

CAMM: A Pooling Mechanism for Fixed-odds Exotics

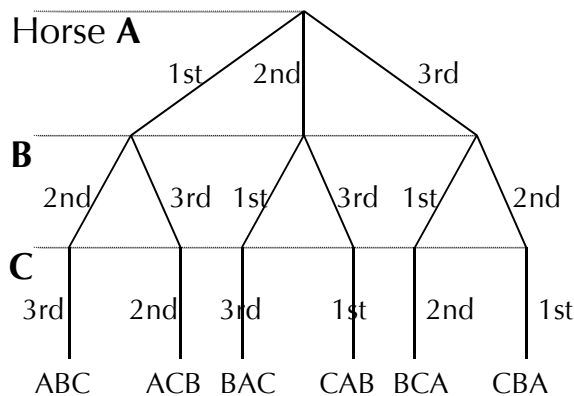
Net Exchange’s Combinatorial Automated Marketmaker (CAMM) is an electronic trading technology designed to manage the transaction and pricing of many hundreds of interrelated futures contracts. CAMM can be implemented as a bookmaker in a fixed-odds gambling system, making it ideal for horse race wagering since there are many interrelated bets in each race. In such a role, CAMM can pool a broader range of bets than a pari-mutuel system can. This broad pooling capability offers improved risk management for bookmaking systems. CAMM’s commercial significance is greatest with regard to exotic bets; namely, bets involving more than one runner.

Building Bets from Race Outcomes

All bets within a race are interrelated – this is the key to pooling liquidity among these bets. Consider a race among three horses, A, B, and C. The odds for the AB forecast are clearly relevant to the odds for the A win, as are the odds for the AC forecast, the A place, and so on. Interrelatedness among bets can be dealt with succinctly and exactly by looking at a horse race as a set of possible outcomes, where each outcome is a possible order of finish among the horses in the race.

Figure 1 is an outcome tree for a three-horse race. A three-letter shorthand is used to designate a particular outcome; e.g., ABC indicates the outcome in which Horse A finishes first, B second, and C third. There are only six possible outcomes to a three-horse race. For races of all sizes, only one outcome can occur, and the true probabilities of all outcomes must sum up to one. Bets can be viewed as subsets of outcomes, where the odds of any bet are the sum of the odds of its constituent outcomes.

Figure 1. Outcome Tree for a three-horse Race



Building Bets from Outcomes

Backing Bet	Outcomes
Win A	ABC, ACB
Win B	BAC, BCA
Forecast AB	ABC
RevFore AB	ABC, BAC
Place A	ABC, BAC, CAB

Race Outcomes as Securities

To CAMM, making book on a race is a market between a bookmaker and punters, where each security is a specific race outcome. The fact that the probabilities of all outcomes must sum to one allows CAMM to use the pricing rule illustrated in Figure 2.

Figure 2. Internal CAMM Pricing Rule

$$£1 = \boxed{\text{ABC}} + \boxed{\text{ACB}} + \boxed{\text{BAC}} + \boxed{\text{BCA}} + \boxed{\text{CAB}} + \boxed{\text{CBA}}$$

The price of a full set of securities (i.e., one of each race outcome) is set equal to £1.00. The probability of each outcome is then its price in pence.

This pricing rule is for internal use only; it provides the link between the internal market and external bookmaking. Customers deal in any standard bet and a system based on CAMM can adhere to any bet-size rules that customers require. The rule's benefit to pooling liquidity among bets is illustrated below.

Example of Pooling Among Bets

Imagine that the operator of a CAMM-based system is willing to commit £100,000 to make book on a three-horse race. Before any bets are taken, and by the pricing rule of Figure 2, CAMM's position for the race can be viewed as 100,000 of each outcome set at zero net risk. Table 1 records CAMM's internal transactions to fill a sequence of six bets from its customers.¹ For example, to fill a backing AC reverse forecast (RevFore), CAMM must sell ACB and CAB outcome securities, retaining the other four securities.

Table 1. Sequence of £1 Bets* filled by CentralBook

Bet	Side	Sold by CentralBook	Retained by CentralBook
AB Forecast	Back	ABC	ACB, BAC, BCA, CAB, CBA
BC RevFore	Back	BCA, CBA	ABC, ACB, BAC, CAB
AC RevFore	Back	ACB, CAB	ABC, BAC, BCA, CBA
CA Forecast	Lay	ABC, ACB, BAC, BCA, CBA	CAB
AB RevFore	Lay	ACB, BCA, CAB, CBA	ABC, BAC
BA Forecast	Back	BAC	ABC, ACB, BCA, CAB, CBA

* Bets with payouts of £1 if they win. The stakes for each bet depend on the odds.

As CAMM sells off pieces of full sets of outcome securities, its retained position, or book, changes composition and thus net risk exposure. Table 2 shows the gross and net positions from having filled the six bets of Table 1. The difference between net and gross is the recognition that full sets of outcome securities have no net risk, or, equivalently, that a full set can be accounted for as £1.00 of cash. Each £1.00 thus reclaimed from betting-in-progress can be put back into use by CAMM to fill bets.

Table 2. CentralBook Holdings from Table 1 Bets

Position	ABC	ACB	BAC	BCA	CAB	CBA	Cash
Gross	4	3	4	3	4	3	μ^*
Net	1	0	1	0	1	0	$\mu + \text{£}3$

* μ is all punter charges for the filled bets plus marked-to-market gains or losses.

The process used by CAMM to set and adjust odds operates at the outcome security level and enforces the rule that the probabilities of each outcome sum to one. After enforcing this rule, a spread may be built into the odds offered to punters or some other

¹ For ease of exposition, each of the six bets is sized so that it will pay £1.00 to the customer that placed it if the bet ends up correct. This is not a requirement of the system, it just makes the example simpler.

revenue model may be used. In Table 2, the symbol μ is used to indicate the cash position resulting from charges to punters and any marked-to-market gains or losses due to odds adjustments (as such, μ is an expected value until the race outcome is known).

Note that although none of the six bets in Table 1 are for the same wager, CAMM has pooled risk across these bets – the net, at-risk position involves a small subset of the outcome securities transacted. Given an odds adjustment process that is responsive to demand, the following two qualities are the basis of CAMM’s commercial value:

1. The size of the net at-risk position is independent of bet volume so long as the volume processed is above some minimum.
2. The capital committed by the system-operator to a race may be used to support very high volumes of betting.

The above holds for larger, more realistic races. Races of eight to twelve horses involve many hundreds of exotic bets among the first three finishers. CAMM’s ability to pool risk and liquidity among all these bets, and fill the bets at fixed odds, is a substantial improvement over both fixed-odds bookmaking and pari-mutuel betting.

Commercial Extensions and Significance

In 2005, a major U.K. 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 was 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 U.K. 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 U.K. betting volume. In the right business model, such as that used by or among bookmakers and betting exchanges, the commercial potential of CAMM is huge.

Further Information

Net Exchange is interested in licensing CAMM to one or more U.K. concerns and then in assisting licensees in capturing the massive potential of fixed-odds exotics in the U.K. market. To express interest in this opportunity, please contact Net Exchange via e-mail on exotics@nex.com. After assessment of the credibility of an inquiry and upon conclusion of a confidentiality agreement, Net Exchange will provide further information on CAMM and its possible business uses.