Introduction

This project undertook the development, implementation, and evaluation of a trend-following trading strategy utilizing historical financial data from Amazon. The strategy was designed to capitalize on market trends by making well-timed entry and exit decisions guided by moving average crossovers. By combining key elements such as rule-based trading, position sizing, equity management, and risk mitigation, the project aimed to construct a comprehensive backtesting framework.

Methodology

Data Collection and Preprocessing

- Historical price data from 2000 to 2019 for Amazon was sourced and processed to construct a dataset suitable for analysis
- The data underwent preprocessing steps to compute essential metrics like daily returns and moving averages

Date	Open	High	Low	Close	Adj Close	Volume
2000-01-03	4.075000	4.478125	3.952344	4.468750	4.468750	322352000
2000-01-04	4.268750	4.575000	4.087500	4.096875	4.096875	349748000
2000-01-05	3.525000	3.756250	3.400000	3.487500	3.487500	769148000
2000-01-06	3.565625	3.634375	3.200000	3.278125	3.278125	375040000
2000-01-07	3.350000	3.525000	3.309375	3.478125	3.478125	210108000
...	...	...	...	...	...	...
2019-12-24	89.690498	89.778503	89.378998	89.460503	89.460503	17626000
2019-12-26	90.050499	93.523003	89.974998	93.438499	93.438499	120108000
2019-12-27	94.146004	95.070000	93.300499	93.489998	93.489998	123732000
2019-12-30	93.699997	94.199997	92.030998	92.344498	92.344498	73494000
2019-12-31	92.099998	92.663002	91.611504	92.391998	92.391998	50130000

Strategy Implementation

The central component of this project involved the meticulous implementation of a trend-following trading strategy utilizing moving average crossovers. This section outlines the foundational principles that underpin the strategy's execution.

Moving Average Crossovers

The crux of the strategy lies in its reliance on the behavior of moving averages to capture and exploit market trends. Moving averages, a vital technical indicator, smooth out price data over a specified period, enabling traders to discern potential trend shifts. The project's implementation harnessed the power of two Simple Moving Averages (SMAs): a 50-day SMA and a 200-day SMA.

Entry and Exit Conditions

Entry and exit conditions served as the critical decision points within the strategy:
Entry Conditions: Trades were initiated based on the occurrence of a crossover between the short-term (50-day) and long-term (200-day) SMAs. This intersection denoted potential shifts in trends, acting as a signal to enter a position in the market.

Exit Conditions: Conversely, the SMA crossover reversal signaled a trend's conclusion. This reversal marked the appropriate moment to exit the position, safeguarding potential gains and minimizing losses.

Integrating Risk Management

A noteworthy aspect of the strategy's implementation was the integration of risk management practices. This facet emphasized the importance of adhering to predefined risk thresholds to preserve capital and mitigate potential losses. The strategy aimed to balance capital allocation and exposure to market fluctuations by factoring in risk management principles.

The Trend-Following Approach

The trend-following trading strategy hinges on capitalizing on observable market patterns. It aims to align trades with prevailing sentiment by identifying trends using moving averages. Amazon's (AMZN) historical price behavior was scrutinized to facilitate strategy exploration. This approach involves buying assets during uptrends and selling during downtrends. It employs technical tools like moving averages to gauge trend direction and strength. Trend-following aims to exploit sustained momentum for profit and is adaptable to various market conditions.

Strategy Implementation and Backtesting Framework

Creating the Backtesting Framework

Central to this endeavor was constructing a dependable backtesting framework that breathed life into the strategy's rule-based approach. This framework, akin to a financial laboratory, facilitated the simulation of trades and the evaluation of their outcomes, casting light on the strategy's viability.

Systematic Position Sizing

Position sizing was paramount in ensuring the strategy's adherence to predefined risk management principles. The framework judiciously determined the allocation of capital, a dynamic process that tailored position sizes based on the risk associated with each trade. This meticulous approach aimed to strike a harmonious balance between capital preservation and pursuing profitable opportunities.

Tracking Equity Performance

The granular tracking of equity performance was integral to evaluating the strategy's efficacy. The backtesting framework orchestrated calculations of closed and open equity curves. These curves visually represented how the strategy fared in realizing profits or incurring losses as simulated trades unfolded.

The Dynamic Loop

The interplay of these components formed a dynamic loop, representing the heartbeat of the strategy's implementation and evaluation:

Strategy Execution: The strategy's execution spanned historical price data, as trading decisions were made based on the occurrence of predefined conditions.

Backtesting Simulation: These decisions were retroactively subjected to the backtesting framework's simulation, mirroring real-world trading scenarios.

Position Sizing Iteration: The framework's position sizing algorithms dynamically determined how much capital was allocated to each trade, aligning with risk management principles.

Equity Tracking and Analysis: As trades progressed, equity calculations meticulously captured the evolution of profits and losses, enabling thorough performance analysis.

Performance Evaluation: The aggregation of simulated trades' outcomes facilitated a comprehensive assessment of the strategy's financial performance, a key gauge of its effectiveness.

The strategy implementation merged with the backtesting framework, engendering a symbiosis of theoretical strategy and practical execution. The orchestrated dance between predefined rules, systematic position sizing, and precise equity tracking elucidated the strategy's behavior in a controlled environment.

Results

Regarding performance metrics, the strategy consistently exhibited an average daily return of 0.082, indicating a consistent positive return trend. The assessment of volatility, quantified by a standard deviation of 0.201, adeptly illuminated the inherent fluctuations in strategy performance. The derived Sharpe ratio of 0.410 artfully underscored a promising equilibrium between risk and potential returns.

```
Performance Metrics:
                Mean   Vol  Sharpe    Min   Max
daily_returns 0.082 0.201   0.410 -0.093 0.561
```

Transitioning to risk metrics, the discerned skewness and kurtosis values emerged notably elevated at 33.853 and 1328.571, respectively, implying the presence of instances characterized by extreme returns. The Value at Risk (VaR) at the 0.05 quantile was computed as 0.000, implying possible losses at the 5th percentile. Moreover, the computed Conditional Value at Risk (CVaR) for the same quantile stood at -0.066, illuminating potential downside risk scenarios.

Turning to maximum drawdown, the project divulged a discerned peak-to-bottom descent of -0.223. This event's comprehensive metrics, encompassing peak date, bottom date, recovery date, and duration for recovery, provided an enhanced contextual understanding of this drawdown episode.

```
Tail Metrics:
              Skewness  Kurtosis  VaR (0.05)  CVaR (0.05)  Max Drawdown  \
daily_returns    33.853  1328.571       0.000       -0.066        -0.223

                    Peak     Bottom    Recover Duration (to Recover)
daily_returns 2004-03-09 2006-02-15 2008-02-05             1428 days
```

Regarding the outcomes of the backtesting process, the strategy's manifestation showcased a net profit approximating $50,330.70. This quantification encapsulates the gains derived from executed trades, meticulously aligned with the pre-established entry and exit regulations. It remains salient, however, that this outcome fails to encompass factors intrinsic to real-world trading, encompassing variables such as transaction costs, slippage, and the ever-evolving dynamism of the market.

Conclusions

In conclusion, this project effectively achieved its objectives of creating, implementing, and assessing a trend-following trading strategy tailored for Amazon. Founded on moving average crossovers, the strategy showcased its ability to capitalize on market trends. Integrating risk management principles within the strategy's framework offered a prudent approach to curtailing potential losses. Through quantified performance and risk metrics, the project yielded valuable insights into the strategy's strengths and avenues for enhancement. Acknowledging limitations, including the assumption of fixed transaction costs, the absence of slippage consideration, and the lack of comprehensive risk management techniques, is important. As the strategy operates within historical data, real-world trading complexities, such as unforeseen events and data

inaccuracies, should be acknowledged. Deploying such a strategy necessitates robust testing, careful accounting for transaction costs, and proactive risk management