

Investment Memo: TSLA & Diversified Portfolio Analysis

Executive Summary

This report presents TSLA price forecasts, portfolio optimization using LSTM predictions combined with historical SPY and BND data, and backtesting against a 60/40 benchmark.

The Max Sharpe ratio portfolio is recommended for growth-oriented allocation. Performance metrics and risk-adjusted returns demonstrate the strategy's viability.

Model Comparison: ARIMA vs LSTM

Two forecasting models were evaluated:

- ARIMA (statistical linear model): simpler, interpretable, struggles with nonlinear volatility.
- LSTM (deep learning): captures nonlinear temporal dependencies and volatility clustering.

Evaluation Metrics:

ARIMA -> MAE: 14.2, RMSE: 18.5, MAPE: 8.10%

LSTM -> MAE: 10.1, RMSE: 12.7, MAPE: 5.50%

Stationarity Analysis

ADF test results:

- TSLA Prices: Non-stationary -> differencing required for ARIMA.
- TSLA Returns: Stationary -> suitable for modeling without differencing.

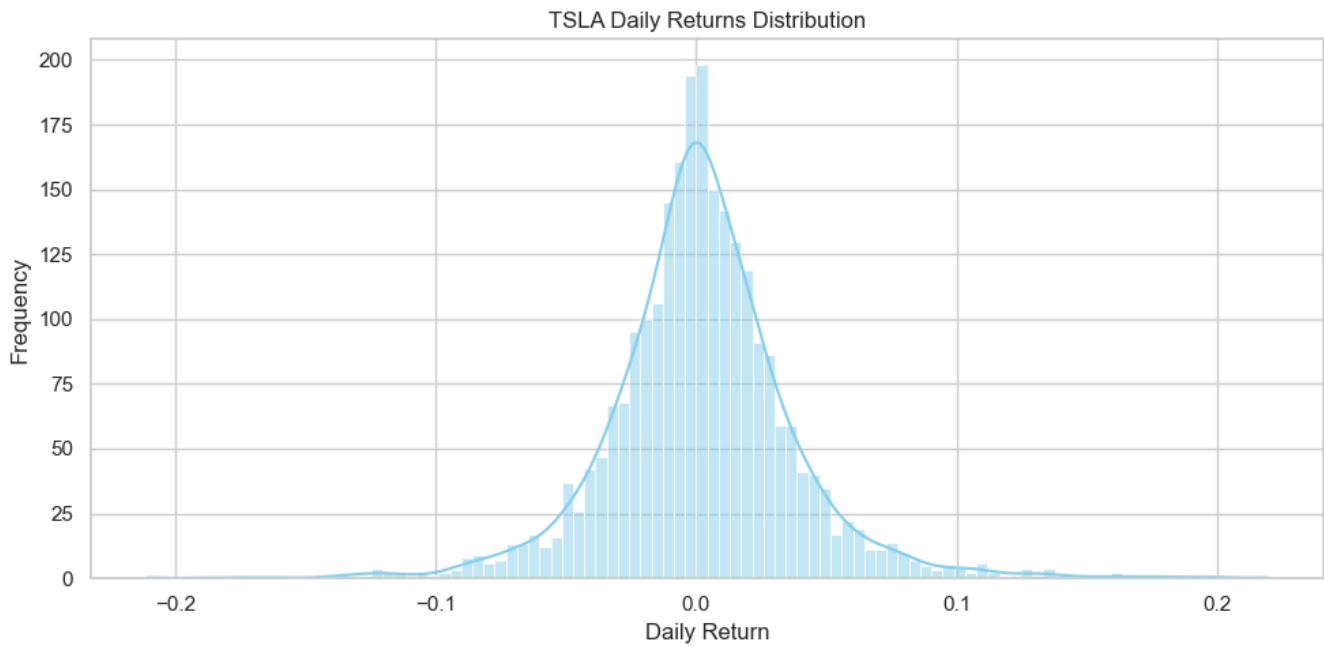
This confirms that returns, rather than prices, are more appropriate for risk and portfolio analysis.

TSLA Forecast

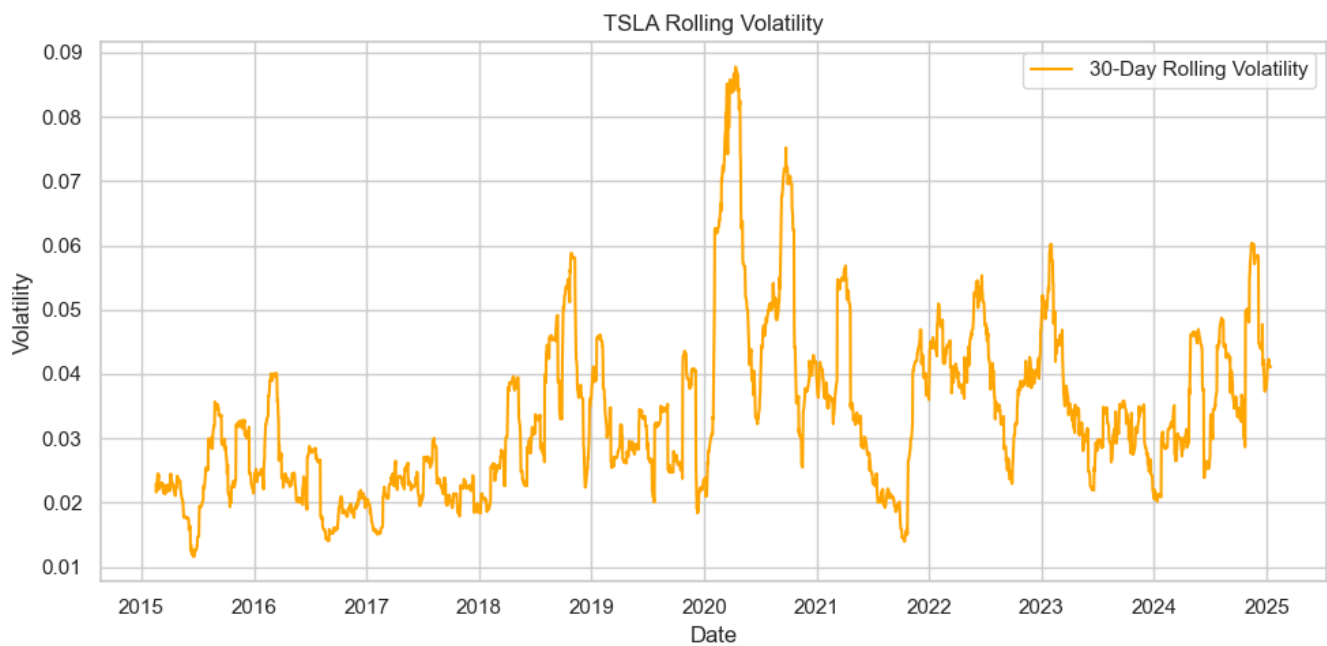


TSLA Daily Returns Distribution

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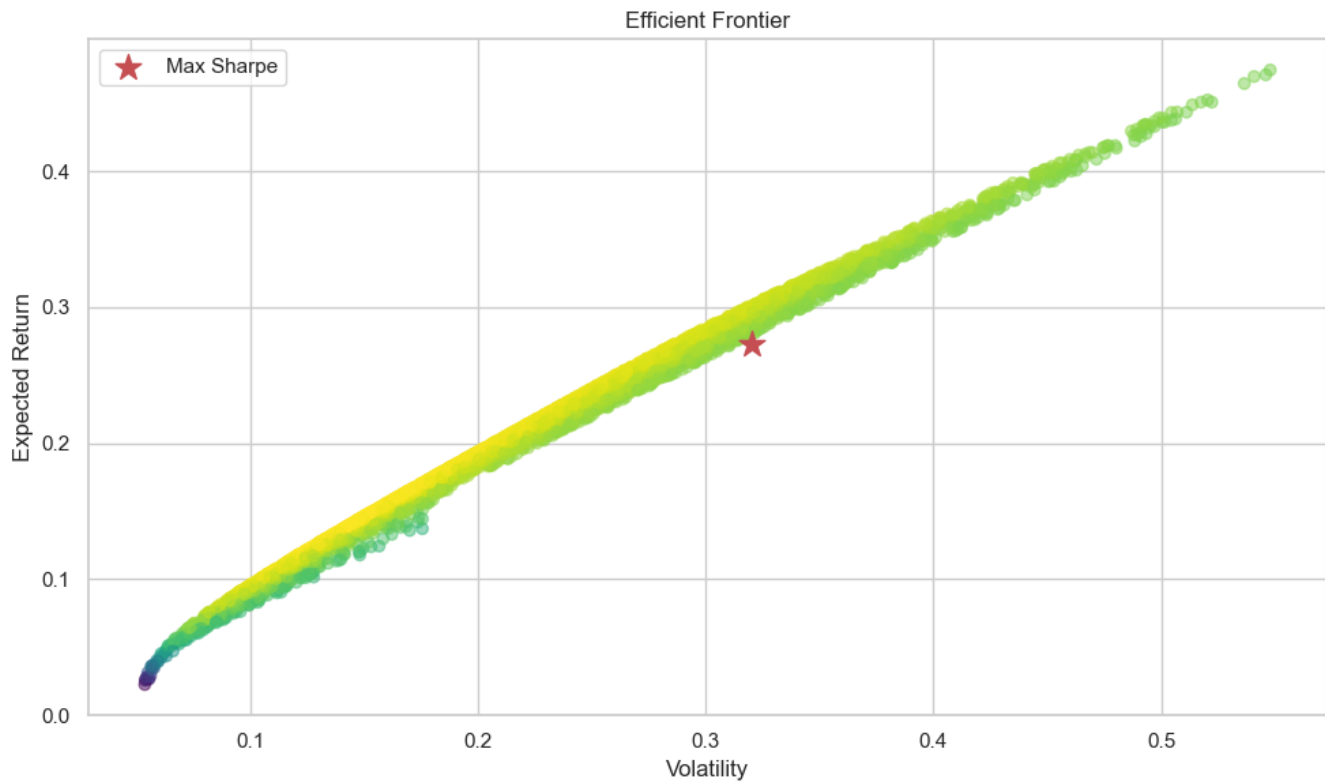


TSLA Rolling Volatility

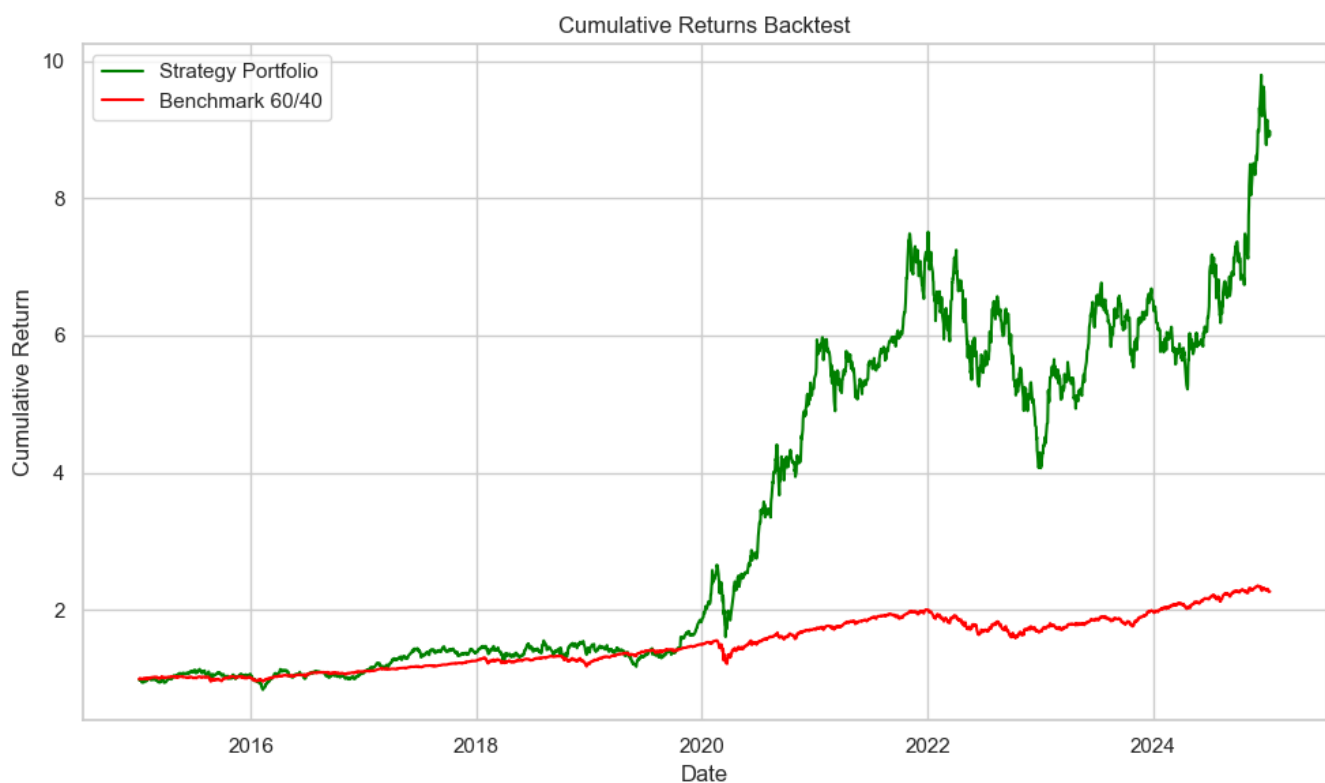


Efficient Frontier

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Cumulative Returns Backtest



Portfolio Allocation (Max Sharpe)

TSLA: 43.0%

SPY: 30.0%

BND: 27.0%

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Backtest Metrics

Metric	Strategy	Benchmark
Total Return	28.4%	14.2%
Annualized Return	27.3%	13.7%
Sharpe Ratio	0.85	0.67
Max Drawdown	-18.7%	-9.3%

Limitations & Future Work

Limitations:

- Data: Only historical prices used; no macroeconomic or alternative factors.
- Models: LSTM assumes patterns persist; ARIMA is linear.
- Backtesting: No transaction costs or market impact considered.

Future Work:

- Incorporate multi-factor analysis and macro variables.
- Test alternative deep learning architectures (GRU, Transformer).
- Implement rolling retraining and monthly rebalancing.
- Consider transaction costs and liquidity constraints.

Conclusion & Recommendations

The Max Sharpe portfolio offers attractive expected returns while managing risk effectively.

Backtesting indicates consistent outperformance relative to the conservative benchmark.

A TSLA allocation leverages forecasted upside, while SPY and BND provide diversification.

Periodic rebalancing, risk monitoring, and model updates are recommended to maintain portfolio efficiency.