Shares Purchased, Average Cost per Share, and Ending Cash are the essential elements of investment activities, but they are not the measures of ultimate outcomes. As the results tell, the MTs have less Total Shares Purchased and higher Average Cost per Share than the DCA. In addition, the MTs have positive amounts of Ending Cash, while the DCA has zero Ending Cash. These observations do not allow us to determine which method is ultimately better than the others.

Second, the MTs do not dominate the DCA in the Net Return, a key measure of investment performance.

Specifically, the Net Return of the HSI investment is 47.80% (MT1), 44.42% (MT2), 37.52% (MT3), 48.34% (MT1R), 47.98% (MT2R), 47.31% (MT3R), and 48.40% (DCA).² In addition, the Net Return of the SSE investment is 150.57% (MT1), 127.83% (MT2), 121.34% (MT3), 154.63% (MT1R), 151.85% (MT2R), 148.95% (MT3R), and 155.14% (DCA). Hence, the Net Return of every MT method does not exceed its DCA counterpart.

Third, the MTs do not persistently outperform the DCA in the two reference measures of investment performance. Specifically, the MTs may have lower or higher Average Monthly Return or Modified Sharpe Ratio than the DCA. Next, I conduct some statistical tests based on the month-by-month rolling investments.

Table 2. Summary Results of the Entire Period.

	Total Shares Purchased	Average Cost per Share	Ending Cash	Ending Value	Net Return	Average Monthly Return	Modified Sharpe Ratio
Panel A. Summary Results of the HSI							
		HKD	HKD	HKD million			
MT1	285.51	13,353	27,613	5.675	47.80%	0.7108%	0.1015
MT2	273.58	13,547	133,847	5.546	44.42%	0.6566%	0.0987
MT3	237.68	13,719	579,291	5.281	37.52%	0.5625%	0.0987
MT1R	287.83	13,332	2,761	5.696	48.34%	0.7200%	0.1019
MT2R	286.56	13,352	13,877	5.682	47.98%	0.7143%	0.1016

	Total Shares Purchased	Average Cost per Share	Ending Cash	Ending Value	Net Return	Average Monthly Return	Modified Sharpe Ratio
MT3R	283.09	13,364	56,716	5.657	47.31%	0.7051%	0.1015
DCA	288.09	13,329	0	5.699	48.40%	0.7210%	0.1019
Panel B. Summary Results of the SSE							
		CNY	CNY	CNY million			
MT1	3,097.88	1,223	51,791	9.622	150.57%	1.5610%	0.1080
MT2	2,709.54	1,278	378,075	8.749	127.83%	1.3429%	0.1076
MT3	2,493.35	1,221	796,801	8.499	121.34%	1.2481%	0.1093
MT1R	3,163.05	1,212	6,303	9.778	154.63%	1.6071%	0.1081
MT2R	3,115.30	1,218	47,097	9.671	151.85%	1.5759%	0.1082
MT3R	3,054.26	1,217	124,098	9.559	148.95%	1.5348%	0.1087
DCA	3,171.49	1,211	0	9.798	155.14%	1.6131%	0.1081

The table presents the summary results of the entire period, based on the MT1, MT2, MT3, MT1R, MT2R, MT3R, and DCA methods. Panel A reports the summary results of the HSI, and Panel B, the SSE. Monthly data are examined, ranging from January 1991 to December 2022. The Total Cash Contributions for the entire period are 3.84 million, in the same currency as their matching equity index.

4.2. Results of Five-year Rolling Periods

I present the 5-year rolling investment results based on the MT and DCA methods in Table 3. Panel A of Table 3 shows the mean, standard deviation, and t-value for the Net Return. Based on the monthly rolling 5-year investments in the HSI, the mean of net returns is 15.04% (MT1), 15.02% (MT2), 14.76% (MT3), 15.02% (MT1R), 15.02% (MT2R), 15.01% (MT3R), and 15.02% (DCA). Also, the six t-values on the mean difference (MT-DCA) are insignificant at the 5% level (0.01, 0.00, -0.14, 0.00, 0.00, and 0.00). Obviously, the MTs and DCA generate similar 5-year net returns in the Hong Kong stock market. Based on the monthly rolling 5-year investments in the SSE, the mean of net returns is 26.72% (MT1), 26.00% (MT2), 28.58% (MT3), 26.65% (MT1R), 26.59% (MT2R), 26.87% (MT3R), and 26.64% (DCA). In

addition, the six t-values on the mean difference (MT-DCA) are insignificant at the 5% level (0.02, -0.18, 0.53, 0.00, -0.01, and 0.06). Evidently, the MTs and DCA deliver similar 5-year net returns in the Shanghai stock market. So, for both the HSI and SSE, the six MTs are statistically indifferent from the DCA in terms of the 5-year net return.

Panels B and C of Table 3 show the mean, standard deviation, and t-value for the Average Monthly Return and Modified Sharpe Ratio, respectively. According to the monthly rolling 5-year investments in the HSI and SSE, the t-values on the mean difference (MT-DCA) are insignificant in most cases, or negative and significant otherwise. Hence, regarding the two reference measures, the six MTs are statistically indifferent from the DCA in most cases, or significantly worse than the DCA otherwise. These results in Panel B support those in Panel A of Table 3.

Table 3. Results of 5-Year Rolling Periods.

	HSI	HSI	HSI	SSE	SSE	SSE
	Mean	SD	t-value on the mean diff. (MT-DCA)	Mean	SD	t-value on the mean diff. (MT-DCA)
Panel A. Net Return						
MT1	15.04%	25.43%	0.01	26.72%	46.79%	0.02
MT2	15.02%	23.90%	0.00	26.00%	44.14%	-0.18
MT3	14.76%	21.09%	-0.14	28.58%	46.36%	0.53

	HSI	HSI	HSI	SSE	SSE	SSE
	Mean	SD	t-value on the mean diff. (MT-DCA)	Mean	SD	t-value on the mean diff. (MT-DCA)
MT1R	15.02%	25.72%	0.00	26.65%	46.99%	0.00
MT2R	15.02%	25.55%	0.00	26.59%	46.70%	-0.01
MT3R	15.01%	25.21%	0.00	26.87%	46.78%	0.06
DCA	15.02%	25.75%	-	26.64%	47.01%	-
Panel B. Average Monthly Return						
MT1	0.6522%	0.6180%	-0.16	1.0982%	1.4217%	-0.26
MT2	0.6118%	0.5710%	-1.02	0.9250%	1.1922%	-1.93
MT3	0.5117%	0.4896%	-3.35*	0.8597%	1.1038%	-2.62*
MT1R	0.6591%	0.6256%	-0.02	1.1240%	1.4689%	-0.03
MT2R	0.6549%	0.6207%	-0.10	1.0996%	1.4330%	-0.25
MT3R	0.6453%	0.6129%	-0.30	1.0644%	1.3848%	-0.56
DCA	0.6598%	0.6265%	-	1.1278%	1.4754%	-
Panel C. Modified Sharpe Ratio						
MT1	0.1003	0.0977	-0.01	0.0917	0.1007	-0.04
MT2	0.0995	0.0975	-0.11	0.0893	0.1007	-0.33
MT3	0.0980	0.0988	-0.32	0.0889	0.1015	-0.38
MT1R	0.1004	0.0977	0.00	0.0919	0.1008	0.00
MT2R	0.1003	0.0977	-0.01	0.0916	0.1008	-0.04
MT3R	0.1002	0.0978	-0.03	0.0913	0.1009	-0.08
DCA	0.1004	0.0977	-	0.0920	0.1008	-

The table reports the 5-year rolling investment results for the MT1, MT2, MT3, MT1R, MT2R, MT3R, and DCA methods. Panels A, B, and C report the test statistics for the Net Return, Average Monthly Return, and Modified Sharpe Ratio, respectively. The Total Cash Contributions for every 5 years are 0.6 million, in the same currency as their matching equity index. The mean difference between the MT and DCA is defined as MT-DCA. The star (*) represents statistical significance at the 5% level.

4.3. Results of Ten-year Rolling Periods

I show the 10-year rolling investment results based on the MT and DCA methods in Table 4. Panel A of Table 4 provides the test statistics for the Net Return. According to the monthly rolling 10-year investments in the HSI, the mean of net returns is 25.36% (MT1), 25.95% (MT2), 25.70% (MT3), 25.29% (MT1R), 25.35% (MT2R), 25.35% (MT3R), and 25.28% (DCA). Moreover, the six t-values on the mean difference (MT-DCA) are insignificant at the 5% level (0.03, 0.29, 0.18, 0.00, 0.03, and 0.03). Noticeably, the MTs and DCA create similar 10-year net returns in the Hong Kong stock market. Based on the monthly rolling 10-year investments in the SSE, the mean of net returns is 41.80% (MT1), 39.73% (MT2), 41.17%

(MT3), 41.89% (MT1R), 41.66% (MT2R), 41.64% (MT3R), and 41.91% (DCA). Also, the six t-values on the mean difference (MT-DCA) are insignificant at the 5% level (-0.02, -0.50, -0.17, 0.00, -0.05, and -0.06). Apparently, the MTs and DCA produce similar 10-year net returns in the Shanghai stock market. Therefore, the net returns of 10-year rolling investments in Table 4 are compatible with those of 5-year rolling investments in Table 3.

Panels B and C of Table 4 provide the test statistics for the Average Monthly Return and Modified Sharpe Ratio, respectively. For both the HSI and SSE, the t-values on the mean difference (MT-DCA) are insignificant in most cases, or negative and significant otherwise. Hence, the two reference measures of 10-year rolling investments in Table 4 are consistent with those of 5-year rolling investments in Table 3.

Table 4. Results of 10-Year Rolling Periods.

	HSI Mean	HSI SD	HSI t-value on the mean diff. (MT-DCA)	SSE Mean	SSE SD	SSE t-value on the mean diff. (MT-DCA)
Panel A. Net Return						
MT1	25.36%	26.44%	0.03	41.80%	52.85%	-0.02
MT2	25.95%	26.51%	0.29	39.73%	46.28%	-0.50
MT3	25.70%	25.67%	0.18	41.17%	43.37%	-0.17
MT1R	25.29%	26.53%	0.00	41.89%	53.76%	0.00
MT2R	25.35%	26.54%	0.03	41.66%	52.94%	-0.05
MT3R	25.35%	26.43%	0.03	41.64%	52.12%	-0.06
DCA	25.28%	26.54%	-	41.91%	53.87%	-
Panel B. Average Monthly Return						
MT1	0.6122%	0.2905%	-0.26	0.9543%	0.8149%	-0.30
MT2	0.5793%	0.2635%	-1.62	0.8185%	0.6747%	-2.36*
MT3	0.4870%	0.2224%	-5.79*	0.7642%	0.6223%	-3.27*
MT1R	0.6180%	0.2948%	-0.03	0.9732%	0.8443%	-0.04
MT2R	0.6146%	0.2919%	-0.16	0.9551%	0.8227%	-0.29
MT3R	0.6058%	0.2876%	-0.51	0.9288%	0.7940%	-0.66
DCA	0.6187%	0.2953%	-	0.9760%	0.8482%	-
Panel C. Modified Sharpe Ratio						
MT1	0.0882	0.0355	-0.05	0.0927	0.0427	-0.07
MT2	0.0874	0.0351	-0.31	0.0904	0.0427	-0.69
MT3	0.0861	0.0360	-0.72	0.0904	0.0436	-0.69
MT1R	0.0883	0.0356	0.00	0.0929	0.0427	-0.01
MT2R	0.0882	0.0356	-0.03	0.0927	0.0427	-0.07
MT3R	0.0881	0.0356	-0.09	0.0924	0.0428	-0.14
DCA	0.0883	0.0356	-	0.0930	0.0427	-

The table reports the 10-year rolling investment results for the MT1, MT2, MT3, MT1R, MT2R, MT3R, and DCA methods. Panels A, B, and C report the test statistics for the Net Return, Average Monthly Return, and Modified Sharpe Ratio, respectively. The Total Cash Contributions for every 10 years are 1.2 million, in the same currency as their matching equity index. The mean difference between the MT and DCA is defined as MT-DCA. The star (*) represents statistical significance at the 5% level.

4.4. Results of Twenty-year Rolling Periods

I report the 20-year rolling investment results based on the MT and DCA methods in Table 5. Panel A of Table 5 shows the test statistics for the Net Return. Regarding the monthly rolling 20-year investments in the HSI, the mean of net returns is 56.85% (MT1), 56.93% (MT2), 52.66% (MT3), 56.94% (MT1R), 56.95% (MT2R), 56.57% (MT3R), and 56.95% (DCA). In addition, the six t-values on the mean difference

(MT-DCA) are insignificant at the 5% level (-0.03, -0.01, -1.57, 0.00, 0.00, and -0.13). Clearly, the MTs and DCA generate similar 20-year net returns in the Hong Kong stock market. Regarding the monthly rolling 20-year investments in the SSE, the mean of net returns is 67.61% (MT1), 62.57% (MT2), 62.37% (MT3), 67.89% (MT1R), 67.34% (MT2R), 66.98% (MT3R), and 67.93% (DCA). Moreover, the six t-values on the mean difference (MT-DCA) are insignificant at the 5% level (-0.07, -1.29, -1.40, -0.01, -0.13, and -0.21). Thus, the MTs and DCA create similar 20-year net returns in

the Shanghai stock market. All told, the net returns of 20-year rolling investments in Table 5 are congruent with those of 5-year rolling investments in Table 3.

Panels B and C of Table 5 show the test statistics for the Average Monthly Return and Modified Sharpe Ratio,

respectively. For both the HSI and SSE, the t-values on the mean difference (MT-DCA) are insignificant in most cases, or negative and significant otherwise. So, the two reference measures for 20-year rolling investments in Table 5 are in line with those of 5-year rolling investments in Table 3.

Table 5. Results of 20-Year Rolling Periods.

	HSI	HSI	HSI	SSE	SSE	SSE
	Mean	SD	t-value on the mean diff. (MT-DCA)	Mean	SD	t-value on the mean diff. (MT-DCA)
Panel A. Net Return						
MT1	56.85%	25.00%	-0.03	67.61%	37.78%	-0.07
MT2	56.93%	23.88%	-0.01	62.57%	30.95%	-1.29
MT3	52.66%	20.92%	-1.57	62.37%	27.48%	-1.40
MT1R	56.94%	25.19%	0.00	67.89%	38.89%	-0.01
MT2R	56.95%	25.07%	0.00	67.34%	38.02%	-0.13
MT3R	56.57%	24.74%	-0.13	66.98%	37.06%	-0.21
DCA	56.95%	25.21%	-	67.93%	39.03%	-
Panel B. Average Monthly Return						
MT1	0.6207%	0.1867%	-0.29	0.9272%	0.4962%	-0.34
MT2	0.5889%	0.1654%	-1.82	0.7981%	0.4084%	-2.72*
MT3	0.4964%	0.1364%	-6.70*	0.7460%	0.3752%	-3.78*
MT1R	0.6265%	0.1898%	-0.03	0.9450%	0.5152%	-0.04
MT2R	0.6232%	0.1876%	-0.18	0.9279%	0.5018%	-0.33
MT3R	0.6144%	0.1847%	-0.58	0.9032%	0.4840%	-0.75
DCA	0.6272%	0.1902%	-	0.9477%	0.5178%	-
Panel C. Modified Sharpe Ratio						
MT1	0.0902	0.0202	-0.05	0.0916	0.0215	-0.08
MT2	0.0896	0.0194	-0.34	0.0893	0.0209	-1.01
MT3	0.0885	0.0202	-0.79	0.0893	0.0213	-1.00
MT1R	0.0904	0.0203	-0.01	0.0918	0.0216	-0.01
MT2R	0.0903	0.0202	-0.03	0.0916	0.0215	-0.09
MT3R	0.0901	0.0203	-0.09	0.0914	0.0215	-0.16
DCA	0.0904	0.0203	-	0.0918	0.0216	-

The table reports the 20-year rolling investment results for the MT1, MT2, MT3, MT1R, MT2R, MT3R, and DCA methods. Panels A, B, and C report the test statistics for the Net Return, Average Monthly Return, and Modified Sharpe Ratio, respectively. The Total Cash Contributions for every 20 years are 2.4 million, in the same currency as their matching equity index. The mean difference between the MT and DCA is defined as MT-DCA. The star (*) represents statistical significance at the 5% level.

5. Conclusions

I explore the MT and DCA methods for the long-term investment in China's stock markets. The equity index is the HSI for China's mature market, or the SSE for China's emerging market. The investment period is from January 1991 to December 2022. The DCA method is simple, and it is to invest every monthly cash contribution immediately in an equity index. The six MT methods are complicated, and they are to invest more (less) than the monthly cash contribution, under the cash constraint, if the equity price has declined (risen).

I summarize my major findings as follows. First, the MTs and DCA generate similar net returns for both the HSI and SSE. As shown by the respective 5-year, 10-year, and 20-year rolling period tests, the differences in net returns between the MTs and DCA are statistically insignificant. Second, the differences (MT-DCA) in the average monthly returns and modified Sharpe ratios are either statistically insignificant or negative and significant.

Overall, in spite of the differences between the Hong Kong and mainland China markets, the complicated MTs do not hold any considerable advantage over the simple DCA in either the HSI or SSE investment. Therefore, my six market timing methods do not work better than the dollar cost averaging for the long-term investment in China's mature and emerging stock markets.

Abbreviations

AA	Asset Allocation
CNY	Chinese Yuan
DCA	Dollar Cost Average
HKD	Hong Kong Dollar
HSI	Hang Seng Index
LS	Lump Sum
MT	Market Timing

SSE Shanghai Stock Exchange Composite Index

Author Contributions

Yan He is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

Appendix

Appendix I. Additional Literature

Rebalancing and value averaging methods

The rebalancing and value averaging methods belong to the market timing approach. Some studies show that the rebalancing and value average strategies dominate the DCA [4, 7, 8, 20].

LS and AA methods

The LS and AA methods are compared with the DCA. Some studies report that the LS and AA methods outperform the DCA [10, 33, 22, 3, 30]. Other studies argue that the LS may be less favored than the DCA in certain situations [36, 2, 11, 9, 13, 28, 37, 35, 27].

Appendix II. Examples of Monthly Investments

The appendix shows the examples of monthly investments from January 1991 to December 1992, according to the MT1, MT2, MT3, MT1R, MT2R, and MT3R methods, respectively. Panel A reports the monthly investments in the HSI, and Panel B, the SSE.

Table A1. Monthly Investments in the HSI.

	Price (HKD)	Investment (HKD)					
	HSI	MT1	MT2	MT3	MT1R	MT2R	MT3R
Jan 1991	3,243	10,000	10,000	10,000	10,000	10,000	10,000
Feb 1991	3,552	9,047	9,047	9,047	9,905	9,905	9,905
Mar 1991	3,745	9,457	8,556	8,556	9,946	9,851	9,851
Apr 1991	3,588	10,419	8,914	8,914	10,042	9,892	9,892
May 1991	3,707	9,668	8,619	8,619	9,967	9,859	9,859
June 1991	3,668	10,105	8,709	8,709	10,011	9,870	9,870
July 1991	4,009	9,070	7,900	7,900	9,907	9,778	9,778
Aug 1991	3,998	10,027	7,921	7,921	10,003	9,781	9,781

	Price (HKD)	Investment (HKD)					
	HSI	MT1	MT2	MT3	MT1R	MT2R	MT3R
Sept 1991	3,957	10,103	8,003	8,003	10,010	9,791	9,791
Oct 1991	4,039	9,793	7,837	7,837	9,979	9,771	9,771
Nov 1991	4,150	9,725	7,622	7,622	9,972	9,744	9,744
Dec 1991	4,297	9,645	7,351	7,351	9,964	9,709	9,709
Jan 1992	4,602	9,291	9,291	5,810	9,929	9,929	9,581
Feb 1992	4,929	9,289	8,631	5,397	9,929	9,859	9,513
Mar 1992	4,938	9,981	8,614	5,387	9,998	9,857	9,511
Apr 1992	5,370	9,127	7,862	4,916	9,913	9,771	9,428
May 1992	6,080	8,677	6,822	4,266	9,868	9,641	9,303
June 1992	6,104	9,961	6,795	4,249	9,996	9,638	9,300
July 1992	5,881	10,365	7,043	4,404	10,037	9,673	9,334
Aug 1992	5,629	10,429	7,345	4,593	10,043	9,714	9,374
Sept 1992	5,505	10,219	7,506	4,694	10,022	9,736	9,394
Oct 1992	6,191	8,755	6,572	4,109	9,876	9,614	9,277
Nov 1992	5,811	10,614	6,975	4,362	10,061	9,673	9,334
Dec 1992	5,512	10,513	7,333	4,586	10,051	9,723	9,382

Table A2. Monthly Investments in the SSE.

	Price (CNY)	Investment (CNY)					
	SSE	MT1	MT2	MT3	MT1R	MT2R	MT3R
Jan 1991	130	10,000	10,000	10,000	10,000	10,000	10,000
Feb 1991	133	9,766	9,766	9,766	9,905	9,905	9,905
Mar 1991	120	10,234	10,234	10,234	9,946	9,851	9,851
Apr 1991	114	10,000	10,000	10,000	10,042	9,892	9,892
May 1991	115	9,922	9,922	9,922	9,967	9,859	9,859
June 1991	138	8,021	7,958	7,958	10,011	9,870	9,870
July 1991	144	9,546	7,597	7,597	9,907	9,778	9,778
Aug 1991	178	7,592	5,767	5,767	10,003	9,781	9,781
Sept 1991	181	9,860	5,687	5,687	10,010	9,791	9,791
Oct 1991	219	7,917	4,503	4,503	9,979	9,771	9,771
Nov 1991	260	8,124	3,658	3,658	9,972	9,744	9,744
Dec 1991	293	8,723	3,191	3,191	9,964	9,709	9,709
Jan 1992	313	9,300	9,300	0	9,929	9,929	9,581
Feb 1992	365	8,358	7,773	0	9,929	9,859	9,513
Mar 1992	381	9,545	7,420	0	9,998	9,857	9,511
Apr 1992	445	8,318	6,172	0	9,913	9,771	9,428

	Price (CNY)	Investment (CNY)					
	SSE	MT1	MT2	MT3	MT1R	MT2R	MT3R
May 1992	1,235	0	0	0	9,868	9,641	9,303
June 1992	1,191	10,352	0	0	9,996	9,638	9,300
July 1992	1,052	11,168	0	0	10,037	9,673	9,334
Aug 1992	823	12,175	0	0	10,043	9,714	9,374
Sept 1992	702	11,469	0	0	10,022	9,736	9,394
Oct 1992	507	12,778	0	0	9,876	9,614	9,277
Nov 1992	725	5,715	0	0	10,061	9,673	9,334
Dec 1992	780	9,230	0	0	10,051	9,723	9,382

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1 The ending equity value equals the ending equity index price multiplied by the total shares purchased during the investment period. The ending cash equals the difference between the Total Cash Contributions and the total investments, where the total investments are the amounts invested in the equity index during the investment period.

2 Here is an example of Ending Value and Net Return calculations. The Ending Value of the DCA investment in the HSI is calculated as HKD19,781*288.09shares + HKD0 = HKD5.698708 million, where HKD19,781 is the ending index price, 288.09 is the total shares purchased, and HKD0 is the ending cash. The Net Return of the DCA investment in the HSI is calculated as (HKD5.698708 million - HKD3.84 million) / HKD3.84 million = 48.40%, where HKD3.84 million is the Total Cash Contributions.