When the Billionaire Tweets: Analyzing the Impact of Elon Musk on Dogecoin Price

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1 Introduction

This project investigates the correlation between Elon Musk's social media activity and the market dynamics of Dogecoin. Specifically, we analyze whether his tweets serve as a reliable indicator for price movements. The project aims to answer two primary questions:

1. Is it profitable to purchase Dogecoin immediately after a relevant tweet from Musk?
2. What is the optimal time frame to sell Dogecoin following such an event?

2 Data Sources

The analysis is based on two primary datasets:

- **Twitter Data:** Elon Musk's tweet history (2010–2025) sourced from Kaggle. [8] [9]
- **Market Data:** Historical Dogecoin (DOGE) price data obtained from CryptoArchive. [2] [3] [4] [5] [6] [7]

The preprocessing pipeline for the social media data involved several stages of validation. Initial cleaning included the removal of duplicate entries to ensure data integrity. Subsequently, a comparative analysis was performed against a secondary quote dataset to identify unique posts, however, no additional tweets were recovered from this source. The final stage involved keyword based filtering to isolate tweets specifically relevant to Dogecoin.

The cryptocurrency datasets contained several gaps in the time series, primarily resulting from intermittent Binance service outages. These missing data points were resolved using linear interpolation to ensure a continuous high frequency stream for the causal analysis.

The project structure maintains data integrity by separating the pipeline stages: the `datasets/raw` directory contains the original, unmodified files, while the `datasets/processed` directory stores the cleaned and synchronized datasets specifically prepared for the web based visualization dashboard.

3 Exploration of relationship

For all identified tweets, there is monitoring of the price fluctuations.

- **Temporal Overview:** A macro level examination of the longitudinal time series suggests that Elon Musk's social media activity does not exert a sustained fundamental influence on the long term valuation of Dogecoin. Furthermore, the data indicates that his posting behavior is independent of market conditions, as tweets occur regardless of whether the asset is in a bullish or bearish phase. Figure 1
- **Event Window Analysis:** By isolating high frequency data within short term windows surrounding each tweet and normalizing prices relative to the "T-zero" intervention time, significant immediate market reactions become evident. The aggregated average price trajectory (visualized as the white trendline in Figure 2) reveals a characteristic sharp appreciation in value followed by a gradual decay. This suggests that while the social media stimulus triggers rapid buy side pressure, the effect is transitory as the market eventually mean reverts. Figure 2
- **Causal Impact Assessment:** To rigorously quantify the causal effect of individual tweets, the `CausalImpact` library [1] is utilized. This methodology employs a Bayesian Structural Time Series (BSTS) model to construct a "synthetic control" or counterfactual trajectory. By using correlated cryptocurrencies (**BNB, BTC, ETH, FLOKI, and SOL**) as control variables, the model estimates what the Dogecoin price would have been had the tweet never occurred. Figure 3 illustrates the analysis for the tweet with the highest observed

magnitude, providing statistical evidence that the subsequent price appreciation is a direct consequence of the intervention rather than random market volatility.

4 Results

The empirical results quantify the market's response to social media interventions by analyzing the average "pump" duration and the magnitude of price appreciation following a tweet.

4.1 Profitability and Timing

Based on the aggregated analysis of the selected events, the following conclusions can be drawn regarding trading strategies:

1. **Immediate Entry Profitability:** Opening a position immediately following a relevant tweet is statistically profitable, but the opportunity window is transitory. Within 6 hours of the event, the average cumulative price gain regresses to approximately 1%, as the initial buy side pressure subsides.

2. **Optimal Exit Strategy:** The data suggests that the optimal holding period to maximize returns is approximately **45 minutes** post tweet. At this peak, the average price appreciation reaches **4 %**. However, it is important to note that performance is inconsistent across individual events, several tweets resulted in negative returns within this same timeframe, highlighting the inherent risk of the strategy.

4.2 Variance in Impact

As illustrated in Figure 2, there is a high degree of variance in the market's sensitivity to Musk's social media activity. While certain high profile tweets trigger explosive volatility and significant gains, others yield negligible market movement. Despite this individual variance, the aggregated mean (visualized as the white trendline) confirms a statistically observable and characteristic price spike followed by a gradual mean reversion.

5 Conclusion

This project successfully addresses the questions regarding the extent and mechanics of Elon Musk's influence on Dogecoin market dynamics. The empirical evidence demonstrates that while his tweets trigger significant localized volatility and short term price appreciation, these effects are largely transitory and do not establish long term fundamental support levels.

5.1 Future Work

Several avenues for expanding this research have been identified:

- **Sentiment Analysis:** Implementing Natural Language Processing to classify tweet content could help distinguish between casual mentions and official endorsements, potentially increasing the predictive power of the model.

- **Temporal Sensitivity:** Investigating the "time-of-day" effect would determine if market reactions vary based on active trading sessions (NYSE vs. Asian market hours).

- **Engagement Metrics:** While this study focused on timestamps, future iterations could explore the correlation between engagement metadata such as likes and retweets and price magnitude. However, such metrics are often lagging indicators (accruing after the price move) and may be less applicable for real time execution strategies.

References

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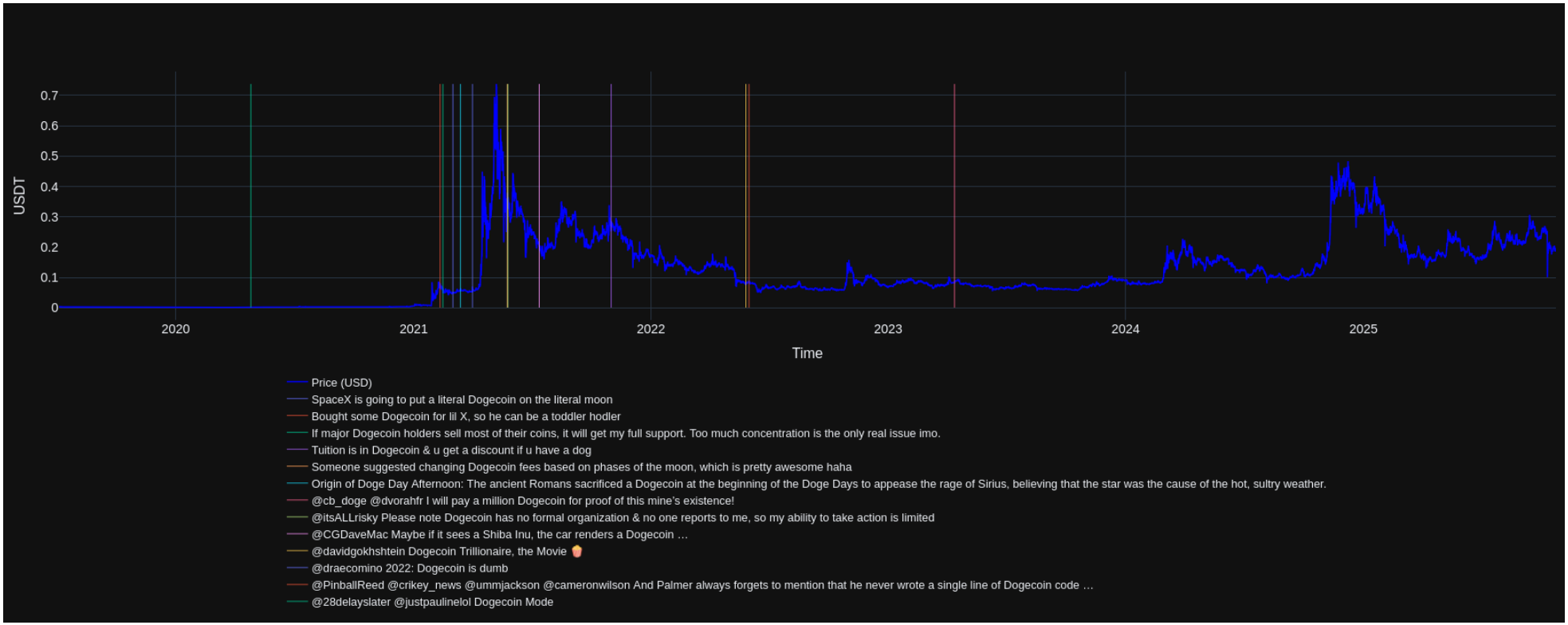

Figure 1: Overview

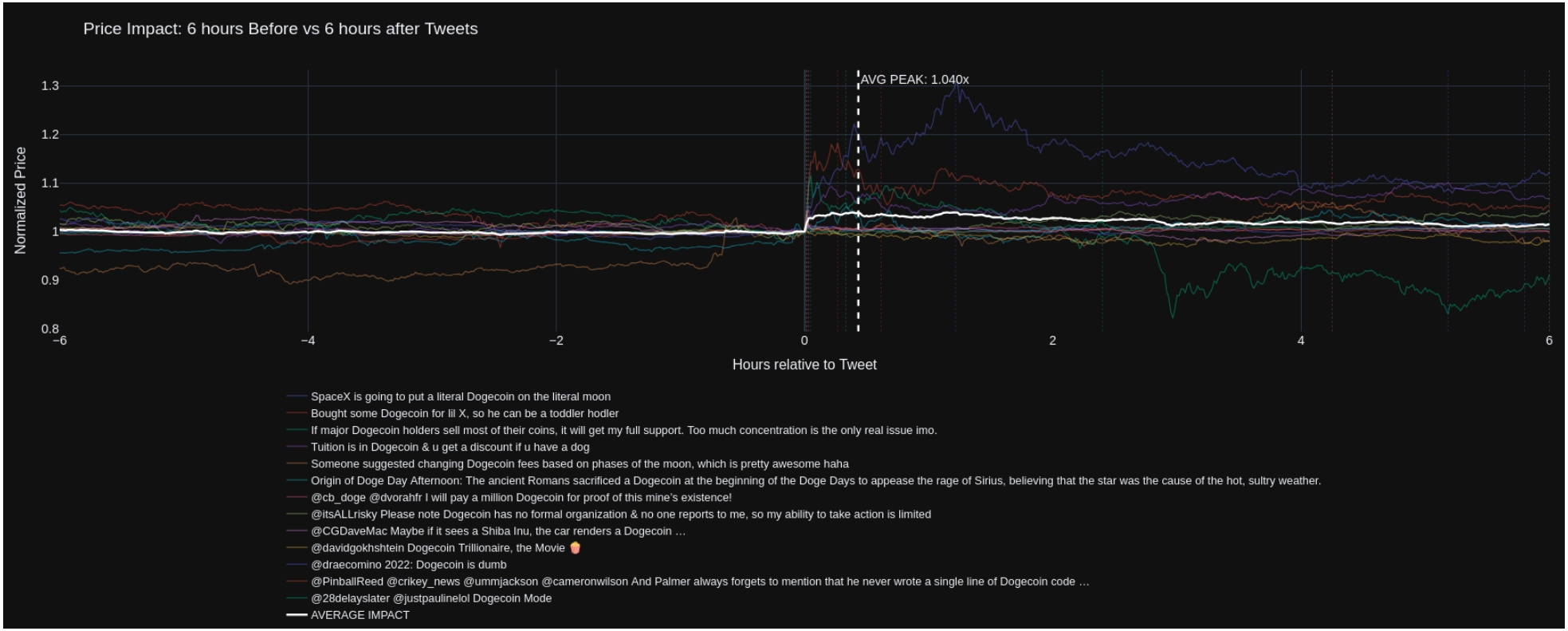

Figure 2: Relative time and price

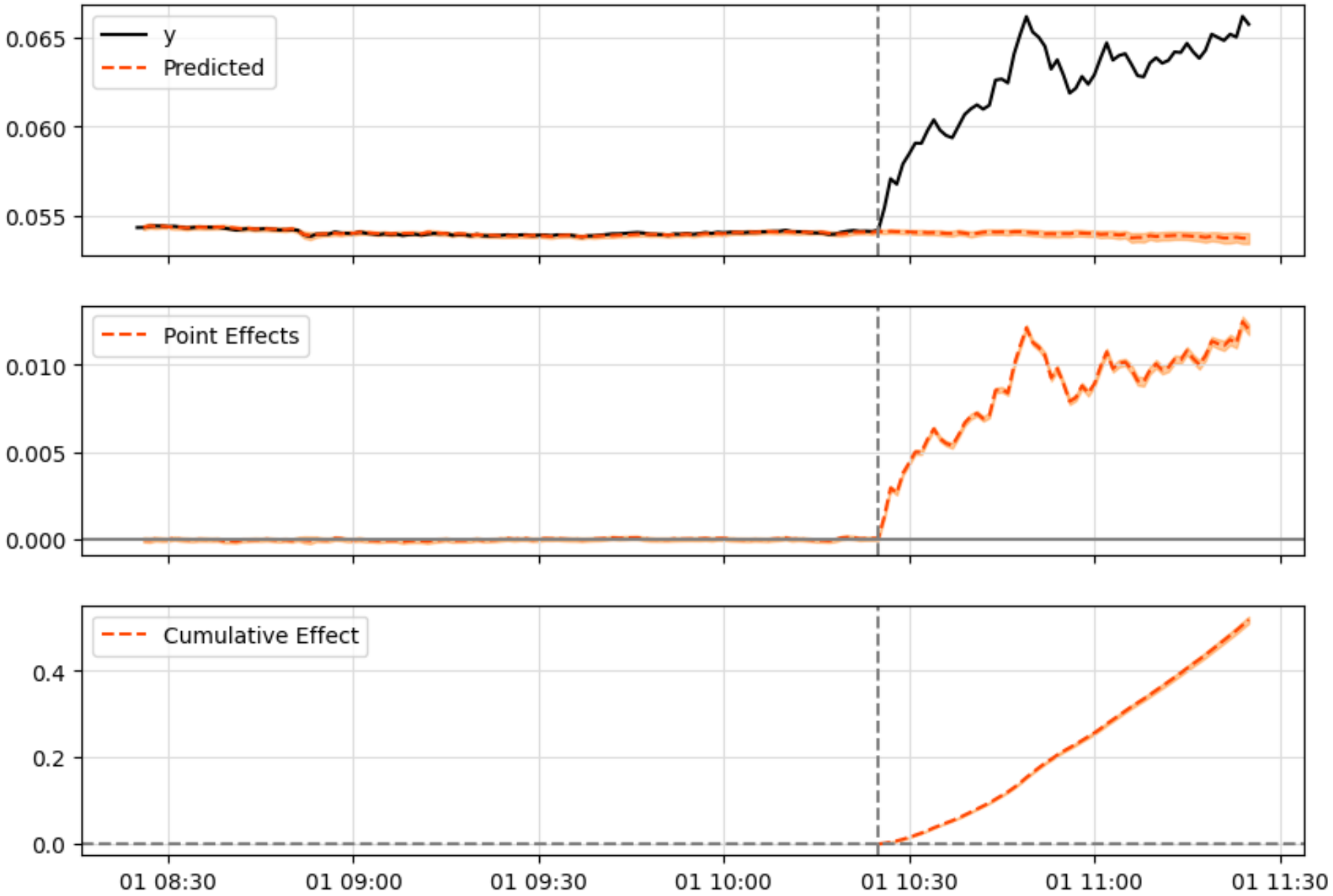

Figure 3: Causal impact for tweet: "SpaceX is going to put a literal Dogecoin on the literal moon"