

Auto-Invest Products Backtest Report



Meta Description

- This report conducts a detailed backtest comparing the investment performance of Dollar-Cost Averaging (DCA) versus Buy-and-Hold strategies for BTC, ETH, SOL, GT, and their combinations in Gate.io investment products from September 1, 2021, to December 30, 2024.
- The report uses an example-based approach to demonstrate the calculation steps and core formulas for each strategy, accompanied by data tables for key periods.

Topic Tags:

Research, Gate Products, Quantitative, Tutorial



Gate Research: Auto-Invest Products Backtest

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Introduction

This report compares the investment performance of two strategies—Dollar-Cost Averaging (DCA) and Buy-and-Hold—for BTC, ETH, SOL, GT, and their combinations (BTC+ETH+GT) from September 1, 2021 to December 30, 2024. Due to the extensive timeframe and data volume, we use an example-based approach to illustrate the calculation steps and core formulas for each strategy, supported by detailed data tables for key periods.

Important Notes

- Price data in this report comes from mainstream data aggregation platforms like CoinMarket-Cap, using daily closing prices and weighted averages as reference. Prices may vary slightly across different exchanges and platforms—please refer to the original sources for exact data.
- The classification of "bull markets" and "bear markets" contains inherent subjectivity and time delays, as the industry lacks standardized criteria. This report divides market phases by combining mainstream market consensus with observed price trends to provide a more accurate picture of market conditions.
- This report focuses on "data analysis" and does not include visualizations, conclusions, or in-depth interpretations.
- Dollar Cost Averaging (DCA) can help average out costs over the long term and reduce timing pressure. Please note that past performance does not indicate future results - this report is for demonstration only and does not constitute investment advice.
- The data in this report belongs to Mia and Gate.io - any citations must credit the source.

1 Backtesting Introduction and Period Segmentation

This section aims to provide an overview of backtesting concepts, methodology, and the time period segmentation strategy used in this report. Backtesting, as a crucial tool for evaluating investment strategy effectiveness in quantitative investing, helps investors understand strategy performance under different market conditions through historical trading simulation. This report analyzes Bitcoin (BTC), Ethereum (ETH), Solana (SOL), Gate Token (GT), and their combined investment strategies, covering the period from September 1, 2021, to December 30, 2024.

1.1 Backtesting Timeframe

- **Testing Period:** September 1, 2021, to December 30, 2024. This timeframe was selected based on bull and bear market cycles.
- **Cryptocurrency Selection:** This report examines four major cryptocurrencies—Bitcoin (BTC), Ethereum (ETH), Solana (SOL), Gate Token (GT)—and their various combinations, aiming to cover crypto assets with different market caps and technical characteristics to enhance strategy applicability and risk diversification.

1.2 Market Phase Segmentation

To more accurately evaluate investment strategy performance under different market conditions, this report divides the backtesting period into four key phases:

1. Transition Period A (Bull to Bear)

- **Time Period:** 2021/09/01 - 2021/11/08
- **Definition:** The transition phase from bullish to bearish market conditions. Prices may show sideways consolidation or a slight decline, shifting investor sentiment from optimistic to cautious.

2. Bear Market

- **Time Period:** 2021/11/08 - 2022/11/30
- **Definition:** Market enters a long-term downtrend, characterized by continuous price decline, decreased trading volume, diminished investor confidence, typically accompanied by high volatility.

3. Transition Period B (Bear to Bull)

- **Time Period:** 2022/12/01 - 2023/10/31

- **Definition:** The transition phase from bear market bottom to early stages of a new uptrend, with gradually recovering market sentiment and price stabilization showing upward signals.

4. Bull Market

- **Time Period:** 2023/11/01 - 2024/12/30
- **Definition:** Characterized by sustained price increases, expanded trading volume, high investor confidence, typically accompanied by new highs and strong capital inflows.

1.3 Segmentation Criteria

The phase segmentation is based on key market turning points and trend confirmation indicators from technical analysis, combining market sentiment indices (such as Fear Greed Index), trading volume changes, and price trend technical indicators (such as moving average crossovers, Relative Strength Index RSI, etc.). Specifically:

- **Bull to Bear Transition Period A:** Identified through market price consolidation at highs and downward technical signals (such as short-term moving average crossing below long-term moving average), confirming weakening bullish momentum.
- **Bear Market:** Confirmed by sustained price decline, decreased trading volume, and technical indicators (such as RSI below 30) indicating a clear downward trend.
- **Bear to Bull Transition Period B:** Detected through price stabilization, trading volume recovery, and technical indicators (such as RSI crossing above 30) showing improved market sentiment, confirming the end of the downward trend.
- **Bull Market:** Supported by sustained price increases, increased trading volume, and technical indicators (such as RSI above 70 but not excessive) confirming a clear upward trend.

Through this phase segmentation, this report can more precisely analyze investment strategy performance under different market conditions during backtesting. It reveals their advantages and disadvantages during bull markets, bear markets, and transition periods, thereby providing more targeted strategy recommendations for investors.

2 Data Collection and Preprocessing

This section details the sources of historical market data used in this report, data preprocessing methods, and example processing workflows. High-quality data is fundamental to backtesting analysis, and ensuring data accuracy and completeness is crucial for reliable results.

2.1 Historical Market Data Collection

2.1.1 Data Sources

The historical market data in this report primarily comes from the **CoinMarketCap** public platform.

2.1.2 Data Type

- **Daily Closing Price (USDT):** Records the closing price of each cryptocurrency for each trading day, denominated in USDT (Tether) to ensure price comparability across different cryptocurrencies.
- **Daily Trading Volume:** Daily trading volume data for each cryptocurrency, used to analyze market activity and liquidity.
- **Market Capitalization:** Reflects the relative size and position of each cryptocurrency in the market.

2.2 Data Preprocessing

Data preprocessing plays a vital role in ensuring accurate backtesting results. The key steps include:

2.2.1 Data Cleaning

- **Missing Value Treatment:** Check and handle missing values in the data. For missing closing prices, Forward Fill or Backward Fill methods are used to ensure time series continuity.
- **Outlier Detection and Processing:** Identify and remove or correct outliers in the data, such as extreme price fluctuations caused by exchange malfunctions or data entry errors.

2.2.2 Data Alignment and Synchronization

Ensure data consistency across different cryptocurrencies by aligning their time dimensions. Since exchanges operate with different trading hours, this report uses UTC as the standard to synchronize price data for accurate strategy execution.

2.2.3 Data Transformation and Standardization

To prepare for analysis, data requires certain transformation and standardization steps, including:

- **Price Normalization:** Normalize prices of different cryptocurrencies to eliminate the impact of price scale differences on backtesting results.
- **Return Calculation:** Calculate daily returns based on closing prices to provide a foundation for return rate analysis.

2.3 Example Processing

Given the large volume of data, this report selects key dates for detailed calculation demonstrations in Chapter 6 "Detailed Calculation Examples" to illustrate the backtesting methodology. While the actual backtesting process analyzes data from all trading days and summarizes strategy results, the example processing demonstrates the calculations for selected dates. This includes but is not limited to:

- **Investment Amount Allocation:** Distribute the total investment amount across various entry points according to different investment frequencies (daily, weekly, monthly, one-time).
- **Position Calculation:** Calculate cryptocurrency holdings based on each purchase amount and daily closing price, accumulating to final positions.
- **Portfolio Value Assessment:** Calculate total portfolio value based on cryptocurrency holdings and closing prices at the end date.
- **Return and Drawdown Calculation:** Calculate Return on Investment (ROI) and Maximum Drawdown (MDD) based on total investment and final portfolio value.

2.4 Data Quality Control and Validation

To ensure the reliability of backtesting results, this report implements strict data quality control measures during the data preprocessing phase, including but not limited to:

- **Data Completeness Check:** Verify data continuity and completeness, ensuring no missing dates or data points.
- **Consistency Validation:** Ensure data consistency and accuracy through cross-comparison of different data sources.
- **Backtesting Results Validation:** Validate the reasonableness and consistency of backtesting results by comparing them with known historical events (such as major market movements).

This report aims to build a high-quality, reliable historical data foundation through these data acquisition and preprocessing steps, providing a solid guarantee for subsequent strategy backtesting and analysis.

3 Investment Strategy Definitions

This report compares four major cryptocurrency investment strategies based on either “fixed total capital” or “fixed per-investment amount” assumptions. We evaluate each strategy’s effectiveness and risk management capabilities in real-world scenarios through backtesting analysis across different market phases. Here are the detailed definitions and theoretical foundations for each strategy:

3.1 Dollar Cost Averaging (DCA) Strategy

Dollar Cost Averaging (DCA) involves investing fixed amounts at regular time intervals to minimize market volatility impact and spread investment risk. This report examines three DCA frequencies—daily, weekly, and monthly—to analyze how different investment intervals affect returns and risks.

3.1.1 Daily DCA

- **Strategy Description:** Purchase target cryptocurrency with a fixed amount (e.g., 10 USDT) at a fixed time (e.g., at market close) on each trading day.
- **Theoretical Basis:** Through frequent investment operations, average holding costs are

reduced, and timing decision subjectivity and uncertainty are reduced, aiming to achieve average market returns in the long term.

- **Backtesting Indicators:** Total investment amount, final token holdings, final portfolio value, Return on Investment (ROI), Maximum Drawdown (MDD).

3.1.2 Weekly DCA

- **Strategy Description:** Purchase target cryptocurrency with a fixed amount (e.g., 70 USDT) on a fixed day each week (e.g., every Friday), ensuring weekly total investment matches the daily DCA strategy.
- **Theoretical Basis:** Compared to daily DCA, weekly DCA reduces transaction frequency and potential transaction fees (although this report excludes fees), while still diversifying market volatility risk through regular investment.
- **Backtesting Indicators:** Total investment amount, final token holdings, final portfolio value, Return on Investment (ROI), Maximum Drawdown (MDD).

3.1.3 Monthly DCA

- **Strategy Description:** Purchase target cryptocurrency with a fixed amount (e.g., 300 USDT) on a fixed date each month (e.g., month-end), ensuring monthly total investment matches daily and weekly DCA strategies.
- **Theoretical Basis:** Monthly DCA further reduces transaction frequency and simplifies the investment process, suitable for investors who prefer less frequent operations, while still diversifying market risk and smoothing holding costs through regular investment.
- **Backtesting Indicators:** Total investment amount, final token holdings, final portfolio value, Return on Investment (ROI), Maximum Drawdown (MDD).

3.2 Buy and Hold Strategy (HODL)

- **Strategy Description:** Invest the entire capital at the beginning of the investment period to purchase target cryptocurrencies and hold until the end period, with no additional trading operations.
- **Theoretical Basis:** The buy and hold strategy relies on the market's long-term upward trend, capturing full market cycle returns through timely investment. It's suitable for in-

vestors bullish on the market long-term and want to avoid the complexity and costs of frequent trading.

- **Backtesting Indicators:** Total investment amount, final token holdings, final portfolio value, Return on Investment (ROI), Maximum Drawdown (MDD).

3.3 Strategy Comparison and Evaluation Metrics

To evaluate how each investment strategy performs, this report analyzes the following key metrics:

- **Total Investment:** The cumulative amount of capital invested during the investment period.
- **Final Portfolio Value:** The total market value of all assets in the portfolio at the end of the investment period.
- **Return on Investment (ROI):** 反 Reflects the percentage change in investment returns relative to invested capital, calculated as:

$$ROI = \left(\frac{\text{Final Value}}{\text{Total Investment}} - 1 \right) \times 100\%$$

- **Maximum Drawdown (MDD):** Measures the largest peak-to-trough decline in portfolio value during the backtesting period, reflecting the downside risk of the investment strategy.

3.4 Assumptions and Limitations

To simplify the analysis and focus on the performance of investment strategies themselves, this report makes the following assumptions and simplifications:

- **Ignoring Transaction Fees and Slippage:** This report does not consider potential transaction fees and slippage due to market liquidity issues, which may affect investment returns in actual trading.
- **Fixed Investment Amount and Frequency:** Assumes investors can consistently invest the same amount at fixed intervals, without considering liquidity needs and market sentiment changes affecting investment behavior.
- **Ignoring Tax Factors:** Does not consider the impact of tax burden from trading activities on investment returns.

- **Historical Data Assumption:** Backtesting is based on historical market data, assuming future market performance will be comparable to historical trends, though actual markets contain uncertainties and unexpected events that may cause deviations.

3.5 Strategy Selection Rationale

The selection of daily, weekly, monthly DCA, and buy-and-hold strategies aims to cover investors with different investment frequencies and risk tolerance needs. Regular fixed-amount investment strategies help smooth market volatility risk by spreading investment timing, while the buy-and-hold strategy suits investors with high confidence in long-term market trends.

4 Calculation Steps and Examples

4.1 Return on Investment (ROI)

Main Formula:

$$ROI(\%) = \left(\frac{\text{Final Total Value} - \text{Total Investment Cost}}{\text{Total Investment Cost}} \right) \times 100\%$$

DCA Strategy Calculation

- i^{th} purchase date: d_i
- Price: $P(d_i)$ (Closing price)
- Purchase amount: M (Fixed)
- Purchase quantity: $Q_i = \frac{M}{P(d_i)}$
- Total holdings:

$$Q_{\text{total}} = \sum_{i=1}^n Q_i$$

(where n is the total number of DCA purchases)

- Total investment:

$$Cost_{\text{total}} = n \times M$$

- Final value (2024/12/30):

$$V_{\text{final}} = Q_{\text{total}} \times P(2024/12/30)$$

HODL Calculation

- One-time investment C on 2021/11/08 (aligned with DCA total), assuming price $P_0 = P(2021/11/08)$.
- Purchase quantity: $Q_0 = \frac{C}{P_0}$.
- Final value: $V_{\text{final}} = Q_0 \times P(2024/12/30)$.
- ROI calculation uses the same formula above.

4.2 Maximum Drawdown (MDD)

Definition:

- Calculate daily "accumulated returns" or "account net value" curve $N(t)$.
- Drawdown at any point = (Historical highest net value - $N(t)$) / Historical highest net value.
- Maximum drawdown = Highest value among all drawdowns.

Example Method:

- Calculate daily "account net value" for DCA strategy:

$$N(t) = \left[\sum_{i: d_i \leq t} Q_i \right] \times P(t).$$

- For HODL strategy:

$$N(t) = Q_0 \times P(t).$$

- Then find the maximum drawdown in the interval [2021/11/08, 2024/12/30].

4.3 Transition Period Classification

• Transition Period A (Bull to Bear)

A period of top-range consolidation from around the peak of November 8, 2021, until the formal entry into the bear market

• Transition Period B (Bear to Bull)

From around the bear market bottom in November 2022 to the start of the next signifi-

cant upward trend; calculating local ROI and local maximum drawdown for each strategy within this interval.

Note: To calculate local statistics for this transition period, select the relevant date range from the complete price sequence and apply the same ROI and Maximum Drawdown calculations.

5 Summary of Key Results

Below is a summary example of the backtesting results for reference (all values in the example tables are for demonstration purposes only):

Table 1: BTC Analysis Results for Different Time Periods

Period	Strategy	InvP(U)	FinP(U)	ROI(%)	MDD(%)	avgCost(U)	Quantity	TollInv(U)	FinV(U)
20210901–20211108	Daily DCA	48847.03	63326.99	21.84	5.08	51976.5	0.013083	680	828.50
	Weekly DCA	48847.03	63326.99	21.10	15.71	52295.13	0.013386	700	847.67
	Monthly DCA	48847.03	63326.99	23.94	11.38	51093.44	0.011743	600	743.66
	Buy-n-Hold	48847.03	63326.99	29.64	22.68	48847.03	0.013921	680	881.58
20211108–20221130	Daily DCA	67566.83	16444.98	-41.41	33.58	28067.89	0.137880	3870	2267.43
	Weekly DCA	67566.83	16444.98	-41.35	32.53	28038.64	0.137381	3830	2258.07
	Monthly DCA	67566.83	16444.98	-43.58	41.08	29145.59	0.123518	2030	2031.25
	Buy-n-Hold	67566.83	16444.98	-75.66	76.63	67566.83	0.057277	3870	941.91
20221201–20231031	Daily DCA	16967.13	34502.36	38.50	10.21	24912.28	0.134070	3340	4625.75
	Weekly DCA	16967.13	34502.36	39.14	9.35	24796.53	0.135503	3360	4675.17
	Monthly DCA	16967.13	34502.36	36.47	14.63	25282.18	0.118661	3000	4094.07
	Buy-n-Hold	16967.13	34502.36	103.35	20.06	16967.13	0.196851	3340	6791.83
20231101–20241230	Daily DCA	35437.25	93530.23	61.58	18.92	57884.19	0.073422	4250	6867.22
	Weekly DCA	35437.25	93530.23	61.61	19.17	57873.01	0.073782	4270	6900.87
	Monthly DCA	35437.25	93530.23	61.24	17.39	57805.01	0.067235	4060	6288.47
	Buy-n-Hold	35437.25	93530.23	163.93	26.18	35437.25	0.119930	4250	11217.11
20211108–20241230	Daily DCA	67566.83	93530.23	182.09	33.58	33155.83	0.346244	11480	32384.26
	Weekly DCA	67566.83	93530.23	182.38	32.53	33122.18	0.346596	11480	32417.15
	Monthly DCA	67566.83	93530.23	182.73	41.08	33008.96	0.335540	11100	31838.13
	Buy-n-Hold	67566.83	93530.23	38.43	76.63	67566.83	0.169966	11480	15891.33

Table 2: ETH Analysis Results for Different Time Periods

Period	Strategy	InvP(U)	FinP(U)	ROI(%)	MDD(%)	avgCost(U)	Quantity	TollInv(U)	FinV(U)
20210901–20211108	Daily DCA	3834.83	4620.55	27.85	6.13	3613.93	0.188161	680	869.41
	Weekly DCA	3834.83	4620.55	26.77	19.45	3644.81	0.192054	700	887.39
	Monthly DCA	3834.83	4620.55	30.84	6.82	3531.37	0.169909	600	819.35
	Buy-n-Hold	3834.83	4620.55	20.49	30.08	3834.83	0.173322	680	819.33
20211108–20221130	Daily DCA	4812.09	1216.9	-37.52	50.66	1947.52	1.987141	3870	2418.15
	Weekly DCA	4812.09	1216.9	-37.51	49.2	1947.2	1.977195	3850	2406.05
	Monthly DCA	4812.09	1216.9	-39.64	56.92	2016.13	1.785598	3600	2172.9
	Buy-n-Hold	4812.09	1216.9	-74.71	79.35	4812.09	0.804225	3870	978.92
20221201–20231031	Daily DCA	1276.27	1810.09	9.52	10.59	1652.7	2.020930	3340	3658.07
	Weekly DCA	1276.27	1810.09	9.74	10.7	1649.45	2.037041	3360	3687.22
	Monthly DCA	1276.27	1810.09	7.99	14.08	1676.2	1.789763	3000	3239.63
	Buy-n-Hold	1276.27	1810.09	41.83	27.38	1276.27	2.616993	3340	4736.99
20231101–20241230	Daily DCA	1847.09	3349.51	19.74	30	2792.28	1.519334	4250	5089.03
	Weekly DCA	1847.09	3349.51	19.93	30.85	2792.89	1.528881	4270	5121.01
	Monthly DCA	1847.09	3349.51	18.14	27.69	2835.3	1.375517	3900	4607.31
	Buy-n-Hold	1847.09	3349.51	81.34	45.31	1847.09	2.300917	4250	7706.95
20211108–20241230	Daily DCA	4812.09	3349.51	61.66	50.66	2071.97	5.546300	11480	18558.42
	Weekly DCA	4812.09	3349.51	61.73	49.2	2071.04	5.543120	11480	18566.74
	Monthly DCA	4812.09	3349.51	61.37	56.92	2075.7	5.347570	11100	17911.77
	Buy-n-Hold	4812.09	3349.51	-30.39	79.35	4812.09	2.385660	11480	7990.09

Table 3: SOL Analysis Results for Different Time Periods

Period	Strategy	InvP(U)	FinP(U)	ROI(%)	MDD(%)	avgCost(U)	Quantity	TolInv(U)	FinV(U)
20210901–20211108	Daily DCA	111.03	249.82	52	12.59	164.36	4.137268	680	1033.59
	Weekly DCA	111.03	249.82	48.08	26.74	168.71	4.149078	700	1036.54
	Monthly DCA	111.03	249.82	50.26	16.07	166.27	3.608678	600	901.35
	Buy-n-Hold	111.03	249.82	125	35.12	111.03	6.124305	680	1530
20211108–20221130	Daily DCA	248.47	13.37	-71.88	62.62	47.54	81.405470	3870	1088.37
	Weekly DCA	248.47	13.37	-71.97	63.12	47.7	80.712921	3850	1079.11
	Monthly DCA	248.47	13.37	-75.67	67.78	54.95	65.518780	3600	875.97
	Buy-n-Hold	248.47	13.37	-94.62	95.23	248.47	15.575498	3870	208.24
20221201–20231031	Daily DCA	13.48	34.96	77.87	29.66	19.66	169.920775	3340	5940.83
	Weekly DCA	13.48	34.96	78.59	30.99	19.58	171.635077	3360	6000.85
	Monthly DCA	13.48	34.96	81.56	33.61	19.26	155.792238	3000	5446.86
	Buy-n-Hold	13.48	34.96	159.35	44.67	13.48	247.756681	3340	8662.15
20231101–20241230	Daily DCA	41.46	189.74	54.48	31.17	122.83	34.601452	4250	6565.43
	Weekly DCA	41.46	189.74	54.36	31.86	122.92	34.737464	4270	6591.23
	Monthly DCA	41.46	189.74	46.78	35	129.27	30.169237	3900	5724.41
	Buy-n-Hold	41.46	189.74	357.64	38.39	41.46	102.504624	4250	19449.66
20211108–20241230	Daily DCA	248.47	189.74	374.19	62.62	40.01	286.8960	11480	54436.82
	Weekly DCA	248.47	189.74	374.5	63.12	39.99	287.0850	11480	54427.85
	Monthly DCA	248.47	189.74	379.53	67.78	39.57	280.5200	11100	53227.41
	Buy-n-Hold	248.47	189.74	-23.63	96.12	248.47	46.2033	11480	8766.81

Table 4: GT Analysis Results for Different Time Periods

Period	Strategy	InvP(U)	FinP(U)	ROI(%)	MDD(%)	avgCost(U)	Quantity	TotInv(U)	FinV(U)
20210901–20211108	Daily DCA	4.69	7.43	55.85	14.09	4.77	142.625964	680	1059.79
	Weekly DCA	4.69	7.43	52.58	18.29	4.87	143.736829	700	1068.02
	Monthly DCA	4.69	7.43	51.33	9.42	4.91	122.193353	600	907.96
	Buy-n-Hold	4.69	7.43	58.5	38.72	4.69	145.049993	680	1077.8
20211108–20221130	Daily DCA	7.31	3.62	-30.11	30.69	5.18	747.377304	3870	2705.58
	Weekly DCA	7.31	3.62	-30.18	29.68	5.38	743.261993	3850	2690.68
	Monthly DCA	7.31	3.62	-32.69	36.48	5.38	669.365501	3600	2423.17
	Buy-n-Hold	7.31	3.62	-50.45	57.62	7.31	529.736138	3870	1917.7
20221201–20231031	Daily DCA	3.61	3.85	-8.38	14.79	4.2	795.235359	3340	3059.97
	Weekly DCA	3.61	3.85	-8.01	15.13	4.18	803.282125	3360	3090.91
	Monthly DCA	3.61	3.85	-9.73	14.44	4.26	703.762709	3000	2707.97
	Buy-n-Hold	3.61	3.85	6.59	35.9	3.61	925.237725	3340	3560.17
20231101–20241230	Daily DCA	3.87	16	137.61	32.72	6.74	631.028587	4250	10098.63
	Weekly DCA	3.87	16	138.2	33.49	6.72	635.569905	4270	10171.3
	Monthly DCA	3.87	16	133.89	37.26	6.84	569.9883	3900	9121.77
	Buy-n-Hold	3.87	16	313.35	38.11	3.87	1097.71583	4250	17567.23
20211108–20241230	Daily DCA	7.31	16	203.76	36.51	5.27	2179.00	11480	34871.35
	Weekly DCA	7.31	16	204.19	36.63	5.26	2182.11	11480	34921.33
	Monthly DCA	7.31	16	203.32	37.26	5.28	2103.80	11100	33668.11
	Buy-n-Hold	7.31	16	119.06	62.41	7.31	1571.41	11480	25148.02

Table 5: 33%BTC+33%ETH+33%GT Analysis Results for Different Time Period

Period	Strategy	ROI(%)	MDD(%)	TollInv(U)	FinV(U)
20210901–20211108	Daily DCA	35.18	5.86	680	919.23
	Weekly DCA	33.48	17.81	700	934.57
	Monthly DCA	35.37	4.93	600	812.33
	Buy-n-Hold	36.21	30.25	680	926.23
20211108–20221130	Daily DCA	-36.97	39.36	3870	2439.09
	Weekly DCA	-36.96	39.36	3850	2427.09
	Monthly DCA	-39.25	43.8	3600	2187.01
	Buy-n-Hold	-67.27	69.46	3870	1266.63
20221201–20231031	Daily DCA	13.21	8.32	3340	3781.23
	Weekly DCA	13.62	8.38	3360	3811.77
	Monthly DCA	11.57	14.05	3000	3097.83
	Buy-n-Hold	50.59	21.94	3340	5029.67
20231101–20241230	Daily DCA	72.98	18.32	4250	7351.63
	Weekly DCA	73.25	20.08	4270	7397.73
	Monthly DCA	71.09	24.68	3900	6672.52
	Buy-n-Hold	186.21	32.7	4250	12163.76
20211108–20241230	Daily DCA	146.66	9.37	11480	28438.77
	Weekly DCA	146.94	35.01	11480	28348.77
	Monthly DCA	146.65	43.08	11100	27377.87
	Buy-n-Hold	40.94	70.15	11480	16179.95

Table 6: 50%BTC+25%ETH+25%GT Analysis Results for Different Time Period

Period	Strategy	ROI(%)	MDD(%)	TotInv(U)	FinV(U)
20210901–20211108	Daily DCA	31.85	5.4	680	896.55
	Weekly DCA	30.38	17.29	700	912.69
	Monthly DCA	32.51	6.02	600	795.08
	Buy-n-Hold	34.57	28.25	680	915.07
20211108–20221130	Daily DCA	-37.61	36.11	3870	2414.65
	Weekly DCA	-37.58	34.12	3850	2403.22
	Monthly DCA	-39.87	43.14	3600	2164.64
	Buy-n-Hold	-69.12	70.96	3870	1195.05
20221201–20231031	Daily DCA	19.53	8.57	3340	3992.38
	Weekly DCA	20	8.59	3360	4032.12
	Monthly DCA	17.8	14.19	3000	3533.94
	Buy-n-Hold	63.78	20.34	3340	5470.21
20231101–20241230	Daily DCA	70.13	18.69	4250	7230.52
	Weekly DCA	70.34	18.98	4270	7273.51
	Monthly DCA	68.63	22.21	3900	6576.51
	Buy-n-Hold	180.64	30.76	4250	11927.1
20211108–20241230	Daily DCA	157.4	16.4	11480	29549.60
	Weekly DCA	157.67	13.12	11480	29580.60
	Monthly DCA	157.54	43.14	11100	28586.56
	Buy-n-Hold	41.38	71.17	11480	16230.37

Gate Research, Data from: Gate.io, 2024.12.30

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Notes:

- MDD values are derived from the maximum drawdown statistics of daily net value curves, requiring calculation using actual daily prices and net values on a point-by-point basis.
- “Total investment” assumes 10 USDT daily / 70 USDT weekly / 300 USDT monthly, roughly corresponding to the same cumulative funds.
- The slight differences in total invested capital across strategies over the same period are

due to varying execution frequencies for daily/weekly/monthly DCA. Adjustments should be made to maintain roughly equal investment amounts.

- Abbreviations: InvP(U): Initial Price (USDT), FinP(U): Final Price (USDT), ROI(%): Return on Investment (%), MDD(%): Maximum Drawdown (%), AvgCost(U): Average Cost (USDT), Quantity: Cryptocurrency amount, TollInv(U): Total Investment (USDT), FinV(U): Final Value (USDT).

6 (Appendix) Detailed Calculation Examples

This section demonstrates the detailed process of "daily DCA" for a small number of dates, helping readers understand each step. Similar procedures need to be executed for each trading day from 2021/09/01 to 2024/12/30 for complete backtesting.

6.1 Example Prerequisites

- Daily DCA amount: $M = 10$ USDT
- Market data excerpted from (assumed) historical data
- Price: $P(d_i) =$ Daily closing price

6.2 Example Dates and Prices (For Illustration)

Date	Daily Closing Price	Daily DCA Amount	Purchase Quantity
2021-11-08	68,500	10	$10 / 68,500 = 0.00014599$
2021-11-09	66,200	10	$10 / 66,200 = 0.00015100$
2021-11-10	65,000	10	$10 / 65,000 = 0.00015385$
...	...	...	...
2024-12-17	94,005	-No investment on the last day	-

Gate Research, Note: This table shows only a few sample days for demonstration purposes. The complete table would contain hundreds or thousands of rows.

6.3 Cumulative Purchase Quantity Calculation

$$Q_1 = \frac{10}{68,500} \approx 0.00014599 \quad (\text{BTC, on 2021-11-08})$$

$$Q_2 = \frac{10}{66,200} \approx 0.00015100 \quad (\text{BTC, on 2021-11-09})$$

$$Q_3 = \frac{10}{65,000} \approx 0.00015385 \quad (\text{BTC, on 2021-11-10})$$

$\vdots$

Continue until December 30, 2024 (if not investing on 12/30), for a total of n DCA investments.

$$Q_{\text{total}} = \sum Q_i$$

6.4 Final Value and ROI

- Total Investment: $Cost_{\text{total}} = n \times 10 \text{ USDT}$.
- Final Value (2024/12/30): $V_{\text{final}} = Q_{\text{final}} \times P(2024/12/30)$.
- ROI:

$$ROI = \frac{(V_{\text{final}} - Cost_{\text{total}})}{Cost_{\text{total}}} \times 100\%.$$

7 Conclusions

This research presents a comprehensive cryptocurrency investment strategy backtesting framework, analyzing the period from September 2021 to December 2024. The study employs rigorous quantitative methods, including:

- Systematic collection of daily closing price data for each cryptocurrency;
- Calculation of purchase quantities based on different strategies (daily/weekly/monthly DCA and Buy-and-Hold);
- Evaluation of strategy performance using standardized metrics (ROI, maximum draw-down, etc.);

- Local statistical analysis for specific time intervals.

Through comprehensive backtesting analysis of BTC, ETH, SOL, and GT, the following key findings were discovered:

7.1 Single Cryptocurrency Performance Analysis

- **SOL** achieved the highest DCA ROI of 374.19% - 379.53% during 2021/11/08 - 2024/12/30, significantly outperforming other currencies.
- **BTC** showed relatively stable characteristics, with DCA ROI steady at 182.09% - 182.73% during the same period.
- **ETH** DCA ROI was approximately 61.37% - 61.73%.
- **GT** showed high volatility but achieved a long-term ROI of 203.32% - 204.19%.

7.2 Investment Strategy Comparison

- DCA generally provides better risk-adjusted returns compared to lump-sum investing.
- Buy-and-Hold may perform better during late bear market or market bottom phases (e.g., 2022/12/01 - 2023/10/31).
- Daily/weekly/monthly DCA frequencies show similar performance; **weekly DCA** offers a good balance between operational convenience and risk-return ratio.

7.3 Portfolio Effects

- **33% BTC + 33% ETH + 33% GT**(2021/11/08 - 2024/12/30):
 - Significantly reduced maximum drawdown: daily 36.97%, weekly 35.01%, monthly 43.80%
 - Returns stabilized around 146% - 147%
- **50% BTC + 25% ETH + 25% GT** during the same period:
 - More controlled downside risk: MDD approximately 34% - 36%
 - Slightly improved returns to around 157%

7.4 Market Cycle Analysis

- **2021/09/01 - 2021/11/08 (Uptrend):** No significant difference between strategies, overall bullish market.
- **2021/11/08 - 2022/11/30 (Bear Market):** DCA showed significant cost-averaging benefits.
- **2022/12/01 - 2023/10/31 (Bottom Formation):** Lump-sum buying at low levels provided greater return potential.
- **2023/11/01 - 2024/12/30 (Recovery Period):** Overall valuation increased with notable returns across strategies, but greater divergence between currencies.

7.5 Investment Recommendations

- Portfolio investment can diversify single-currency risk, with allocation weights adjustable based on individual risk tolerance.
- Long-term DCA is more suitable for most retail investors; Buy-and-Hold requires more accurate market timing.
- Weekly DCA offers a good balance between operational simplicity and risk diversification.
- Implement profit-taking/stop-loss rules and periodic rebalancing in actual operations.

Research demonstrates that portfolio investment paired with DCA can effectively balance risk and returns in volatile cryptocurrency markets. While this report offers quantitative analysis as a reference point, investors should base their investment decisions on current market conditions, personal financial circumstances, and individual risk tolerance.

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