

AN ECONOMIST'S GUIDE TO LOTTERY DESIGN

This month sees the seventh anniversary of the UK's National Lottery - first sales, 14 November 1994, first draw, 19 November 1994 - and, after some confusion and controversy, the start of Camelot's second license period, which allows the company to run the game for a further seven years. In a research report published in the latest issue of the *Economic Journal*, Professor **Ian Walker** and **Juliet Young** analyse some of the key issues in the operation of lottery games and explore the implications for ticket sales and hence for revenue for the 'good causes'. Their efforts to put some science into the art of lottery design reveal that:

- While the Saturday draw was initially a runaway success, quickly achieving weekly sales of £70 million, sales have fallen gradually since 1997 to less than £50 million a week now.
- While the Wednesday draw has been successful by international standards, regularly selling about £25 million, its introduction has reduced Saturday sales dramatically. Now Saturday plus Wednesday sales only just match Saturday sales before the midweek game was launched.
- The new 'Extra' game, which offers just a jackpot and no smaller prizes and can only be bought in conjunction with a regular draw ticket, has not been a success.
- Good causes revenue might be higher if the 'take-out' - the proportion of sales that is returned as prize money - were smaller: although sales would fall a little, the good causes would get a larger share of the smaller revenue.
- But lotteries are not good vehicles for taxation since they are a larger part of the spending of the poor than of the rich. And there is no compelling evidence that there is any merit in having much of the take-out dedicated to good causes.

Walker and Young's research analyses how sales have evolved over time. It suggests that ticket sales depend positively on the *average return* - the proportion of revenue returned as prizes - because punters like better bets. Sales also depend on the skewness in the prize distribution, for example, how much of the prize money goes to the jackpot: the more *skewness*, the better for sales. In addition, sales depend on the *variance* in the prize distribution, a measure of the riskiness of the return - so the less variance, the better for sales. The sizes of these effects are important: Walker and Young's statistics suggest that the effect of the average return is small as is the effect of the skewness, while the (negative) variance effect is quite important.

This work helps to explain the variation in sales over time. The Saturday draw was initially a runaway success: it offered such a better deal than the football pools that it quickly cleaned up in the market for long-shot bets. But the decline in the Saturday game started when the Wednesday game was introduced: Saturday sales immediately fell by around £10 million. One problem is that the games were linked: Wednesday rolled over into Saturday and so, while there were more rollovers (because midweek sales are low), they were smaller rollovers - so the Saturday game didn't get the intermittent injection of fun from large rollovers - it got many small ones instead.

Sales of the new 'Extra' game, which has not been a success, are volatile since it is designed to roll over frequently. But the average is barely £1 million per draw. This research suggests that the skewness in the prize distribution (from being just a jackpot) fails to compensate for the low average/high variance return (because there is such a high probability of the return being zero in any draw - that is, there is a large rollover probability). The 'Thunderball' game is a fairly low variance game because it has a guaranteed jackpot, but this also implies quite low skewness.

The research suggests that good causes revenue might be higher if the game were meaner (with a lower take-out) because, although sales would fall a little (since it would become a worse bet on average), the good causes would get a larger share of the smaller revenue. And if more of the prize money was used for the jackpot, or if the variance in the expected prizes were reduced, sales would rise.

BUT, in practice, it is difficult to change one aspect of the design of the game without having a countervailing effect on another aspect. It is difficult to make judgements about the merits of alternative game designs without looking at ALL the proposed parameters.

Overall, the researchers conclude, there should be a lottery because people enjoy playing and it does little harm. But lotteries are not good vehicles for taxation because they are a larger part of the spending of the poor than of the rich.

Moreover, there is no compelling empirical evidence to suggest that there is any merit in having much of the take-out dedicated to good causes. Such 'hypothecation' is bad for sound investment decision-making. What is more, the best good causes - health, education, etc. - are already the recipients of taxpayer largesse, so adding lottery funds to these causes simply displaces Treasury money; while those causes where this 'additionality' issue is not a problem are unlikely to be very 'good'.

Notes for Editors: 'An Economist's Guide to Lottery Design' by Ian Walker and Juliet Young is published in the November 2001 issue of the *Economic Journal*. Walker is Professor of Economics at the University of Warwick, Coventry CV4 7AL; Young is at National Economic Research Associates, 15 Stratford Place, London W1.

For Further Information: contact Ian Walker on: 024-765-23054 (mobile: 07785-538218; fax: 024-765-23032; email: i.walker@warwick.ac.uk); or RES Media Consultant Romesh Vaitilingam on 0117-983-9770 or 07768-661095 (email: romesh@compuserve.com).