Income elasticity of demand for horse wagering — Large-scale evidence from online betting accounts

David Forrest, Tuomo Kainulainen, Jani Saastamoinen, Niko Suhonen

PII: S0165-1765(22)00047-7
DOI: https://doi.org/10.1016/j.econlet.2022.110356
Reference: ECOLET 110356

To appear in: *Economics Letters*

Received date : 9 September 2021
Revised date : 28 January 2022
Accepted date : 4 February 2022

Please cite this article as: D. Forrest, T. Kainulainen, J. Saastamoinen et al., Income elasticity of demand for horse wagering — Large-scale evidence from online betting accounts. *Economics Letters* (2022), doi: https://doi.org/10.1016/j.econlet.2022.110356.

INCOME ELASTICITY OF DEMAND FOR HORSE WAGERING – LARGE-SCALE EVIDENCE FROM ONLINE BETTING ACCOUNTS

David Forrest[a], Tuomo Kainulainen[b], Jani Saastamoinen[c,*], Niko Suhonen[d]

[a] University of Liverpool Management School, Chatham Street, Liverpool, L69 7ZH, United Kingdom, e-mail: david.forrest@liverpool.ac.uk

[b] University of Eastern Finland Business School, P.O. Box 111, FI-81101 Joensuu, Finland, e-mail: niko.suhonen@uef.fi

[b] University of Eastern Finland Business School, P.O. Box 111, FI-81101 Joensuu, Finland, e-mail: tuomo.kainulainen@uef.fi

[d] University of Eastern Finland Business School, P.O. Box 111, FI-81101 Joensuu, Finland, e-mail: jani.saastamoinen@uef.fi, *Corresponding author.

Abstract

The paper investigates income elasticity of demand for online horserace betting, using individual account data and administrative data from Finland. Overall income elasticity is positive but low. However, elasticity varies substantially across the income distribution from near-zero at the bottom to unity among higher income groups. Increased betting expenditure as income increases is associated with greater intensity rather than with greater frequency of betting.

Key words: betting; horseracing; income elasticity; spline regression

JEL codes: D12, L83

Funding

This research was funded by the Academy of Finland Grant Number #32307.

Acknowledgement

The authors greatly appreciate the financial support from the Academy of Finland (grant #331102). We thank Fintoto Ltd for providing the horse betting data, and Statistics Finland for the socioeconomic registry data (license #TK53-1048-16).

INCOME ELASTICITY OF DEMAND FOR HORSE WAGERING – LARGE-SCALE EVIDENCE FROM ONLINE BETTING ACCOUNTS

1. Introduction

Several papers have estimated the income elasticity of demand for either gambling as a category of consumer expenditure (e.g. Roukka and Salonen, 2020) or for specific gambling products, most often lotteries (e.g., Combs and Spry, 2019). Their results point to low positive income elasticity, implying weakly regressive implicit taxes. However, conclusions drawn may be inaccurate due to methodological issues relating to data sources and estimation methods.

These past papers model consumption of gambling products as a function of income (and controls), but dependence on unreliable data compromises conclusions. Typically, research is based on either a household expenditure (e.g., Rude, Surry and Kron, 2014) or a gambling prevalence (e.g., Roukka and Salonen, 2020) survey. However, self-reported data are problematic. Respondents may misunderstand the concept of expenditure, which could refer to total stakes or to the player's net loss. Further, underreporting gambling activity is common (Auer and Griffiths, 2017), resulting in systematic biases relevant to estimation. Consequently, several authors have instead exploited objective data on gambling expenditure in retail outlets by zipcode and related them to median zipcode income (e.g., Combs and Spry, 2019). However, such an aggregated approach risks committing the ecological fallacy, which could be avoided by using granular individual-level data (Garrett, 2016). Moreover, prior papers do not investigate whether income elasticities vary in different parts of the income distribution.

This study adds to broader literature in several ways. We estimate income elasticity for a gambling product, horserace betting, hitherto largely neglected in this literature. We employ measures based on objective records of individual expenditure through a monopoly operator's website together with linkage to administrative registry data which provide information on income and other socio-economic-demographic variables. Our standard model estimates positive but low income elasticity, similar to prior studies of overall gambling demand and lottery demand. However, more detailed modelling using spline regression shows radically different estimates towards the top and bottom ends of the income distribution.

We find that spending on horserace betting increases only modestly with income across the lowest quartile of the income range. In the middle of the income range, elasticity is greater; and in the top quartile estimates of elasticity reach unity. Additional analysis of a physical measure of consumption, number of betting days, investigates whether increases in spending channel through higher stakes or increased betting frequency. We find that increases in expenditure through the the income range are explained primarily by increasing stake-per-bet rather than increased frequency of betting.

2. Data and models

We use data from Finland where a state-sanctioned monopoly, Veikkaus Ltd, organizes horse wagering. Most betting relates to domestic races seldom available at international websites. Wagering follows the parimutuel system, with 15 betting products (each with its own pool), which include basic race-level bets (e.g., Win, Quinella) and exotic multiple-race bets (e.g., Duo, Pick 4). The operator's take-out rate varies between 15% and 35%, depending on the

betting format. Altogether, online stakes totalled €141m, of which 23% was retained by the operator.

Our data record each client's activity for one year from September 1, 2015. Racing took place daily except for Christmas (Eve and Day); so, accounting for leap year, there were 364 betting days. Information was available for all customers who placed at least one bet. We excluded 264 cases where betting expenditure exceeded reported disposable income.[1] Across the remaining 44,826 customers, the mean number of days on which a bet was placed was 56.9 and the mean amount wagered over the year €2,733.

Online betting accounts allowed linkage to administrative data (the FOLK data set), collected by Statistics Finland, which has near-universal coverage of adults. We use it as the source for our control variables, reported as of end-2015, except for income which is the mean annual disposable income in 2015 and 2016.

Following much of prior literature, we first present a two-part model (TPM). The first equation (probit) models the probability that a Finnish adult placed at least one online horse bet during the year (participation in online horse betting). The second (ordinary least squares) models the level of consumption conditional on participation. Then we use spline regression to investigate how income elasticity varies in different parts of the income distribution. Three alternative indicators measure consumption: total stakes, total expenditure (stakes minus winnings), and the number of betting days during the year. The expenditure metric carries the complication that some accounts (8.8%) proved profitable over the period. Since negative consumption is an uncomfortable concept, we exclude these winners from expenditure models, which reduces the sample to 40,868 bettors.

In all models, the focus variable is the individual's disposable income. Controls include individuals' age, level of mortgage and other debt, and dummy variables representing gender, native language, marital status, number of children, home ownership, occupational status, level of education, whether they lived in an urban or rural municipality and whether they paid the voluntary tax which funds the State Church.

3. Results

Table 1 reports summary statistics for the dependent variables (stakes, expenditure, days played) and the focus regressor (income) in the empirical models. All dependent variables are highly skewed (medians are considerably lower than means).

Table 1. Summary statistics.

	N	Mean	Sd	Median
Stakes (€)	44,826	2,732.55	15,913.76	207.22
Expenditure (€)	40,868	799.14	2,510.29	99.27
Betting days	44,826	56.87	83.90	15.00
Income (€)	44,826	27,546.59	33,211.90	24,814.50

[1] These individuals tended to be heavy bettors (mean amount wagered €18,473) and were disproportionately entrepreneurs or had 'unknown job status'. Estimations carried out with this group included were largely consistent with the reported results.

Table 2 first presents 'average marginal effects' from participation models for whether a Finnish adult placed an online horse bet during the year (the proportion doing so was .0119) and then results from the 'level' equations.

With or without controls, the marginal effect of income on the probability of participation was statistically but not economically significant. According to the model with controls, a 10% increase in income would, on average, raise the probability of participation by .0002. The corresponding effect in the unconditional model is +.0004. Even for a non-marginal change in income, the probability of participation would therefore be raised trivially and, similar to findings on lottery demand (Humphreys et al., 2010), changes on the extensive margin would make a negligible contribution to overall income elasticity.

Table 2. Regression results.

	Participation		ln(Stakes)		ln(Expenditure)		Betting days	
	AME	AME	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
ln(Income)	0.002***	0.004***	0.317***	0.502***	0.317***	0.516***	0.825	6.749***
	(0.000)	(0.000)	(0.023)	(0.020)	(0.023)	(0.019)	(0.785)	(0.686)
Controls	yes	no	yes	no	yes	no	yes	no
N	3,914,970	3,914,970	44,826	44,826	40,868	40,868	44,826	44,826
R^2 (pseudo)	(0.054)	(0.011)	0.101	0.014	0.110	0.019	0.105	0.002

Notes: AME = average marginal effect. Standard errors in parentheses, *** $p < 0.01$.

As in previous studies, our estimation imposes a common elasticity across the whole income range. Regarding the intensive margin, estimated elasticity is close to +0.3 in both the total stakes and expenditure models when controls are included and increases to +0.5 without controls. The number of betting days is unrelated to income in the conditional equation; in the unconditional equation, income has a statistically significant effect but the effect size (+0.7 days for a 10% increase in income) is small. Any impact of income on spending appears primarily the result of increased intensity rather than increased frequency of play.

Whether it is appropriate to use an estimate from a conditional or unconditional model depends on the purpose. Income elasticity from a model without controls appears more appropriate for estimating the degree to which gambling disproportionately extracts revenue from lower-income groups (Forrest and Gulley, 2009). Adding controls allows estimation of how expected consumption would vary in response to a change in income for an individual with given characteristics. At the population level, account should be taken of both the extensive and intensive margins. In our case, the contribution of effects of income on participation is close to zero. Among existing bettors, the relevant elasticity estimate is approximately +0.5 (whether one considers stakes or expenditure). However, if weighted by their proportion in the adult population (1-2%), overall income elasticity is then virtually zero. This probably applies to any niche gambling activity: the tax falls on those with a preference for that activity and is barely related to income at population level. Among Finnish horse bettors, the burden of high take-outs could be viewed as regressive implicit taxation falling disproportionately on low-income bettors. But the tax could be regarded as 'fair' according to the benefit principle of taxation because it funds the sports product on which bettors wager.

We also explored whether elasticity might vary with income by using a piecewise linear function in ln(income), allowing elasticity to be different in each of three income ranges (with

knots at the 25th (low) and 75th (high) percentiles of income). Results reported in Table 3 indicate a more nuanced relationship between consumption and income than a simple approach would demonstrate.

Table 3. Spline regression results.

	ln(Stakes)		ln(Expenditure)		Betting days	
ln(Income)	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
0-25th %-tile	0.075	0.296***	0.159***	0.366***	2.184	14.09***
	(0.039)	(0.0384)	(0.037)	(0.037)	(1.356)	(1.345)
25th-75th%-tile	0.462***	0.448***	0.445***	0.411***	-0.673	-6.533***
	(0.064)	(0.057)	(0.060)	(0.054)	(2.236)	(2.003)
75th-100%-tile	0.636***	1.001***	0.635***	0.974***	-0.125	12.20***
	(0.059)	(0.059)	(0.056)	(0.056)	(2.055)	(2.074)
Controls	yes	no	yes	no	yes	no
N	44,826	44,826	40,868	40,868	44,826	44,826
R^2	0.103	0.017	0.111	0.021	0.105	0.003

Notes: Standard errors in parentheses. *** $p < 0.01$.

In the models without controls, income elasticity in the bottom and middle parts of the income distribution is positive but low (0.3-0.4) but increases to unity in the top quartile of income. With controls, betting amounts are highly unresponsive to income in the bottom quartile but the elasticity estimate increases in the middle-income range and increases again for the top quartile. In all results, the effect of increased income on the number of betting days is modest (even negative), so increases in betting associated with higher incomes can be almost wholly attributed to more intense rather than more frequent betting.

4. Conclusion

We used data from online betting accounts to examine income elasticity of demand for horse wagering. Prior papers on both gambling in general and for lotteries, a structurally very different gambling product from betting, have reported that income elasticity is positive but low. Our standard modelling comes to a similar conclusion though we find that elasticity is a little higher where models exclude controls. However, our results became more nuanced when we applied spline regression, indicating higher income elasticity towards the top part of the income distribution. In additional analysis, we found that higher volumes of betting at higher incomes were associated with higher stakes placed rather than higher frequency of betting. Future studies of the income elasticity of demand for gambling products might estimate models without as well as with controls, examine whether elasticity varies across the income range, and distinguish between greater engagement with gambling and higher staking behaviour as income increases.

References

Auer, M., Griffiths, M.D. (2017). Self-reported losses versus actual losses in online gambling: An empirical study. *Journal of Gambling Studies*, 33(3), 795-806.

Combs, K.L., Spry, J.A. (2019). The effects of lotto game changes and large jackpots on income elasticity and sales, *Contemporary Economic Policy*, 37(2), 261-273.

Forrest, D., Gulley, O.D. (2009) Participation and level of play in the UK National Lottery and correlation with spending on other modes of gambling, *International Gambling Studies*, 9(2), 165-178.

Garrett, T.A. (2016) The (aggregate) demand for state-lottery tickets: what have we really learned? *Contemporary Economic Policy*, 43(3), 475-482.

Humphreys, B.R., Lee, Y-S, Soebbing, B.P. (2010). Consumer behaviour in lottery: the double hurdle approach and zeros in gambling survey data. *International Gambling Studies*, 10(2), 165-176.

Roukka, T., Salonen, A.H. (2020).The winners and the losers: Tax incidence of gambling in Finland. *Journal of Gambling Studies*. 36, 1183–1204.

Rude, J., Surry, Y., Kron, R. (2014). A generalized double-hurdle model of Swedish gambling expenditures. *Applied Economics*, 46(34), 4151-4163.

Highlights

- Income elasticity is estimated using online betting account data.
- Overall income elasticity for horserace betting is positive but low.
- Income elasticity varies substantially across the income distribution.
- Greater betting intensity rather than greater frequency explains income elasticity.