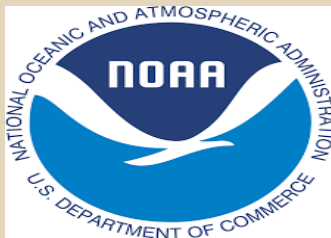


SP25-MSBR-70320-SS-1F Time Series Forecasting

Modeling for Temperature Forecasting and Prediction Markets

Alex Heck
Cooper Foster
Tim McDonald

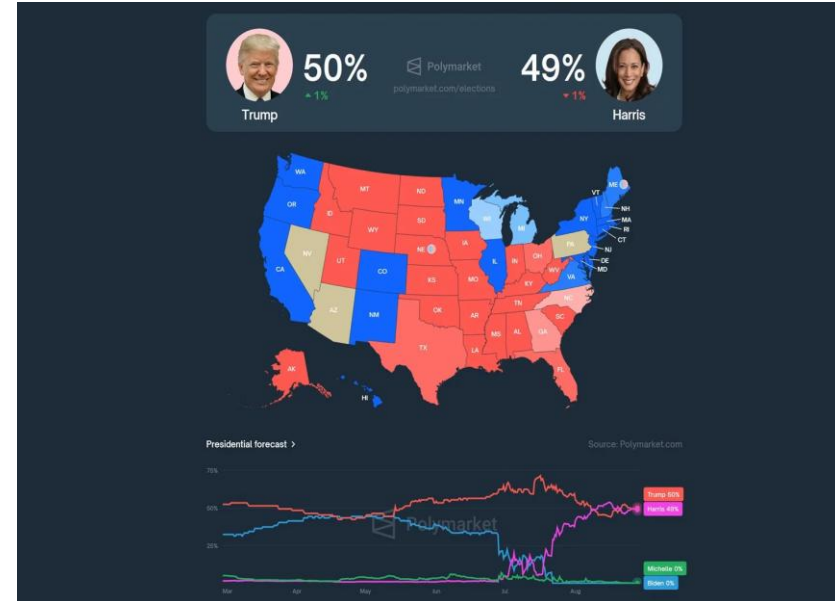


Agenda

- 1 Intro & Polymarket Explainer
- 2 Data & Models
- 3 Model Validation
- 4 Stakeholders & Benefits
- 5 Further Analysis

Introduction - Polymarket Event Prediction Market

- Founded in 2020, Polymarket has quickly become one of the most popular event prediction markets in the world.
- Polymarket rose in popularity last year as they offered several betting markets on the 2024 United States elections





Global trade wars

Hedge risk & forecast the fallout, amid rising US tariffs.

[Markets >](#)

Race to AGI

Predict model dominance, policy changes, & more...

[Markets >](#)

First 100 days

What will Trump accomplish in his most pivotal days?

[Markets >](#)

Free to join

The world's largest prediction market.

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Top

New

German Election

Trump Presidency

Breaking News

Bybit Hack

Ukraine

Declassification

DOGE

Epstein



Germany Parliamentary Election Winner

CDU/CSU

96% [Yes](#) [No](#)

AfD

4% [Yes](#) [No](#)

Other

1% [Yes](#) [No](#)

\$126m Vol.



Will Kanye launch a coin in February?

[Buy Yes](#)[Buy No](#)

\$19m Vol.



Trump ends Ukraine war in first 90 days?

[Buy Yes](#)[Buy No](#)

\$18m Vol.



Will Putin meet with Trump in first 100 days?

[Buy Yes](#)[Buy No](#)

\$4m Vol.



Which company has best AI model end of February?

xAI

86% [Yes](#) [No](#)

OpenAI

9% [Yes](#) [No](#)

Anthropic

7% [Yes](#) [No](#)

\$3m Vol.



Russia x Ukraine ceasefire in 2025?

[Buy Yes](#)[Buy No](#)

\$3m Vol.



Trump declassifies Epstein list in first 100 days?

[Buy Yes](#)[Buy No](#)

\$1m Vol.



Gold missing from Fort Knox?

[Buy Yes](#)[Buy No](#)

\$591k Vol.



Ukraine agrees to give Trump rare earth metals before...

[Buy Yes](#)[Buy No](#)

\$334k Vol.



Kash Patel releases Epstein files on Day 1?

[Buy Yes](#)[Buy No](#)

\$232k Vol.



Will Trump cut military spending?

[Buy Yes](#)[Buy No](#)

\$129k Vol.



New pandemic in 2025?

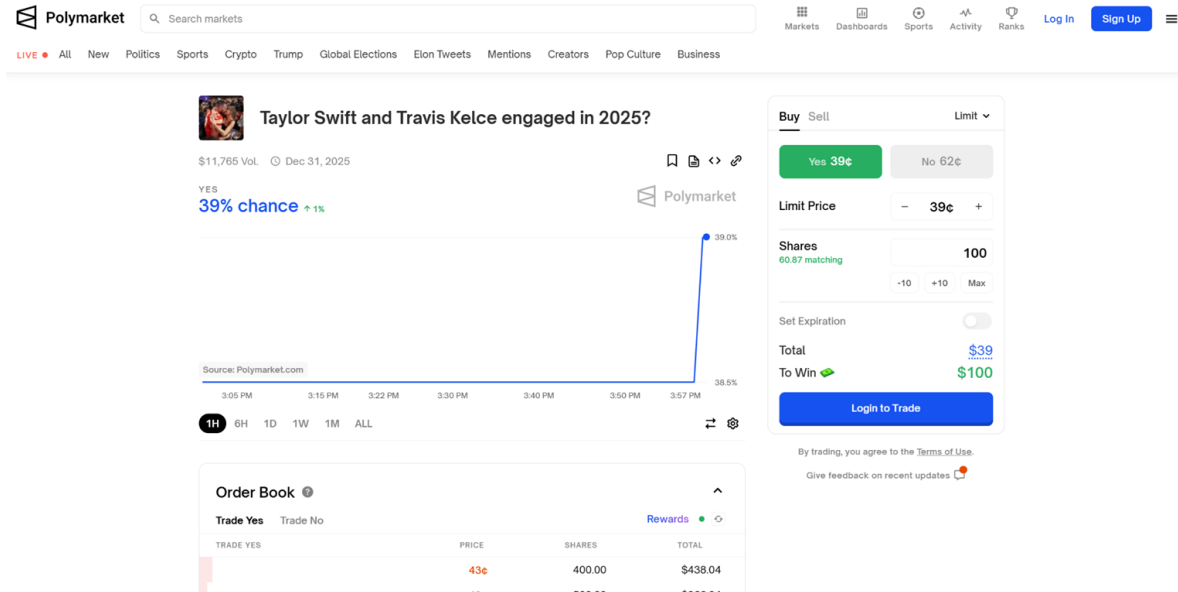
[Buy Yes](#)[Buy No](#)

\$102k Vol.



Introduction - Polymarket Example

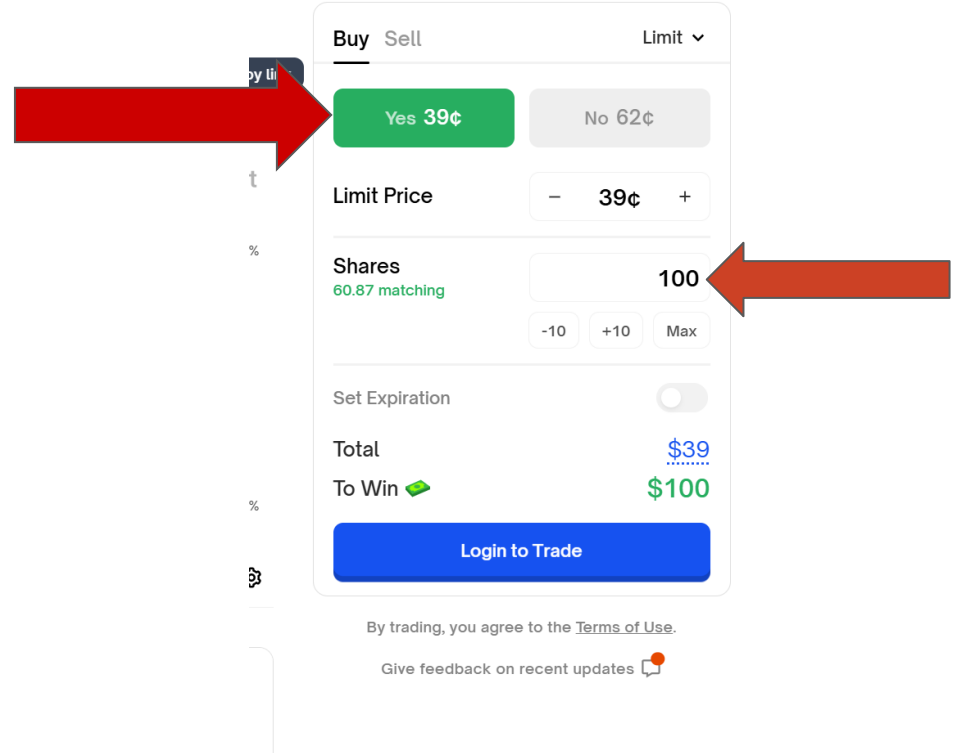
Will Taylor Swift and Travis Kelce get engaged in 2025?



Introduction - Polymarket Example

If Bezel has a strong inclination that the pair will indeed get engaged by the end of the year, he can buy “Yes” for 39 cents per share.

This means that if Kelce pops the question, and Taylor says yes, Bezel would win \$100, a net profit of \$61!



The screenshot shows a trading interface for a market. At the top, there are tabs for 'Buy' and 'Sell', with 'Buy' selected. To the right is a 'Limit' dropdown. Below the tabs are two buttons: a green 'Yes 39¢' button and a grey 'No 62¢' button. A red arrow points to the 'Yes 39¢' button. Below these buttons is a 'Limit Price' section with a minus sign, '39¢', and a plus sign. Underneath is a 'Shares' section showing '60.87 matching' and an input field with '100'. A red arrow points to the '100' in the input field. Below the input field are buttons for '-10', '+10', and 'Max'. Further down is a 'Set Expiration' toggle switch. Below that is a 'Total' section showing '\$39' and a 'To Win' section showing '\$100' with a green diamond icon. At the bottom is a blue 'Login to Trade' button. Below the button is a line of text: 'By trading, you agree to the [Terms of Use](#).' and another line: 'Give feedback on recent updates' with a speech bubble icon.

Introduction - New York City Daily High Temperature

Our team decided to drill down into one specific market:

“Highest Temperature in NYC on ____ date?”

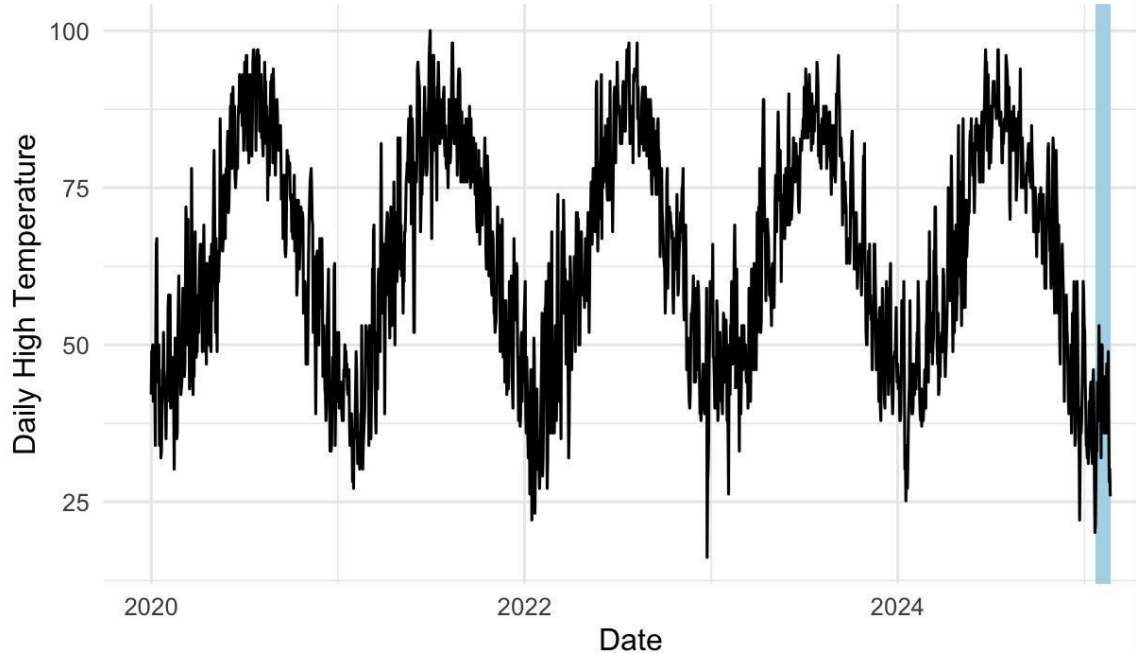
This is a market that takes place everyday, typically open for around 48 hours.

Within this market, users have the opportunity to bet on a list of 7 temperature intervals.

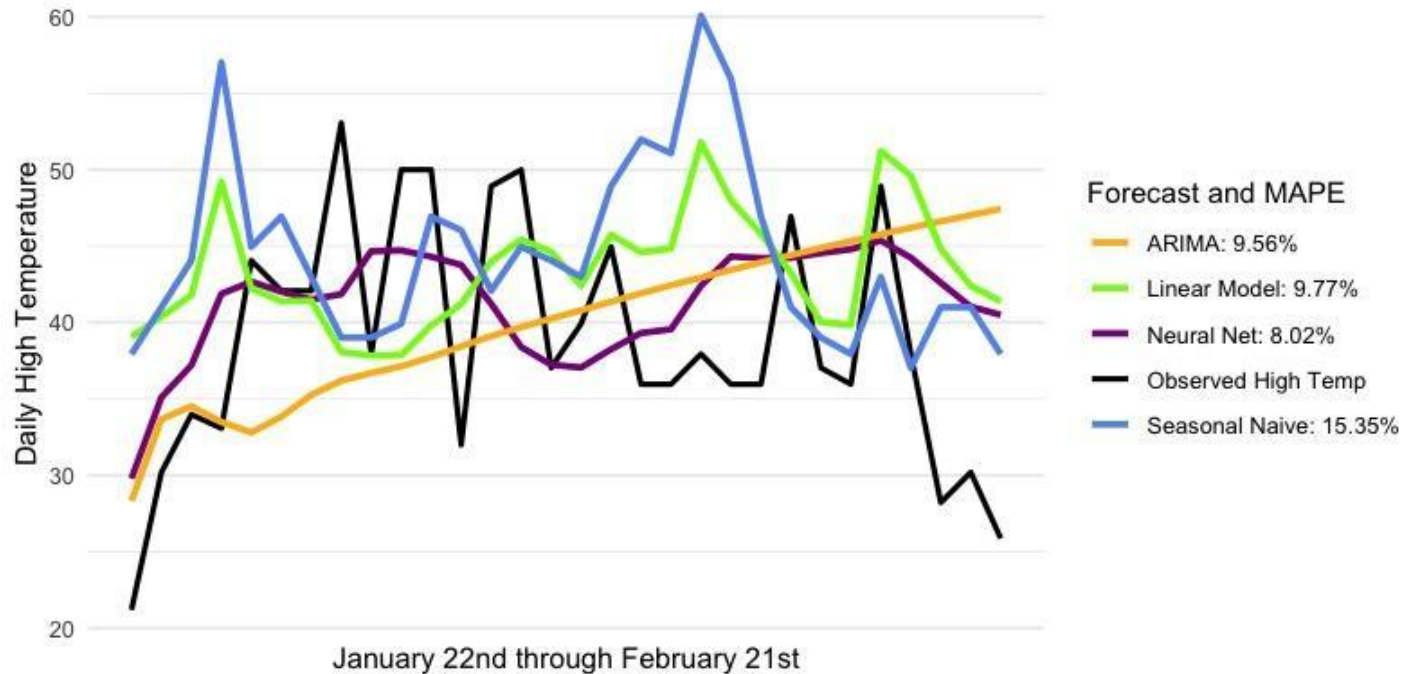
OUTCOME	% CHANCE ↻		
41°F or below \$1,284 Vol. 📦	<1%	Buy Yes 0.4¢	Buy No 99.9¢
42-43°F \$619 Vol. 📦	3%	Buy Yes 3.8¢	Buy No 97.6¢
44-45°F \$420 Vol. 📦	16%	Buy Yes 17¢	Buy No 85¢
46-47°F \$558 Vol. 📦	41%	Buy Yes 46¢	Buy No 65¢
48-49°F \$646 Vol. 📦	34%	Buy Yes 41¢	Buy No 74¢
50-51°F \$494 Vol. 📦	7%	Buy Yes 7¢	Buy No 94¢
52°F or higher \$358 Vol. 📦	2%	Buy Yes 2.4¢	Buy No 98.5¢

Data & Models

- KLGA weather station data used for model training
- We trained a Linear model, ARIMA, and Neural Net, all benchmarked against Naive and S-Naive models
- For ARIMA and Neural Net, models used a rolling validation period to tune parameters.



Model Final Validation: Error



Final Model Validation: Correct Predictions

1/22	1/23 ARIMA	1/24	1/25 NAIVE ARIMA	1/26	1/27 No predictions	1/28 NAIVE LM NN
1/29	1/30 SNAIVE LM	1/31	2/1	2/2 NAIVE SNAIVE ARIMA	2/3	2/4 NAIVE ARIMA
2/5	2/6 ARIMA	2/7 ARIMA NN	2/8	2/9 NAIVE	2/10 No predictions	2/11
2/12 NAIVE	2/13	2/14	2/15 NAIVE ARIMA	2/16 LM	2/17 SNAIVE	2/18
2/19	2/20 NAIVE	2/21 NN				

Model	#
NAIVE	8
ARIMA	7
LM	3
SNAIVE	3
NN	3











Model Validation: Hypothetical Profit/Loss

	NAÏVE	SNAÏVE	LinearMod	ARIMA	NeuralNet
Winnings	\$12,471	\$9,382	\$231	\$12,380	\$1,123
Losses	\$(2,100)	\$(2,600)	\$(2,600)	\$(2,200)	\$(2,600)
Net P/L	\$10,371	\$6,782	\$(2,369)	\$10,180	\$(1,477)

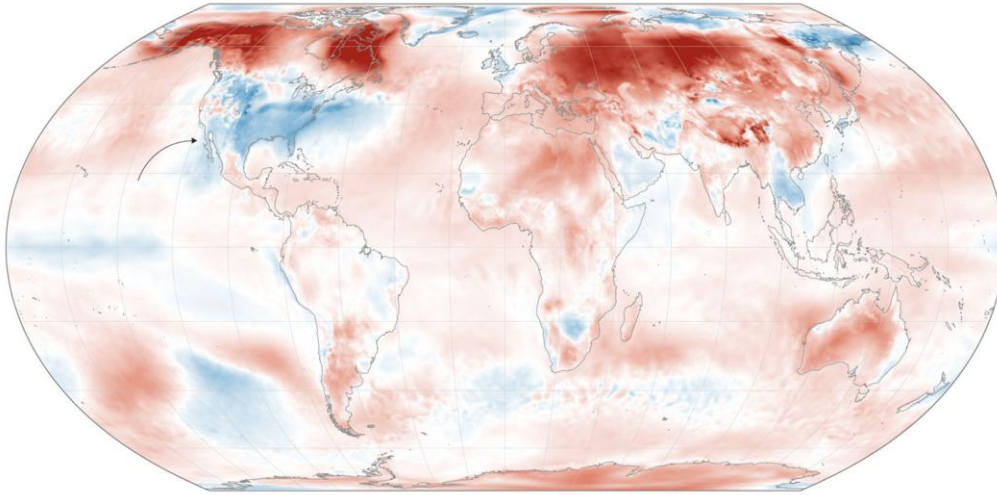
Assumes \$100 bet placed on market for each model's prediction bought at best available price at or near 6pm on the day preceding each market's expiration.

Benefits & Stakeholders

- Stakeholders include thousands of unique market participants.
- Each day, participants bet hundreds of thousands of dollars on these outcomes.
- Betting on daily weather data is just one example of emerging prediction markets that can be used in sophisticated betting strategies, such as hedging another outcome.

Comments	Top Holders	Activity	Related
<div> <div>All</div> <div>Min \$10,000</div> </div>			
	Zyronis sold 102,116 Yes for 40-41°F at 27.0¢ (\$27,572)		12h ago
	lucky99 bought 102,116 No for 40-41°F at 73.0¢ (\$74,545)		13h ago
	YTHGD bought 70,326 No for 33°F or below at 99.1¢ (\$69,693)		1d ago
	Aelthar bought 23,989 No for 42-43°F at 96.9¢ (\$23,245)		1d ago
	tigers bought 62,519 No for 44°F or higher at 99.2¢ (\$62,019)		2d ago
	91588 bought 46,138 No for 33°F or below at 99.7¢ (\$46,000)		2d ago
	Veylix bought 29,785 No for 42-43°F at 96.9¢ (\$28,862)		2d ago
	CRYQQ bought 67,311 No for 34-35°F at 97.9¢ (\$65,897)		2d ago
	CRYQQ sold 116,852 No for 38-39°F at 61.0¢ (\$71,280)		3d ago
	CRYQQ bought 116,852 No for 38-39°F at 61.0¢ (\$71,280)		3d ago

Further Analysis: Temperature Anomalies



January 2025 Average Temperature Anomaly
via CNN

- Record-breaking temperatures affected our seasonal models
- Running this during period with more 'normal' temperatures might yield different model mix
- As temperature anomalies increase over time, models will need to be updated

THANK YOU!

We will now take any questions you may have.



References / Citations

Polymarket

<https://learn.polymarket.com/docs/guides/get-started/what-is-polymarket/>

2/22 Temperature Market

<https://polymarket.com/event/highest-temperature-in-nyc-on-feb-22?tid=1740347588834>

KLGA Data via Meteostat

<https://meteostat.net/en/station/72503?t=2016-01-01/2025-02-14>

CNN

<https://www.cnn.com/2025/02/21/weather/polar-vortex-cold-winter-climate/index.html>