McDonald's (MCD) Stock Price Forecasting Project

1. Summary

Stock price forecasting remains a challenging task due to high volatility, noise, and sensitivity to external factors. This project focuses on predicting McDonald's Corporation (MCD) stock prices by leveraging a combination of technical market indicators and macroeconomic signals. Through rigorous data preparation, feature engineering, and SARIMAX modeling, I deliver a forecasting framework that captures both micro-level stock movements and broader economic conditions.

2. Business Objective

The primary goal is to forecast the daily Close price of McDonald's over a 9-month horizon using:

- Historical stock prices
- Technical indicators (e.g., moving averages, MACD)
- Macroeconomic variables (inflation, GDP growth, interest rates)

Why this matters: A more accurate stock price forecast empowers investors, financial analysts, and portfolio managers to:

- Make better entry/exit decisions
- Understand market risks linked to economic cycles
- Integrate economic health indicators into stock predictions

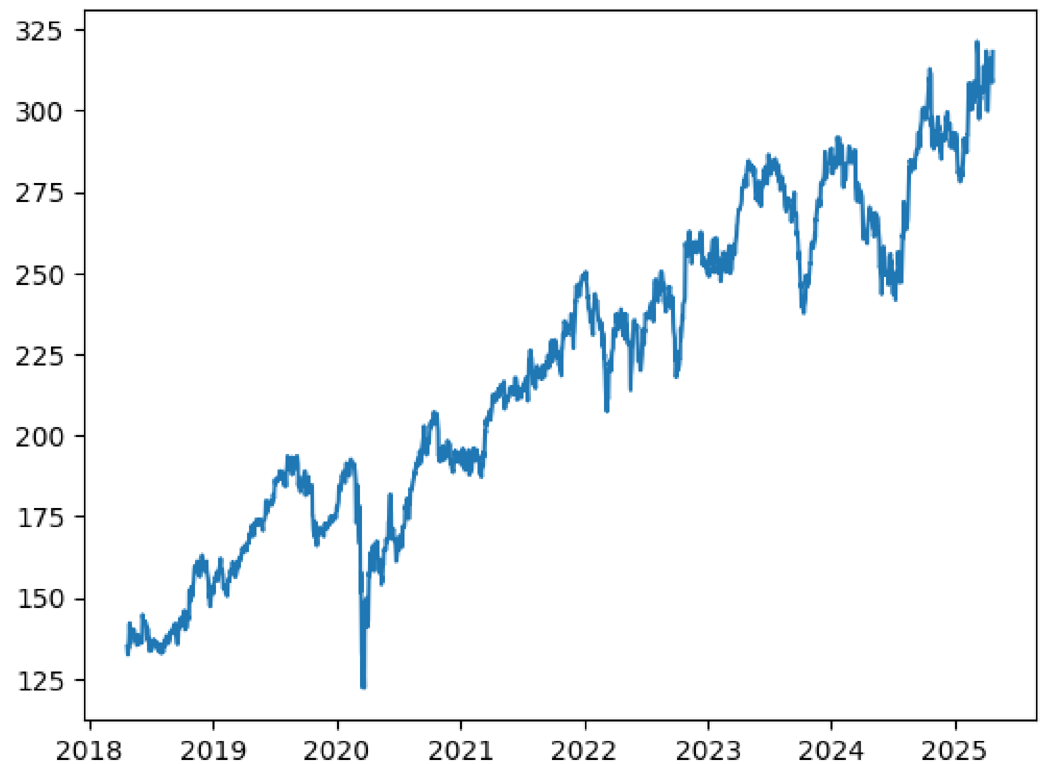
3. Data Acquisition

Stock Data:

Source: Yahoo Finance via yfinance API

Data points: Open, High, Low, Close, Volume, Dividends, Stock Splits

Timeframe: Past 4 years (Daily granularity)



Macroeconomic Data:

Source: Federal Reserve Economic Data (FRED) using fredapi

Variables collected: Inflation Rate (CPI), U.S. GDP Growth Rate, Federal Funds Interest Rate, Yield Curve Spread (10-Year Treasury - 2-Year Treasury)

4. Data Preprocessing

Holiday & Missing Data Handling:

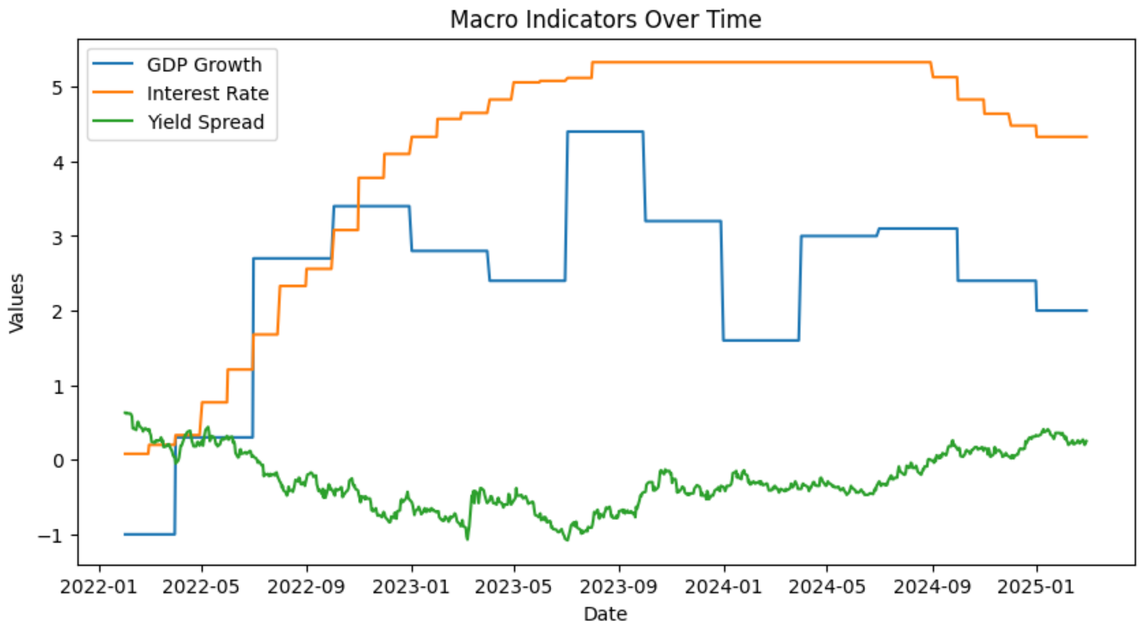
Incorporated NYSE trading calendars using pandas_market_calendars

Forward filled missing market days and interpolated missing economic indicators.

Datetime Standardization:Unified timezones across all datasets.

Converted to business day frequency (B) for modeling compatibility.

Target Variable:Focused exclusively on the Close Price for forecasting.



5. Feature Engineering

Feature	Description	Importance
50-Day SMA	Short-term trend detection	✅ Short & Long-Term
200-Day SMA	Long-term trend reversal signal	✅ Long-Term
RSI (Relative Strength Index)	Overbought/oversold detection	✅ Short-Term
MACD (Moving Average Convergence Divergence)	Momentum and trend shifts	✅ Short & Long-Term
Volatility	Risk measure (standard deviation)	✅ Short-Term
Inflation Rate	Indicator of economic purchasing power	✅ Long-Term
GDP Growth Rate	Proxy for corporate revenue growth	✅ Long-Term
Interest Rate	Borrowing cost and economic activity driver	✅ Long-Term
Yield Spread	Recession predictor; risk sentiment	✅ Long-Term

6. Exploratory Data Analysis (EDA)

Key Visuals:

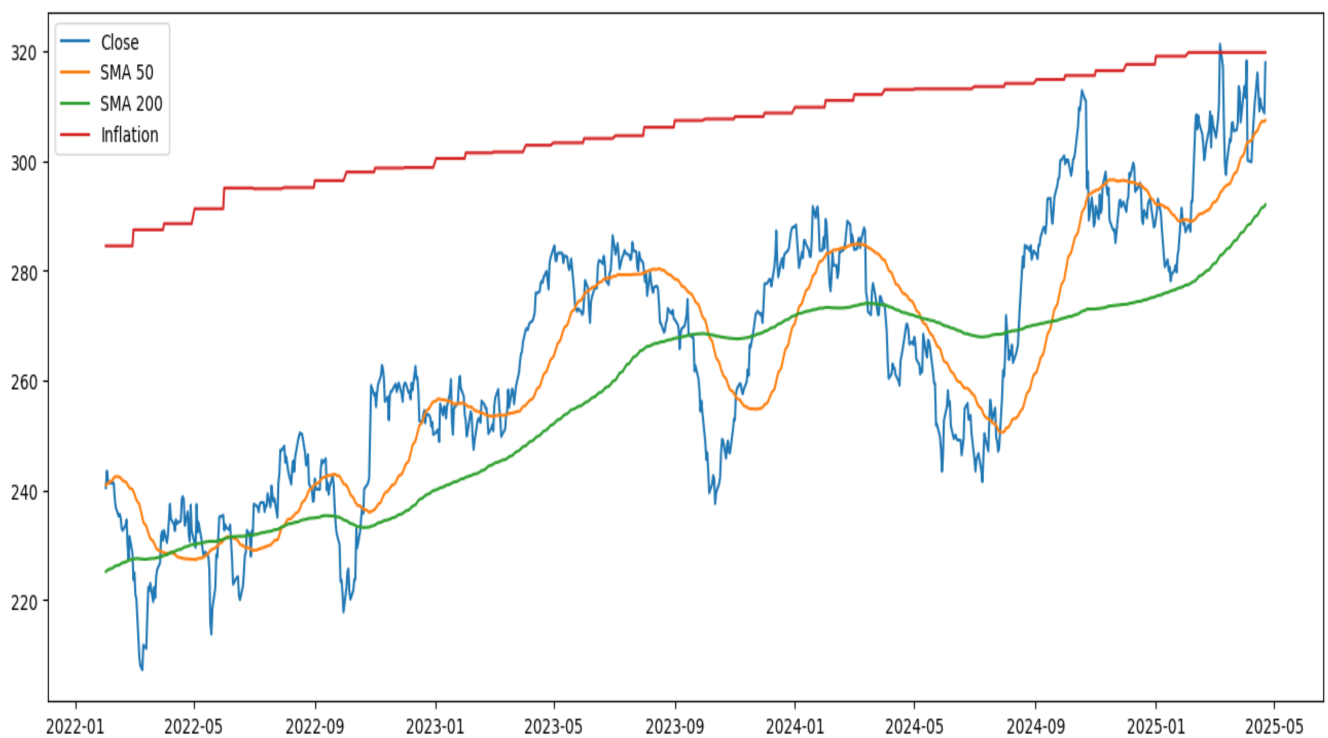
Price Trends: Line plots showed steady growth with periodic corrections.

Moving Averages: 50-day and 200-day SMAs identified key trend shifts (e.g., COVID-19 crash).

Volatility Analysis: High volatility during recession risks or major events.

Macro Influence: Inflation spikes coincided with stock market corrections.

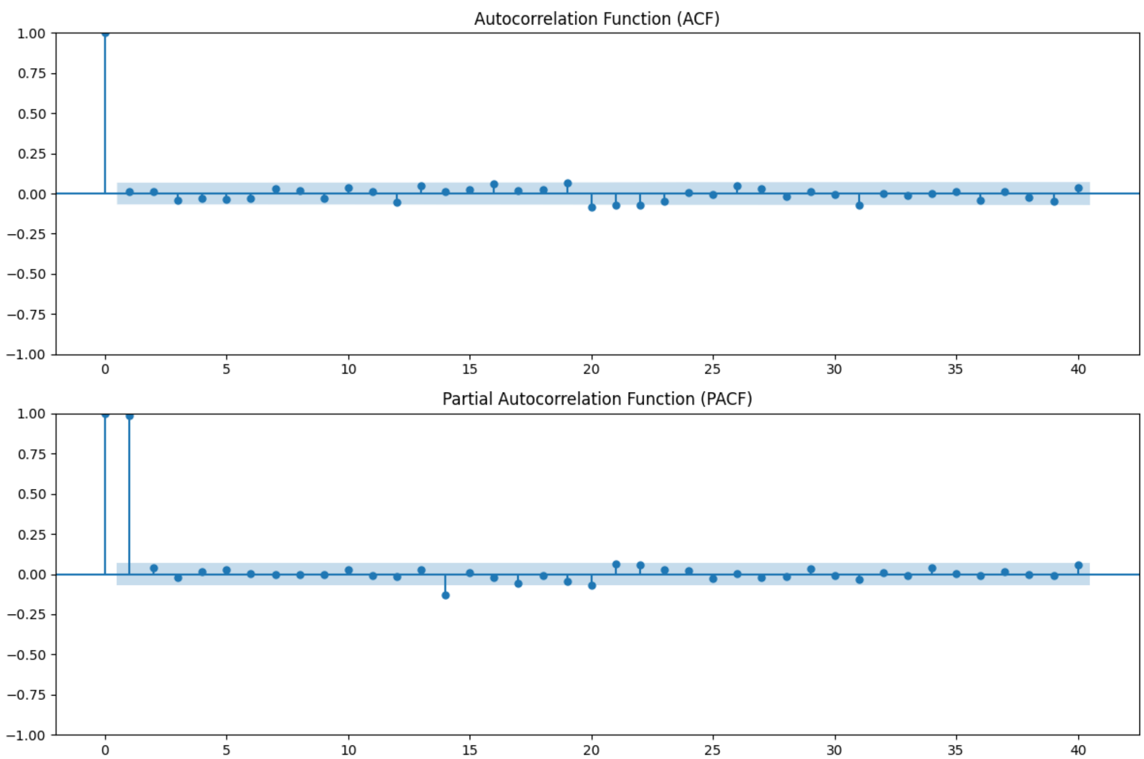
Yield curve inversion periods predicted slowdowns in stock performance.



7. Stationarity and Seasonality Analysis

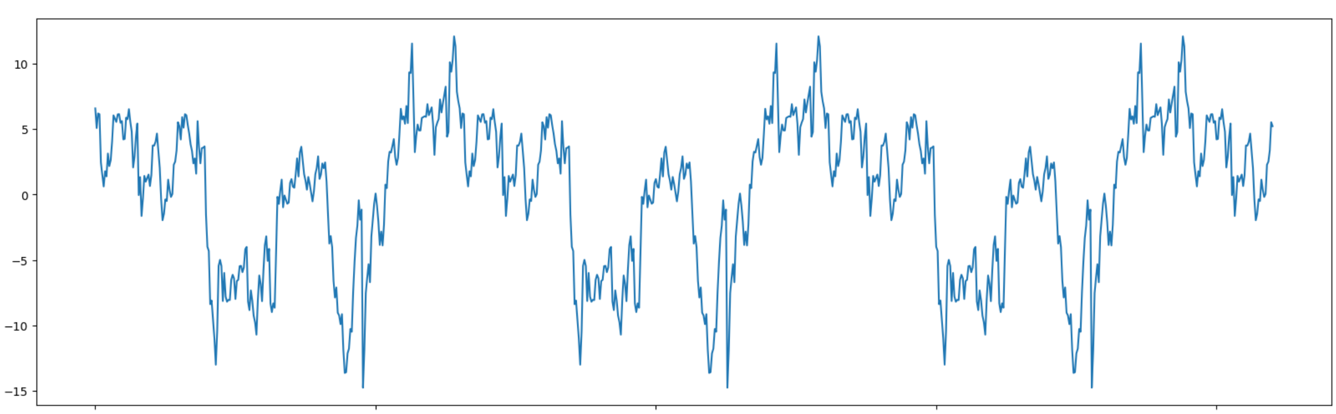
ADF (Augmented Dickey-Fuller) Test:

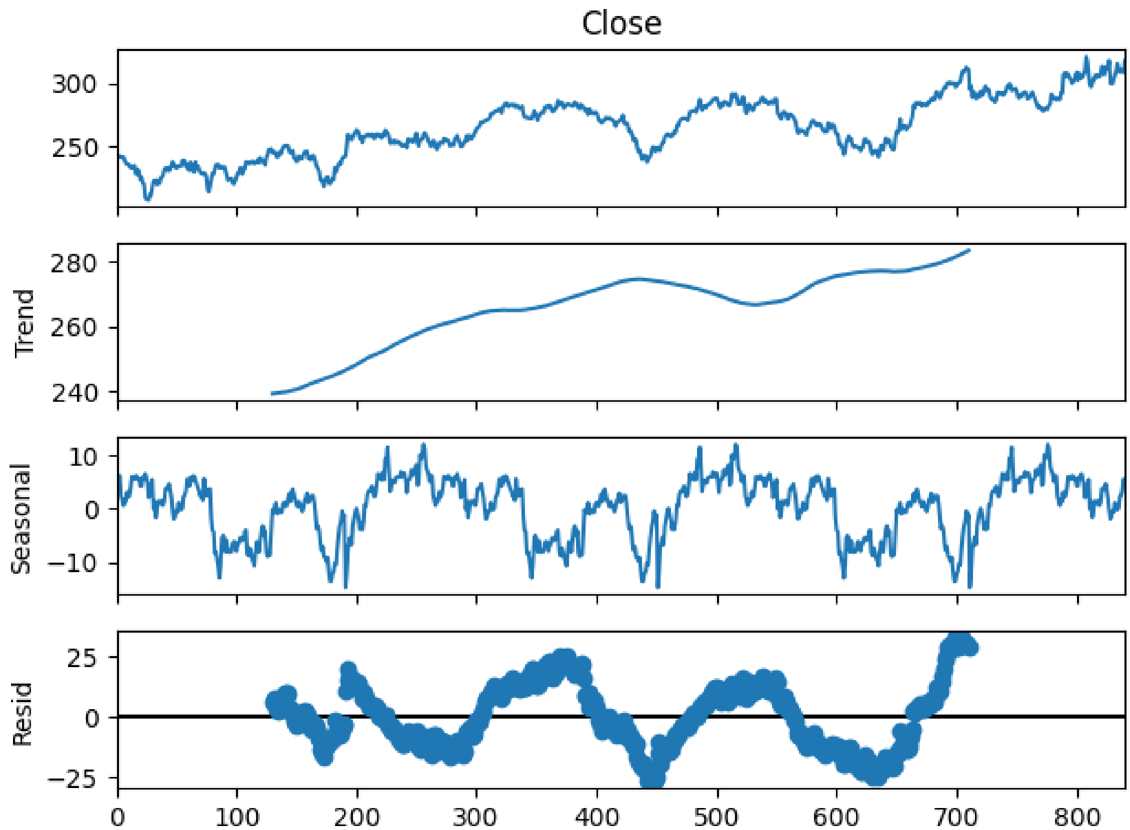
- Null hypothesis (non-stationary) could not be rejected initially.
- First differencing achieved stationarity.



Seasonal Decomposition:

- Clear seasonal patterns were observed (annual business cycle)
- Residual noise analyzed for model error expectations.





Fourier Transform: Identified dominant cycles at approximately ~52 weeks (1-year seasonality).

8. Modeling Approach

Selected Model:

SARIMAX (Seasonal ARIMA with eXogenous variables)

Reason for Choosing SARIMAX: Handles trend and seasonality.

Incorporates external regressors (macro indicators).

Model Parameters: ARIMA Order: (p=3, d=1, q=2)

Seasonal Order: (P=3, D=1, Q=1, m=52)

Exogenous Variables: Dividends, MACD, Volatility, Inflation, GDP, Interest Rate, Yield Spread

Training Strategy: Trained model on 4 years of data.

Forecasted 180 business days ahead (~9 months).

9. Forecasting and Results

Forecast Output:

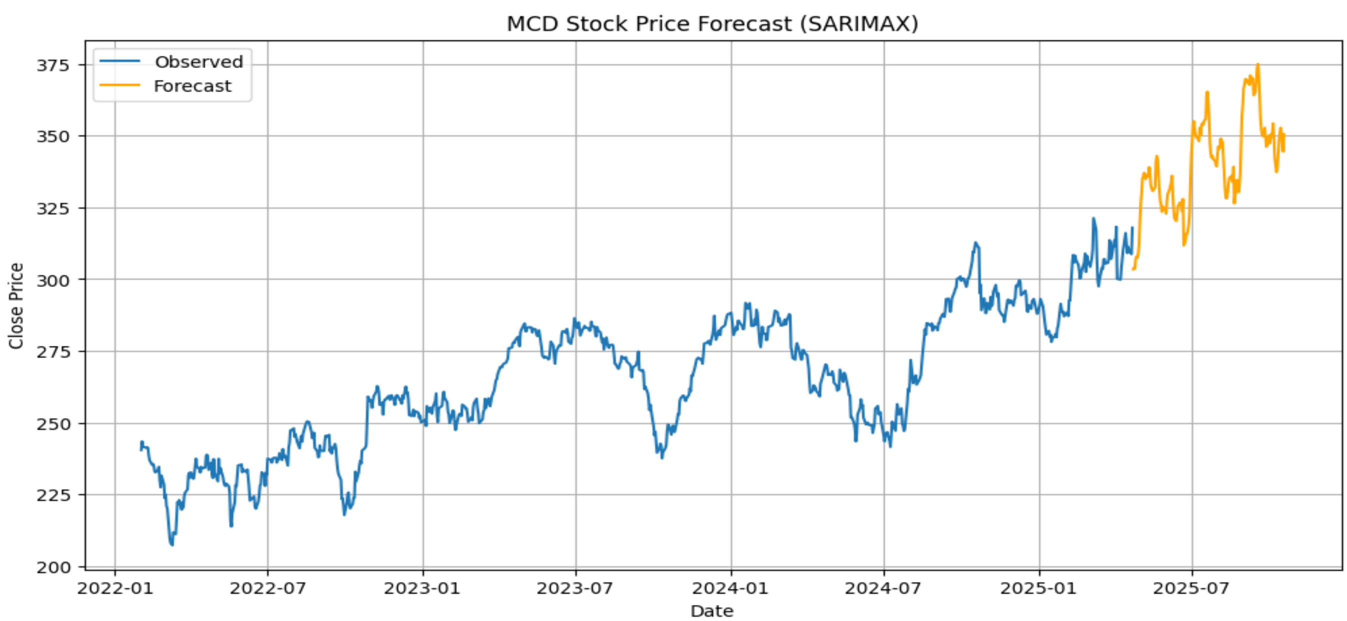
Predicted Close prices with 95% confidence intervals.

Visualization showed predicted values track historical patterns well.

Future trajectory showed moderate growth with uncertainty bounds widening over time.

Key Forecast Insights: Projected stable growth under current macro conditions.

Higher uncertainty during inflation hikes or rate hike cycles.



10. Model Evaluation

Qualitative Check:

Predicted trends and shifts aligned well with expectations.

MAPE (Mean Absolute Percentage Error)

11. Key Findings

Macroeconomic indicators significantly improve long-term stock forecasting performance.

Technical indicators (RSI, MACD, Volatility) are more useful for short-term momentum predictions.

Time series stationarity and seasonality must be handled explicitly for robust forecasts.

12. Limitations and Future Work

Limitations:
- SARIMAX assumes linear relationships.
- Forecasting uncertainty increases over time.
- Exogenous variables assumed constant beyond training horizon.

Future Work:
- Try LSTM, XGBoost, and sentiment analysis.
- Walk-forward cross-validation for backtesting.

13. Final Thoughts

This project demonstrated the importance of combining technical and macroeconomic data for better financial forecasting. Future models could further improve accuracy by incorporating machine learning and sentiment analysis.