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(G*) Universality in Prediction Markets

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In a prediction market, traders buy and sell contracts linked to the outcome of real-world events such as "Donald Trump will be Re-Elected President on November 5, 2024". Each contract (share) pays the bearer 1 dollar if the event happens by the given date, and expires worthless (0 dollars) otherwise. At any given time, therefore, these contracts trade between 0 and 1 dollar, the price representing the market's perception of how likely the event is (e.g. 0.63 dollars = a 63% probability). The price fluctuates as traders buy and sell in response to new information–e.g. Polls, scandals, and other relevant developments–ultimately hitting 1(0) when the event does (does not) come to pass. Most of the past literature studying prediction markets has focused on how accurate these "crowdsourced"assessments of probability are in predicting the final result. Comparatively little attention, however, has been paid to the *dynamics* that drive the market to that accurate (or inaccurate) prediction.

Here, we ask whether there are universal patterns driving the dynamics of prediction markets and how prices change in response to new information. We use tools of information theory and complex systems to quantify the price dynamics of nearly 3,000 contracts from a popular online prediction market –PredictIt. The markets therein cover a wide range of events ranging from election results, to the outcomes of legislative votes, to career milestones of politicians. Despite this heterogeneity, we uncover striking universal patterns in the statistics of price fluctuations and volume of contracts traded over time. In addition, we quantify the long-term *memory* present in contract prices; allowing us to classify time series as "mean-reverting", "random", or "trending", with the time series in each category exhibiting qualitatively similar shapes. Our findings suggest that the complex human interactions driving prediction market dynamics can be embedded in a relatively low-dimensional space of variables. This could open the door to mechanistic modeling of apparently high-dimensional socio-financial systems.

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