Asset Choice Comparison

Asset Class	Pros	Cons
Equities	- Rich historical data - High liquidity - Suitable for HFT and trend-following	- Risk of overfitting due to high volatility
Futures	- Leverage amplifies returns - 24/7 trading - Suitable for macro strategies (sentiment)	- Complexity of futures contracts - High leverage amplifies losses
Forex	- Largest and most liquid market - 24/7 trading - Good for macro and volatility trading	- Sensitive to geopolitical risks - Requires macroeconomic expertise
Commodities	- High volatility - Useful for macroeconomic models - Leverage	- Highly dependent on external factors (e.g., weather, geopolitics) - Some markets illiquid
Crypto	- Extreme volatility offers large profits - 24/7 trading - Sentiment-driven	- Regulatory uncertainty - Lower liquidity compared to traditional markets

Personally my top 2 choice are: Equities or Futures

Equities: Data availability, Liquidity, Volatility
-   Will work for short term and long term trades
-   Well rounded for the algorithms we would like to use

Futures: Leverage, 24/7, Liquidity, Macro Trends, Risk Management (could allow to implement more hedging strategies in the future possibly)
-   24/7 will be really good for reinforcement learning

Equities

AAPL

Pros	Cons
High liquidity: one of the most liquid stocks, trades can be executed quickly and without large price slippage	**Moderate volatility**: less volatile than more speculative tech stocks, which could limit short-term trading opportunities (somewhat a con don't think it would be the worst thing in the beginning)
Abundant data: long history of price data, technical indicators, and sentiment	**High correlation with the tech sector**: performance is closely tied to the overall tech sector, more susceptible to sector-wide downturns.
Strong trends: exhibits clear price trends, good for LSTM model	**Valuation sensitivity**: valuation is closely watched, any deviation from earnings expectations could lead to sharp corrections
Frequent news coverage: media favorite, making it an excellent candidate for sentiment analysis with XGBoost.	**Large-cap stock**: might not experience the same explosive growth opportunities

TSLA

Pros	Cons
High volatility: price movements are frequent and large, providing large opportunities with Reinforcement Learning and XGBoost	**Overly speculative**: subject to wild price swings driven by retail investor sentiment, could result in unpredictable price action and potential overfitting
Sentiment-driven: highly influenced by news and social media, making it ideal for NLP-based sentiment analysis	**Unpredictable fundamentals**: valuation is frequently disconnected from traditional fundamentals, can make it difficult to model using traditional indicators
Frequent trading opportunities: High volatility and liquidity ensure for frequent trading signals	**High risk**: Due to extreme volatility, risk of large drawdowns is higher, could impact the stability of trading strategies
Technological innovation: innovation often results in strong, long-term trends, makes it suitable for LSTM models	**Valuation sensitivity**: high valuation makes it susceptible to large corrections in the event of negative news, regulatory changes, or underperformance

Futures

ES

Pros	Cons
High liquidity: among the most liquid financial products, ensuring easy entry and exit from trades with minimal slippage	**Lower volatility compared to stocks**: may not offer the high volatility needed for short-term, high-frequency strategies (will just be mid-low frequency, don't think think this is terrible)
24/7 trading: trade almost around the clock, making it an excellent asset for Reinforcement Learning that requires a real-time environment	**Index dependency**: tracks a broad index, less responsive to specific events affecting individual stocks, limiting opportunities for event-driven trades (less sentiment analysis)
Macro-level exposure: represent the entire U.S. equity market, making it a strong candidate for macro-economic trend analysis using LSTM	**Complexity**: with concepts like expiration dates and margin requirements, introduces additional complexity compared to trading stocks
Leverage: allow for control of a large position with a small initial margin, increasing the potential for outsized returns	**Leverage risk**: high leverage associated with futures contracts means losses can be amplified

NQ

Pros	Cons
High volatility: more volatile than ES futures due to their heavy weighting in the technology sector, provides opportunities for short-term and high-frequency trading strategies	**Sector concentration risk**: The NASDAQ 100 is heavily weighted in technology companies, its performance is highly correlated with the tech sector, increasing sector-specific risk
24/7 trading: trade almost around the clock, making it an excellent asset for Reinforcement Learning that requires a real-time environment	**Higher risk of large drawdowns**: high volatility and leverage of NQ futures mean drawdowns can be large
Tech-driven trends: NQ futures often exhibit strong, tech-driven trends, ideal for LSTM	**Higher sensitivity to macroeconomic events**: more sensitive to interest rate changes, inflation data, and geopolitical events, making it harder to predict short-term price movements accurately
Leverage: allow for control of a large position with a small initial margin, increasing the potential for outsized returns	**Leverage risk**: high leverage associated with futures contracts means losses can be amplified

My personal choice: TSLA or ES

Tesla

Tesla's high volatility, sentiment-driven price movements, and frequent trading opportunities make it a strong candidate for machine learning models like Reinforcement Learning and XGBoost. The unpredictability and strong price swings provide environment for testing both short-term and long-term strategies. Tesla's frequent news coverage also makes it ideal for sentiment analysis

Better than Apple because:
- While Apple offers more stability, Tesla's higher volatility presents more opportunities for algorithmic trading
- TSLA's heavy reliance on news and sentiment aligns well with NLP and XGBoost, which can be used to predict sentiment-based price movements.

ES

ES offers a balance between liquidity, macro-level exposure, and 24/7 trading, which is perfect for LSTM and Reinforcement Learning models. The futures market's continuous trading hours provide more opportunities for algorithmic execution, while ES's relative stability compared to NASDAQ futures makes it a better choice for developing a well-rounded trading strategy

Better than NQ because:
- While NQ provides more volatility, the sector concentration risk tied to the tech sector makes them more vulnerable to macroeconomic shifts. ES futures represent the broader U.S. economy and offer a more diversified exposure, making them better suited for trend-following models
- ES's high liquidity ensures that trades are executed efficiently, which is crucial for machine learning models that require frequent rebalancing or adjustments

OVERALL PICK: ES

1. Liquidity and Stability:
    -   ES futures are one of the most liquid financial products in the world, ensuring that trades can be executed quickly with minimal slippage. This is crucial when running machine learning models that might make frequent decisions or need quick adjustments
    -   Tesla, while offering more volatility, could introduce unnecessary risk, particularly for models that may overfit to the extreme price swings. ES provides stability with enough volatility for profitable trading but not to the extreme levels seen with TSLA
2. Broader Market Exposure:
    -   ES Futures represent the entire U.S. stock market, giving trading platform exposure to macroeconomic trends. Aligns well with the LSTM model, which is effective for predicting long-term trends based on sequential data.
    -   Tesla, being an individual stock, has company-specific risks, which could be harder to predict and model consistently. ES futures reduce this risk by focusing on the overall market rather than an individual company.
3. 24/7 Trading:
    -   ES futures trade almost 24/7, allowing models to operate in a continuous environment. Makes ES a perfect fit for Reinforcement Learning that needs constant data flow and opportunities to learn
    -   Tesla only trades during regular market hours, limiting the opportunities for real-time algorithmic adjustments and Reinforcement Learning.
4. Risk Management and Leverage:
    -   ES futures offer leverage, but their broader market exposure helps mitigate sector-specific risk, making it easier to manage overall risk compared to Tesla's individual stock volatility. The macro-level trends are easier to model with LSTM, making ES a safer and more consistent choice for building a solid ML trading platform
    -   Tesla's volatility, while providing trading opportunities, also increases the risk of large drawdowns, which could be problematic for machine learning models that haven't fully learned to manage risk
5. Applicability of Strategies:
    -   ES Futures are more suited for multiple strategies, including trend-following, mean-reversion, and macro-economic forecasting, all of which can be captured with our proposed models (LSTM, XGBoost, and Reinforcement Learning)
    -   While Tesla is great for sentiment-driven strategies, the scope is narrower, and the sentiment volatility can cause challenges for long-term, trend-based models

Price Trend Graph

I decided to include a price trend graph to show a better representation of the two assets from the beginning of 2020 to current.

Price Trend for Tesla and S&P 500 E-mini Futures (2020-2024)
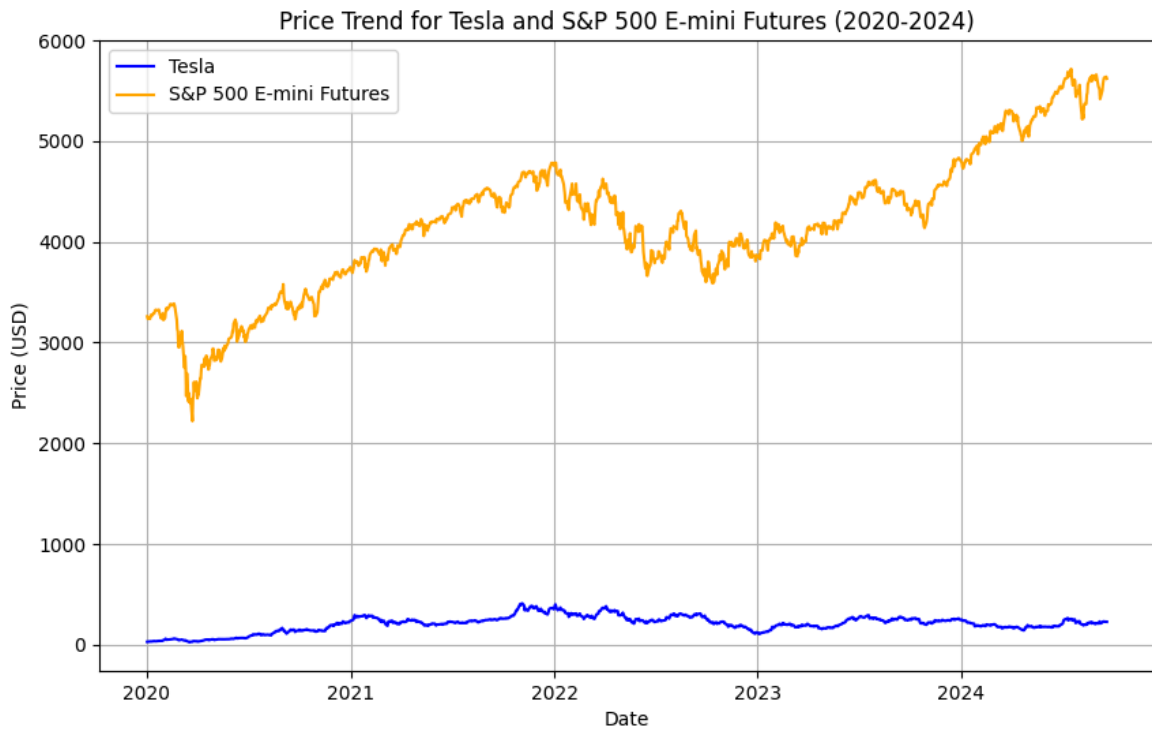
Additional Research - Changed Opinion

After analyzing the implications of using leverage in our project with ES, it has become clear that the complexities introduced by leverage may significantly increase the difficulty and scope of the project. While leverage offers the potential for higher returns, it also introduces numerous challenges, which could hinder our ability to develop a fully functional trading platform within the time constraints of this project.

Challenges:

1. **Margin Calls and Liquidation Risk**:
   ● ES exposes the system to margin calls, where the platform would need to add funds to maintain positions or risk liquidation. This introduces the challenge of constantly monitoring margin requirements and developing systems to handle forced liquidations if the margin falls below acceptable levels. Implementing and testing such mechanisms would add significant complexity to the development process.
2. **Increased Sensitivity to Volatility**:
   ● With leverage, the system becomes more sensitive to small price movements, which could lead to overfitting in our machine learning models or result in overreactive trading behaviors. Adjusting models to handle the increased volatility and prevent over trading would require nuances, which could take more time than originally planned.
3. **Complexity in Position Sizing and Execution**:
   ● Managing leveraged positions requires dynamic position sizing to adjust for changing market conditions. Our models would need to be programmed to adapt to volatility and risk by scaling up or down positions, adding another layer of decision-making that must be thoroughly tested and validated.
4. **Backtesting and Simulation with Leverage**:
   ● Backtesting strategies that involve leverage require simulating real-world margin mechanics and position scaling, which increases the complexity of testing and verification. Ensuring that our models perform well under various leverage scenarios would necessitate extended testing, potentially consuming more time than anticipated.

If time allows later in the project, we can consider expanding to futures trading by gradually introducing leverage and running controlled simulations to handle the additional complexity.