

A TECHNOLOGY TALE: FROM TERRORISM ASSESSMENT TO FIXED-ODDS EXOTICS

A fixed-odds bet is simply a futures contract. But all the mathematical wizardry and computational horsepower of financial risk management have yet to open up the quintessential portfolio play to the UK punter; namely, fixed-odds horseracing exotic bets.

THE AMERICAN FIRM NET EXCHANGE is a trading technology company formed in 1994 by faculty members at the California Institute of Technology. In 2001, the R&D arm of the US Defense Department, known as DARPA, contracted Net Exchange to develop a futures market capable of efficiently hosting the transaction of hundreds of interrelated contracts.

Conventional markets rely on traders to drive efficiency through arbitrage trading. DARPA was interested in a smarter market, one that sensed interrelations from trader activity and drove prices toward efficiency. What DARPA wanted was a terrorism-assessment system capable of pooling information held by many different people, each of whom might have key insight on a few pieces of a larger puzzle.

The DARPA effort collapsed in mid-2003 when the idea of using prediction markets to assess terrorism risks became politically untenable. But, before the collapse, Net Exchange had developed the core technology known as CAMM, the Combinatorial Automated Market Maker. Net Exchange retained the commercial rights to CAMM. This brings us to fixed-odds horseracing, a type of futures market awash in the interrelated contracts/bets for which CAMM was designed. Consider a race between the three horses A, B, and C. Fifteen different bets can be structured among these three horses: three win, three place, six forecast (e.g., B finishes first and A second), and three reverse forecast (e.g., A and C will be the first two finishers). Among these fifteen, nine are multi-horse or exotic bets. As the number of horses in a race increases, the number of exotics increases exponentially while the number of win and place bets increases by one per horse. This sample race offers a rich assortment of interrelated bets that a punter should eagerly wager. For example, a punter who strongly believes A will win can best play that belief by not only backing A to win but also by backing the AB and AC forecasts.

In the United States, punters eagerly wager exotics – approximately half of all horse race wagering is in exotic bets. In contrast, exotics use in the UK is paltry – perhaps five percent of total volume. The fundamental reason for this contrast has nothing to do with the punters. Rather, the reason rests in the different betting systems that predominate in the US and the UK; namely, pari-mutuel and fixed-odds. In the US, fixed-odds is illegal. In the UK, both systems are legal.

The operator of a pari-mutuel system faces

no risk because odds are not fixed until all bets have been made. A fixed-odds system requires bookmakers to be willing to take on the risk of providing firm contracts, bets on which the punter knows the payoff terms at the moment the bet is struck. A bookmaker wants to build a risk-balanced position among the bets it transacts, making money off the spread it charges rather than the potential payoff of a risky net position. In any one horse race, managing risks across a few win and place bets is simpler than managing risks across hundreds of exotic bets. The premia needed to cover the risks of fixed-odds exotics stifle demand.

Should UK punters abandon fixed-odds for pari-mutuel betting? Absolutely not! There is great value in knowing the odds of a bet when paying for it. The commercial opportunity is in building a fixed-odds system in which managing exotics-bet risk and managing win-bet risk are problems of similar scale. Which brings us back to CAMM.

MANAGING EXOTICS

Net Exchange realized that CAMM could power a fixed-odds horse race betting system featuring a full range of exotic bets. The secret is in how CAMM looks at a horse race. To CAMM, before the off, a horse race is a set of possible outcomes in which each outcome is an order of finish among the horses. To CAMM, each order of finish is an individual futures contract. Thus, going back to the three-horse example, CAMM does not have a single contract for Horse A wins; rather, CAMM has the two order-of-finish contracts ABC and ACB.

In the three-horse race, fifteen wagers were identified. Yet, there are only six possible orders of finish: the building blocks ABC, ACB, BAC, BCA, CAB, and CBA. All fifteen of the wagers can be constructed from these building blocks. For example, the BC

reverse forecast is BCA + CBA, B places is BAC + BCA + ABC + CBA, while the AB forecast is just ABC.

A punter comes to CAMM, wants to back the BC reverse forecast, sees CAMM's posted odds, and decides to make the bet. Inside CAMM, the posted odds for the BC reverse forecast are the sum of CAMM's internal odds for BCA + CBA (plus a spread). CAMM sells the punter a package made up of equal numbers of BCA and CBA, which is labeled as the BC reverse forecast because that is how the punter thinks about the bet. CAMM converts the punter's stake into the appropriate number of the other four order-of-finish contracts, which become part of CAMM's internal position – this is how CAMM lays the BC reverse forecast.

CAMM's position is now longer in ABC, ACB, BAC, and CAB. In response, CAMM shifts its internal prices to make bets built from its long positions more attractive. Thus the odds offered for B places, the AB forecast, and all other bets related to the BC reverse forecast are adjusted, driving the system toward efficient prices (odds) while helping to keep CAMM's internal position in balance.

In 2005, a major UK bookmaker allowed Net Exchange access to its retail wagering data from approximately fifty races. In 2005 and 2006, the performance of several CAMM-based systems were simulated using wagering scenarios constructed from these data and containing defensible proportions of exotic bets. The simulation results indicate that a CAMM-based system can be profitable while imposing a spread of only 1%.

If UK punters had access to fixed-odds exotics with risk premia similar to win bets, then they would likely use exotics as readily as do American punters and punters in many other racing jurisdictions, resulting in a significant increase in UK betting volume. ■

AUTHORPROFILE



John O. Ledyard is the Alan and Lenabelle Davis Professor of Economics at The California Institute of Technology. His applied research is in market design for trading

pollution emission rights, managing resources for spacecraft projects, reverse auctions for logistics contracts, swapping portfolios of thinly traded securities, and prediction markets.

AUTHORPROFILE



Dr. Charles Polk is a director of the trading technology firm Net Exchange. With Net Exchange, he has developed markets for pollution credits, bond

portfolio trading, and information gathering. Separate from Net Exchange, he has consulted for NASA on the application of economic principles to mission planning and management.