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Financial Quants and Engineers Club

Front Running Event Contracts

Team 4

12/12/2024

Interest & Relevance

Political Event Contract Markets

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Event Contract Markets Dynamics & Predictions

- Recent legalization of event betting and election betting in the US lead to various betting websites:
  - E.g., Kalshi, Polymarket, Deriv, IQ Option
  - 2024 Election cycle introduces immediate implied probability of various elections that are displayed on the various exchanges
- Event Contracts function similarly to other derivatives products:
  - *"YES and NO contracts always come in pairs. If you would like to invest in a market, Kalshi will match you with another user on the platform looking for the opposite contract on the same market. One of you will receive a YES contract, the other will receive a NO contract, and in return, the two of you will pay a total of $1." (What Are Event Contracts, Kalshi)*
- What other features and quirks can the team explore with regards to market efficiency, pricing, etc.?

Could Political Betting Swing the US Election?

Prediction markets have been around for hundreds of years, but their ability to change reality is increasing.

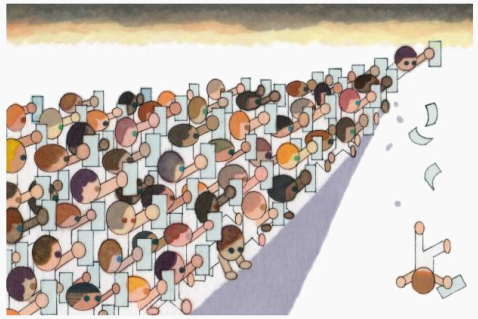

Illustration: Saehan Parc for Bloomberg

Political Betting Markets See Vindication in Trump Victory

Prediction markets, which surged to prominence during the presidential campaign, started reflecting a likely Trump win several weeks ago, even as opinion polls showed a tight race.

Share full article

The average odds from five political betting markets showed Donald Trump with better-than-a-coin-flip odds heading into Election Day. Isadora Kosofsky for The New York Times

Exclusive: Prediction market Kalshi launches crypto deposits as Trump maintains big lead on betting sites

BY LEO SCHWARTZ
October 28, 2024 at 12:49 PM EDT

BUSINESS

Kalshi's daring bet on election betting is paying off — to the tune of $100 million

By Lydia Moynihan
Published Oct. 31, 2024, 6:00 a.m. ET

45 Comments

Literature Review

Diving into the papers that inspired the project

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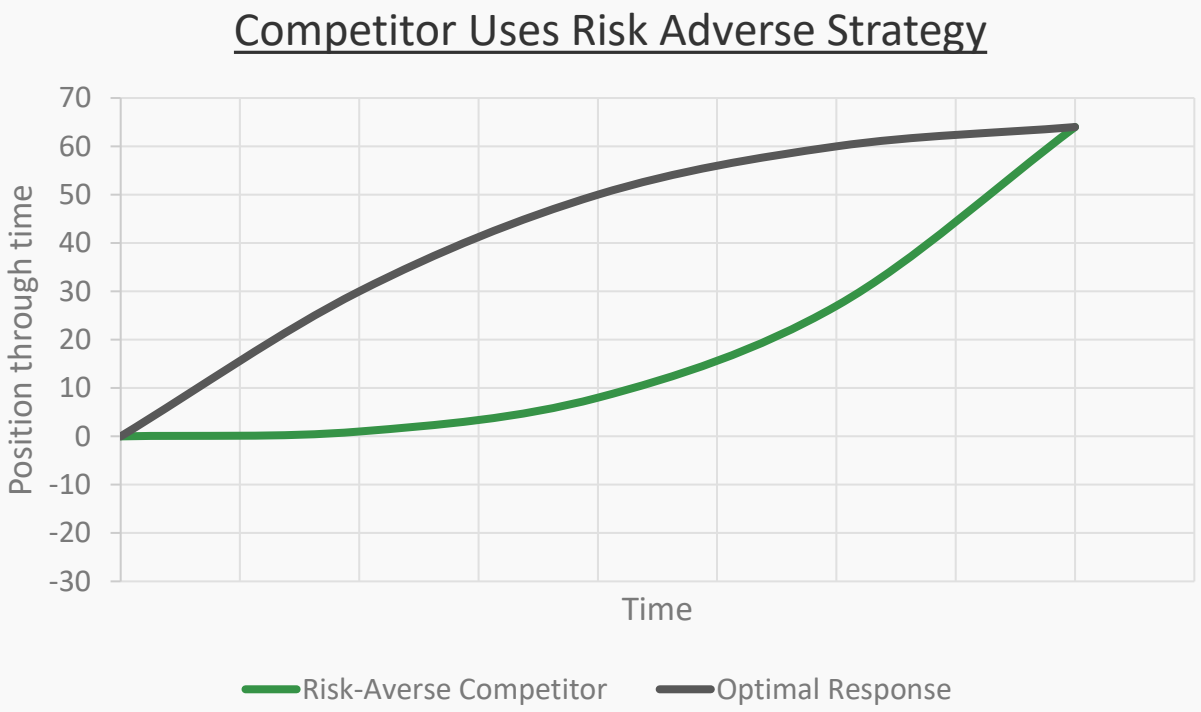
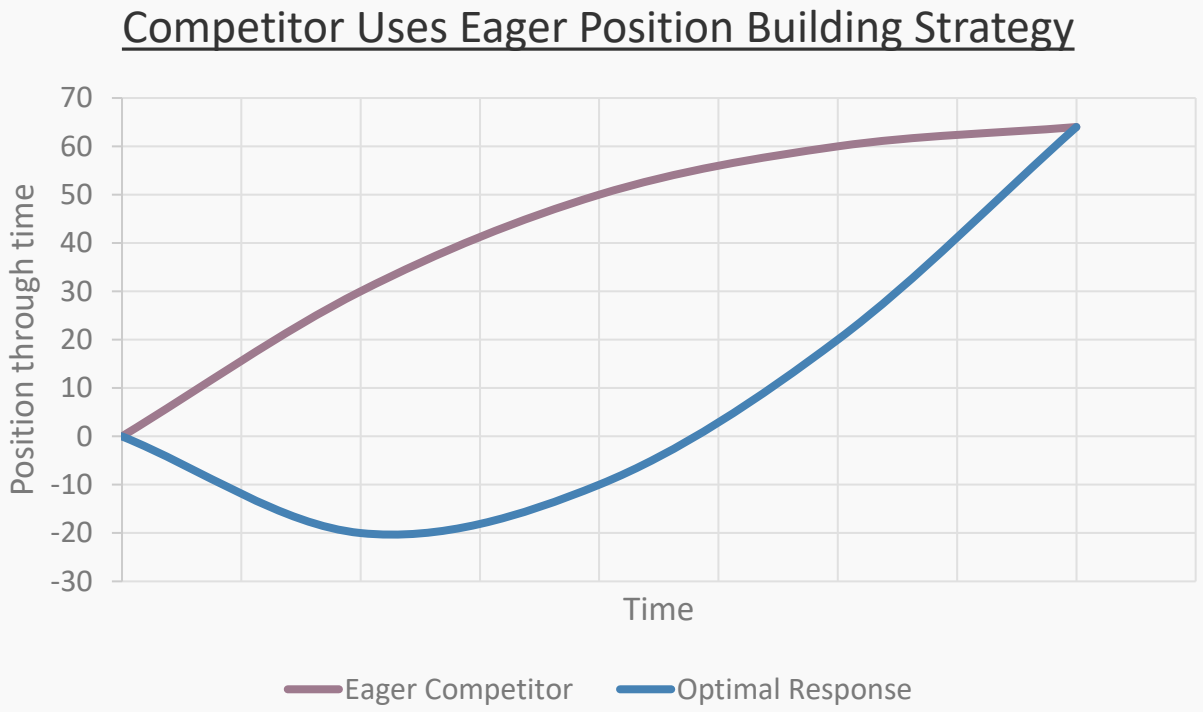
Position Building Strategies in Competition

"Optimal position-building strategies in competition" (Chriss, 2024)





$$2\ddot{a} + \lambda\ddot{b} + \kappa\dot{a} + \lambda\kappa\dot{b} - \kappa\dot{a} \xRightarrow[Euler-LaGrange]{} \ddot{a} = -\frac{\lambda}{2}(\ddot{b} + \kappa\dot{b})$$

Event Contract Market Overview & Literature Application

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Overview of event contract lifecycle

Kalshi used as the exchange to trade as it has a friendly/usable API & with heightened volume compared to other platforms within the event contract market

1. Market Listing & Ideation	2. Market Open	3. Market Closure	4. Market Resolution or determination	5. Market Settlement
"Kalshi members are able to suggest new markets… Before a new market is approved for trading, it undergoes review through the Kalshi team and the Commodity Futures Trading Commission (CFTC)… [then] the market is searchable on Kalshi"	*Trading begins, ability to buy and sell positions across various contracts with binary outcomes: e.g., the "Highest temperature in Chicago today" gives, 'yes' & 'no' contracts across various discrete temperature ranges*	*"Trading ends for the market… trading continues until the market's predetermined close date… the 'Student debt forgiveness' market with a latest possible closure datetime of 12-31-2024 at 10:00 am and a latest possible resolution time 5 hours later; if student loans are forgiven on 09-14-2023, the market closes the next day at 10:00 am and resolves 5 hours after that."*	*"Winners are determined based on predefined contract criteria… data [received] from the source agency [used] to verify the outcome of the market, as defined in the market contract"*	*"Few hours after the market result is determined, based on the predetermined source, market settlement occurs; members receive $1 for each correct contract they are holding at expiration…typically happens three hours after market resolution but can sometimes be longer*

What is the Market Life Cycle, Kalshi

Applying literature: key assumptions to implementation

Simplifying the paper to create a working model for implementation of the literature within Kalshi

1. Paper proposes a model that applies to one other competitor and multiple other competitors
   – However, for the implementation the team decided to model the numerous other traders in the event contract market as one “other” trader to model the aggregate behavior
2. Preliminary analysis of transactions appear to increase as the contract grows closer to expiration
   – The team assumes that as the contract grows closer to expiration activity increases due to:
   a) Increased certainty in the outcome (i.e., various events surrounding the event decrease the probability of another outcoming occurring)
   b) Increased importance of information dispersion related to the information contract (i.e., one day before the presidential election a poll comes out describing that a swing state is leaning towards a certain candidate)
3. Focus on implementation of high-volume event contracts & markets with ability for information dispersion
   – The team wants to ensure that there are enough market participants within the market to leverage both buying & selling of contracts; additional need for markets to have hard expiration date & ability for price-movement

1. “Optimal position-building strategies in competition” (Chriss, 2024)

Applying literature to event contract markets

Creation of a market making strategy to implement three-white papers within the Kalshi platform

Equation 1 – Loss Function for both Investors

$$L(a,b) = (\dot{a} + \lambda\dot{b})\dot{a} + \kappa(a + \lambda b)\dot{a}$$

Key Definitions:

Trader A: Unit Trader

Trader B: λ scaled Trader

$\dot{a}$ = first derivative with respect to (t)

$\dot{b}$ = first derivative with respect to (t)

κ = market impact coefficient

Equation 2 - Autoregressive Model

$$\log(\phi_t) = \omega + \beta\log(\phi_{t-1})$$

Key Definitions:

ϕ = conditional duration at t

ω = constant

β = intra-trade duration

ϕ_{t-1} = conditional duration at t-1

Data requirements & key areas for implementation:

- Defining peak volume windows for a specific contract market
- Market implied probability of the specific contract market across (t,1)
- Number of traders and market capitalization
- Define Adverse Selection – Modeling K with an autoregressive model:
  - –High Beta → persistence in intra-trade duration on t range rolling window

Implementation Strategy

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Implementation Process & Roadmap

We know that information releases closer to expiration have an increased price impact, thus a market-making strategy can leverage individuals who enter the market with an aggressive buying strategy

Completed: EOY - 2024

1 Understanding & Data Gathering

- Developed understanding and downfalls of various platforms, e.g. transaction costs, API usage requirements, etc.
  - Kalshi chosen as default platform
- Aggregated historic data collection method and convert to candlestick data

2 Investment Ideation & Selection

- Selected and blended three white-papers to develop market making strategy to apply on Kalshi
- Identified implementation hurdles and began preliminary development of white-paper strategy development

Implementation: 1H - 2024

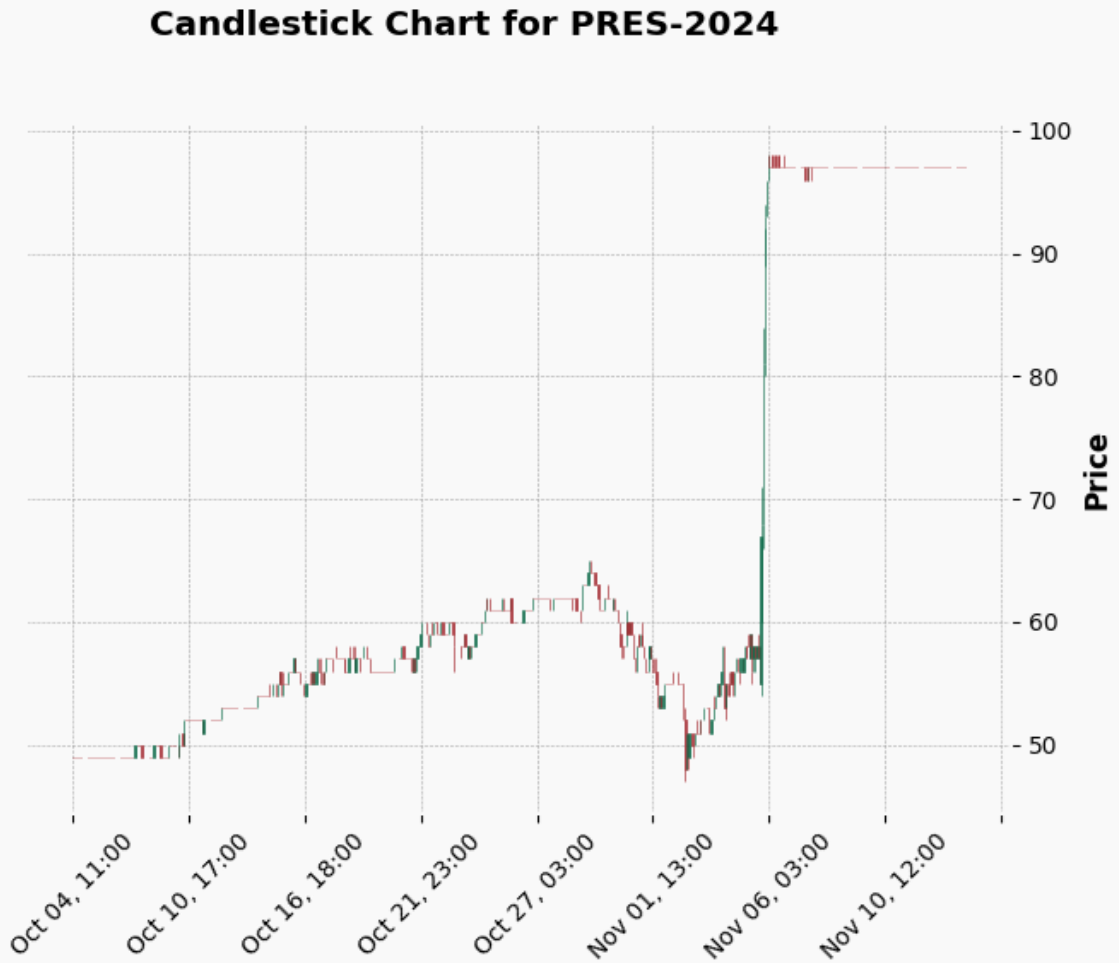
3 Creation & Strategy Refinement

- Implementation Items:
  - Refine volume indicator to approximate peak volume window
  - Define Market implied probability from listing to expiration
  - Create adverse selection model
- Refinement and studies

4 Paper Trading

- Create method to record and implement paper trading
- Select potential benchmark to monitor performance of market making strategy
- Record results and determine scalability of strategy

Applying to the Kalshi 2024 Presidential Event Contract Market



Q&A

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Appendix

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Other relevant papers

“Position-building in competition with real-world constraints” (Chriss, 2024)

“Competitive Equilibria in Trading” (Chriss, 2024)