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August 2011

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The Economics of Lotteries: An Annotated Bibliography

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August 2011

Abstract

This paper presents an annotated bibliography of all papers relating to the economics of lotteries as of early to mid 2011. All published scholarly papers that could be identified by the authors are included along with the published abstract where available.

JEL Classification Codes: D81, H71, L83

Keywords: lotto, lottery, public finance, gambling

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Note to Readers

We assembled this bibliography as background research for a literature review paper on the economics of lotteries we wrote in 2011. That paper was eventually published as a book chapter, “The Economics of Lotteries: A Survey of the Literature,” in the *Oxford Handbook on the Economics of Gambling*, Leighton Vaughn-Williams and Donald Siegel, eds., (London: Oxford University Press, 2012), and we encourage you to check out the finished product.

This bibliography contains as many papers on the economics of lotteries as we could find as of early to mid 2011. While we cannot claim with 100% certainty that there are no omissions, we think the list is fairly exhaustive. The bibliography includes the published abstract, as provided by the authors, where available. At that time this bibliography was assembled, the current published literature regarding the economics of lotteries was extensive enough that it was impractical to cover every paper on the topic in the literature review, but we thought that the publication of our working bibliography may be of some use to other researchers, and given the marvels of modern technology, it could be done at almost no additional effort.

We hope you find this bibliography of use, and if you do, feel free to throw us a bone by citing a paper or two of ours in your own work.

Sincerely,

Victor Matheson, College of the Holy Cross

Kent Grote, Lake Forest College

Adams, P. E. (1994). "Business Failure and the Lottery Syndrome: A Note." Business Finance **3**(2).

Akay, O., M. D. Griffiths, et al. (2008). "An Examination of Two Competing Hypotheses for the Demand for Lottery Tickets." Journal of Gambling Business and Economics **2**(1): 77-102.

We extend previous research on higher sales for end-of-the-week lottery drawings to a longer time series and to different lotteries. We find higher sales for end-of-the-week lotteries drawings with Wednesday/Saturday drawings and Tuesday/Friday drawings. Additionally, higher Friday sales from daily lotteries along with results from bonus play opportunities and intraday lottery sales provide evidence suggesting that the leisure time hypothesis is an incomplete explanation for the observed phenomenon. We offer an alternate explanation related to the preferred habitat for liquidity and suggest that an individual's pool of discretionary funds is largest immediately following pay days. It is the fact that the most common pay pattern is weekly or biweekly with payment on Fridays which likely results in higher sales for end-of-the-week lottery drawings.

Alarie, Y. and G. Dionne (2006). "Lottery Qualities." Journal of Risk and Uncertainty **32**(3): 195-216.

The aim of this paper is to propose a model of decision-making for lotteries. Lottery qualities are the key concepts of the theory. Qualities allow the derivation of optimal decision-making processes and are taken explicitly into account for lottery evaluation. Our contribution explains the major violations of the expected utility theory for decisions on two-point lotteries and shows the necessity of giving explicit consideration to lottery qualities. Judged certainty equivalent and choice certainty equivalent concepts are discussed in detail along with the comparison of lotteries. Examples are provided by using different test results in the literature.

Albers, W., R. Pope, et al. (2002). "Experimental Evidence for Attractions to Chance." German Economic Review **1**(2): 113-130.

Divide the decisionmaker's future into: (i) a pre-outcome period (lasting from the decision until the outcome of that decision is known), and (ii) a sequel post-outcome period (beginning when the outcome becomes known). Anticipated emotions in both periods may influence the decision, in particular, with regard to an outcome that matters to the person, the enjoyable tension from not yet knowing what this outcome will be. In the experiments presented, lottery choice can be explained by this attraction to chance, and cannot be explained by either convex von Neumann-Morgenstern utility, or by rank dependent risk loving weights: attraction to chance is a separate motivator.

Alm, J. and R. Buckley (1998). "Are Government Revenues from Financial Repression Worth the Costs?" Public Finance Review **26**(3): 187-213.

no abstract

Alm, J., M. McKee, et al. (1993). "Fiscal Pressure, Tax Competition, and the Introduction of State Lotteries." National Tax Journal **46**(4): 463-476.

This paper uses discrete-time hazard function estimation methods to examine the factors

that affect the probability that a state will enact a lottery, where the probability is assumed to depend upon economic, fiscal, demographic, and political factors. Of special interest is the hypothesis that a state enacts a lottery in response to fiscal pressures. The results suggest that fiscal stress played an important role in the early introduction of state lotteries, but this influence has declined in recent years. Rather, political considerations and attempts to mimic the behavior of neighboring states now seem the dominant factors.

Andrews, T. and C. Benzing (2003). Incidence of the Pennsylvania Lottery: The Influence of Retail Outlet Location. Proceedings: Ninety-fifth Annual Conference on Taxation, Orlando, Florida, November 14-16, 2002, and minutes of the annual meeting of the National Tax Association, Thursday, November 14, 2002; 383-90. Washington, D.C., National Tax Association.

Aronson, J. R., A. R. Weintraub, et al. (1972). "Revenue Potential of State and Local Public Lotteries." Growth and Change 3(2): 3-8.

Ashley, T., Y. Liu, et al. (1999). "Estimating Net Lottery Revenues for States." Atlantic Economic Journal 27(2): 170-178.

Based on 1980-95 data, this paper estimates and forecasts net lottery revenues for states with and without lotteries. This study indicates that a multi-state estimation is improved when a time-series and cross-section technique is used. Forecasting results are also improved when unequal time series in the data and less-than-full first years of operating lottery are controlled. For states without lotteries, the time-series and cross-section estimation indicates that only two of 14 states without a lottery would have generated net lottery revenue of more than \$100 million. The number increases to five of 14 in the cross-section estimation.

Atkins, A. B. and E. A. Dyl (1995). "The Lotto Jackpot: The Lump Sum Versus the Annuity." Financial Practice and Education 5(2): 107-112.

Bailey, S. J. and S. Connolly (1997). "The National Lottery: A Preliminary Assessment of Net Additionality." Scottish Journal of Political Economy 44(1): 100-112.

This paper assesses how the structure for the distribution of U.K. national lottery funds affects the promise of net additionality for the designated 'good causes.' Indifference analysis demonstrates that the funding structure is optimal in these terms. However measurement of net additionality is highly problematic. While a preliminary comparison with Ireland shows that the U.K. system is in a better position to achieve net additionality through its accountability and transparency, net additionality could still be only a relatively small proportion of the dedicated lottery money, depending on the behavior of politicians, local authorities, other interest groups, and the distribution boards.

Baker, R. D. and I. G. McHale (2009). "Modelling the Probability Distribution of Prize Winnings in the UK National Lottery: Consequences of Conscious Selection." Journal of the Royal Statistical Society: Series A (Statistics in Society) 172(4): 813-834.

In the statistical and economics literature on lotteries, the problem of designing attractive games has been studied by using models in which sales are a function of the structure of prizes. Recently the prize structure has been proxied by using the moments of the prize distribution. Such modelling is a vital input into the process of designing appealing new lottery games that can generate large revenues for good causes. We show how conscious selection, the process by which lottery players choose numbers non-randomly, complicates the multivariate distribution of prize winners by introducing massive overdispersion of numbers of winners, and large correlations between the numbers of different types of prize winner. Although it is possible intuitively to reach a qualitative understanding of the data, an a priori model does not fit well. We therefore construct an empirical model of the joint distribution of prize winners and use it to calculate the moments of ticket value as a function of sales. The new model gives much higher estimates of ticket value moments, particularly skewness, than previously obtained. Our results will have consequences for policy decisions regarding game design. A spin-off result is that, on the basis of the results of model fitting, lottery players may increase the expected value of their ticket by strategically choosing numbers which are less popular with other lottery players.

Banks, J. S. and J. Duggan (2006). "Social Choice Lemma on Voting over Lotteries with Applications to a Class of Dynamic Games." Social Choice and Welfare **26**(2): 285-304.

We prove a lemma characterizing majority preferences over lotteries on a subset of Euclidean space. Assuming voters have quadratic von Neumann-Morgenstern utility representations, and assuming existence of a majority undominated (or "core") point, the core voter is decisive: one lottery is majority-preferred to another if and only if this is the preference of the core voter. Several applications of this result to dynamic voting games are discussed. This paper was completed after Jeff Banks's death. John Duggan is deeply indebted to him for his friendship and his collaboration on this and many other projects.

Beenstock, M., E. Goldin, et al. (2000). "What Jackpot? The Optimal Lottery Tax." European Journal of Political Economy **16**(4): 655-671.

The payout rate on lotto is normally fixed. We show that such a policy is generally suboptimal from the lotto authorities' point of view. The payout rate should be allowed to vary according to the number of rollovers that have occurred. To illustrate our argument, we simulate and optimize an econometric model of the lotto market in Israel. We also consider whether it is profitable to increase the frequency of lotto from once to twice a week.

Beenstock, M. and Y. Haitovsky (2001). "Lottomania and Other Anomalies in the Market for Lotto." Journal of Economic Psychology **22**(6): 721-744.

This research is concerned with the determination of the demand for "lotto" in Israel. While an important focus of our research is upon the effects on the demand for lotto of ticket pricing and jackpot announcements, we also investigate several empirical phenomena that are apparently inconsistent with expected utility theory. These include an effect we call "lottomania" which is induced by rollover, and "prize fatigue" when the jackpot does not increase. Another aberration from expected utility theory is that the

underlying odds of winning have no measurable effect on sales.

Bellhouse, D. R. (1982). "Fair is Fair: New Rules for Canadian Lotteries." Canadian Public Policy **8**(3): 311-320.

Berry, F. S. and W. D. Berry (1990). "State Lottery Adoptions as Policy Innovations: An Event History Analysis." American Political Science Review **84**(2): 395-416.

Two types of explanations of state government innovation have been proposed: internal determinants models (which posit that the factors causing a state government to innovate are political, economic, and social characteristics of a state) and regional diffusion models (which point toward the role of policy adoptions by neighboring states in prompting a state to adopt). We show that the two are conceptually compatible, relying on Mohr's theory of organizational innovation. Then we develop and test a unified explanation of state lottery adoptions reflecting both internal and regional influences. The empirical results provide a great degree of support for Mohr's theory. For the empirical analysis, we rely on event history analysis, a form of pooled cross-sectional time series analysis, which we believe may be useful in a wide variety of subfields of political science. Event history analysis may be able to explain important forms of political behavior (by individuals, organizations, or governments) even if they occur only rarely.

Berry, W. D. and B. Baybeck (2005). "Using Geographic Information Systems to Study Interstate Competition." American Political Science Review **99**(4): 505-519.

Scholars have proposed two distinct explanations for why policies diffuse across American states: (1) policymakers learn by observing the experiences of nearby states, and (2) states seek a competitive economic advantage over other states. The most common empirical approach for studying interstate influence is modeling an indicator of a state's policy choice as a function of its neighbors' policies, with each neighbor weighted equally. This can appropriately specify one form of learning model, but it does not adequately test for interstate competition: when a policy diffuses due to competition, states' responses to other states vary depending on the size and location of specific populations. We illustrate with two substantive applications how geographic information systems (GIS) can be used to test for interstate competition. We find that lottery adoptions diffuse due to competition--rather than to learning--but find no evidence of competition in state choices about welfare benefits. Our empirical approach can also be applied to competition among nations and local jurisdictions.

Blalock, G., D. R. Just, et al. (2007). "Hitting the Jackpot or Hitting the Skids: Entertainment, Poverty, and the Demand for State Lotteries." American Journal of Economics and Sociology **66**(3): 545-570.

State-sponsored lotteries are a lucrative source of revenue. Despite their low payout rates, lotteries are extremely popular, particularly among low-income citizens. State officials laud the benefits of lottery proceeds and promote the fun and excitement of participation. This entertainment value is one explanation for lottery demand by the poor: individuals with lower incomes substitute lottery play for other entertainment. Alternatively, low-income consumers may view lotteries as a convenient and otherwise rare opportunity for

radically improving their standard of living. Bad times may cause desperation, and the desperate may turn to lotteries in an effort to escape hardship. This study tests these competing explanations. We examine lottery sales data from 39 states over 10 years and find a strong and positive relationship between sales and poverty rates. In contrast, we find no relationship between movie ticket sales, another inexpensive form of entertainment, and poverty rates.

Bleaney, M. and S. J. Humphrey (2006). "An Experimental Test of Generalized Ambiguity Aversion Using Lottery Pricing Tasks." Theory and Decision **60**(2-3): 257-282.

Bohm, P. and H. Lind (1993). "Preference Reversal, Real-World Lotteries, and Lottery-Interested Subjects." Journal of Economic Behavior and Organization **22**(3): 327-348.

Preference reversal, or choice/reservation-price inconsistency, has been documented experimentally for certain types of lotteries. The authors argue that the relevance of these findings for real-world markets is uncertain because the type of objects used cannot exist on a market and because the extent to which the subjects had any real interest in the objects is unknown. Using real-world lotteries, they have tested choice/price consistency on subjects who prefer lotteries to cash. Preference reversal was observed, but the frequency was much lower than in earlier experiments. There were no differences between subjects who qualified as 'lottery interested' and those who did not.

Borg, M. O. and P. M. Mason (1988). "The Budgetary Incidence of a Lottery to Support Education." National Tax Journal **41**(1): 75-85.

The evidence in the scholarly literature regarding lottery incidence has universally supported the notion that the tax inherent in the lottery is regressive. The authors' results confirm this conclusion, but go a number of steps further. Results of a study of 518 Illinois state lottery winners indicate that the regressivity of the lottery tax remains when one investigates the lottery's budgetary incidence. Specifically, deducting the benefits of education (the budget recipient of lottery revenues) received by the average lottery playing household in Illinois from their lottery ticket expenditures reduces the regressivity but falls far short of eliminating it. In addition, the results imply that age, race, and place of residence affect the propensity to play the lottery, and that it is likely that the statutory recipient of the lottery revenues is unlikely to be the actual beneficiary.

Borg, M. O. and P. M. Mason (1990). "Earmarked Lottery Revenues: Positive Windfalls or Concealed Redistribution Mechanisms?" Journal of Education Finance **15**(Winter): 289-301.

Borg, M. O., P. M. Mason, et al. (1991). The Economic Consequences of State Lotteries. Westport, CT and London, Greenwood, Praeger.

Examines the impact of state-operated lotteries in the United States on the efficiency and equity of state government revenue and expenditure policy. Summarizes statistical information about the nation's lotteries. Examines equity issues associated with state-operated lotteries by considering the budgetary incidence of the lottery in Florida. Addresses efficiency issues associated with state lotteries, focusing on the six states that have lotteries supporting education. Analyzes the effect of lottery taxes on other sources

of state tax revenue. Explores whether the dollars spent on lottery tickets come at the expense of dispensable alternative expenditures or at the expense of necessities. Presents policy prescriptions regarding the future of lotteries and discusses items for further research.

Borg, M. O., P. M. Mason, et al. (1993). "The Cross Effects of Lottery Taxes on Alternative State Tax Revenue." Public Finance Quarterly **21**(2): 123-140.

Brenner, R. and G. A. Brenner (1990). Gambling and Speculation. Cambridge, Cambridge University Press.

Brinner, R. E. and C. T. Clotfelter (1975). "An Economic Appraisal of State Lotteries." National Tax Journal **28**(4): 395-404.

This paper examines lotteries in terms of broad considerations of economic efficiency and incidence. A state lottery simultaneously creates a consumption good and taxes that good. The creation activity produces an efficiency gain which is only partly erased by the tax. To measure the incidence of the tax revenue collected, the distribution of lottery purchases across income classes is examined. Five sets of data are presented, and each confirms the regressivity of lottery tax revenues.

Brown, R. P. and J. C. Rork (2005). "Copycat Gaming: A Spatial Analysis of State Lottery Structure." Regional Science and Urban Economics **35**(6): 795-807.

In models of tax competition, tax instruments are explicit; all parties are aware of the tax and respond to incentives provided therein. In the case of state lotteries, the tax is the amount of sales collected but not redistributed as prizes. Using data from 1967 to 2000, we show that although such a tax is implicit, states still engage in tax competition; if neighboring states raise their prize payout by 10% (thereby lowering their lottery tax), the home state will respond with up to a 5% increase in their prize payout.

Brunori, D. (2005). State Tax Policy: A Political Perspective. Washington, D.C., Urban Institute Press.

Examines the issues political leaders face when developing and implementing state tax policy. Discusses "classic tax policy," which sets forth certain principles that can lead to viable revenue systems for all levels of government, including states. Addresses the relationship of economic development and the formation of state tax policy. Explores the political interests that influence tax policymaking in the states. Reviews one of the mainstays of state revenue systems--the sales and use tax. Considers personal income tax and corporate income tax. Describes the other categories of taxes imposed by states. Examines the nontax revenue sources used by state governments, including intergovernmental aid, lottery revenue, and fees and licenses. Explores the policy issues presented by the globalization of markets and the advent of the age of electronic commerce. Includes five commonsense policy recommendations for states to consider as they address the issues facing their tax systems.

Calcagno, P. T., D. M. Walker, et al. (2010). "Determinants of the Probability and Timing of Commercial Casino Legalization in the United States." Public Choice **142**(1-2): 69-90.

The adoption of lotteries by state governments has received significant attention in the economics literature, but the issue of casino adoption has been neglected by researchers. Casino gambling is a relatively new industry in the United States, outside Nevada and New Jersey. As of 2007, 11 states had established commercial casinos; several more states are considering legalization. We analyze the factors that determine a state's decision to legalize commercial casinos, using data from 1985 to 2000, a period which covers the majority of states that have adopted commercial casinos. We use a tobit model to examine states' fiscal conditions, political alignments, intrastate and interstate competitive environments, and demographic characteristics, which yields information on the probability and timing of adoptions. The results suggest a public choice explanation that casino legalization is due to state fiscal stress, to efforts to keep gambling revenues (and the concomitant gambling taxes) within the state, and to attract tourism or "export taxes."

Campbell, N. and R. Z. Finney (2005). "Mitigating the Combined Distributional Consequences of the Georgia Lottery for Education and the HOPE Scholarship." Social Science Quarterly **86**(3): 746-758.

Research demonstrates that nonwhite, lower-income households bear the Georgia Lottery's tax burden, yet receive fewer benefits. However, local disparities in grading standards may mitigate the observed income redistribution. Our objective is to determine whether certain localities obtain more HOPE scholarships than expected, mitigating the observed redistribution. We use fixed-effects regression and a sample of Georgia's counties (1996-2002). Our results indicate that some localities obtain more HOPE scholarships than expected, mitigating the observed redistribution. We conclude the income-redistribution research result does not reveal a complete picture because it overlooks the HOPE scholarship's extraordinary allocation mechanism.

Campbell, N. D. (2003). "Do Lottery Funds Increase Educational Expenditure? Evidence from Georgia's Lottery for Education." Journal of Education Finance **28**(3): 383-401.

I examine whether Georgia K-12 educational spending increased following the Georgia Lottery for Education employing a novel approach and panel data set comprising four years of post-lottery observations on each of Georgia's 159 counties. Inconsistent with the literature, I find some evidence for a positive and statistically significant relationship between K-12 educational spending and lottery spending. Consistent with the literature, I find Georgia Lottery K-12 expenditures have no practical impact on K-12 spending. If political support depends on the lottery's K-12 spending it is misplaced.

Carpenter, R. E., E. L. Perlman, et al. (2010). "Who Pays for the Maryland Lottery?: Evidence from Point of Sale Data." Journal of Gambling Business and Economics **4**(1): 31-52.

Caudill, S. B., J. M. Ford, et al. (1995). "A Discrete-Time Hazard Model of Lottery Adoption." Applied Economics **27**(6): 555-561.

This paper uses conventional logit probabilities to estimate a discrete-time hazard model of lottery adoption. The data set consists of a time-series of cross-sections on states in the U.S. Our findings suggest that politicians are more likely to support lottery adoption if high income constituents support the decision. A lottery is more likely to be adopted if there is a favourable climate for gambling in the state and if a bordering state has adopted a lottery.

Caudill, S. B., D. M. Gropper, et al. (1995). "Predicting Net Revenues from State Lotteries." Journal of Business Forecasting **14**(1): 11-17.

Caudill, S. B., S. K. Johnson, et al. (1995). "Economies of Scale in State Lotteries: An Update and Statistical Test." Applied Economics Letters **2**(4): 115-117.

Until 1985, research in the economics literature on state lotteries was based on the simplifying assumption that administrative costs were constant. DeBoer (1985) provided empirical evidence supporting the idea that average administrative costs are not constant, but decline with output. In other words, DeBoer found evidence for the presence of economies of scale in the provision of state lotteries. The purpose of this study is to update and improve upon DeBoer's estimation of the lottery cost function. Unlike DeBoer, we statistically test for the presence of economies of scale in the administration of state lottery games. This study suggests that large scale lottery operations by larger states have lower per-unit costs than lotteries on smaller scales. Our study firmly establishes the presence of statistically significant economies of scale in the provision of state lotteries.

Chang, W.-C. (2004). "An Empirical Analysis of Gambling Addiction: Results from the Case of Taiwan." Topics in Economic Analysis and Policy **4**(1).

Chen, S.-H. and B.-T. Chie (2008). "Lottery Markets Design, Micro-structure, and Macro-behavior: An ACE Approach." Journal of Economic Behavior and Organization **76**(2): 463-480.

An agent-based computational modeling of the lottery market is established in this paper to study the design issue, in terms of the lottery tax rate, as well as the emerging market behavior. By using genetic algorithms and fuzzy logic, lottery participants are modeled as autonomous agents who may endogenously adapt to exhibit behavioral properties consistent with well-noticed behavior of lottery markets. Three major findings are presented. First, as anticipated, a Laffer curve is found in this model; nonetheless, the Laffer curve has a flat top, which indicates the non-uniqueness of the optimal lottery tax rate. Second, conscious selection behavior is also observed, but it becomes weaker as time goes on. Third, for the halo effect, we observe exactly the opposite. Each of these three findings are then compared with available empirical results, and the mechanism of genetic algorithms is further examined in light of the anti-halo effect.

Chen, S.-H., B.-T. Chie, et al. (2009). Income Distribution and Lottery Expenditures in Taiwan: An Analysis Based on Agent-Based Simulation. Natural Computing in Computational Finance. A. Brabazon and M. O'Neill. Berlin and Heidelberg, Springer. **185**: 207-223.

Chernoff, H. (1981). "How to Beat the Massachusetts Numbers Game." Mathematical Intelligencer 3(4): 166-172.

Chew, S. H. and G. Tan (2005). "The Market for Sweepstakes." Review of Economic Studies 72(4): 1009-1029.

This paper studies the market for monopolistically supplied sweepstakes. We derive equilibrium demands for fixed-prize and variable-prize sweepstakes and determine the profit-maximizing prize level and pay-out ratio respectively. It can be profitable to offer each type of sweepstake when there is a large enough number of weighted utility consumers who have constant absolute risk attitudes, are strictly averse to small as well as symmetric risks, and display longshot preference behaviour. Moreover, for the variable-prize sweepstake, the supplier will generally find it profitable to combine sweepstakes targeting two smaller populations, and offer a single sweepstake to the combined population. This implication is corroborated by the recent spate of mergers of smaller state lotteries into larger ones.

Ciecka, J., S. Epstein, et al. (1996). "State Lotteries and Externalities to their Participants." Atlantic Economic Journal: 349-360.

The degree of participation in state lotteries can either increase or decrease expected returns. It is theoretically possible for unfair bets to become more than fair as participation in lotteries changes. In addition, the purchase of every combination of numbers can be more than a fair bet and such a purchase may increase the expected return to other lottery players.

Clotfelter, C. T. (1979). "On the Regressivity of State-Operated 'Numbers' Games." National Tax Journal 32(4): 543-548.

Clotfelter, C. T. and P. J. Cook (1987). "Implicit Taxation in Lottery Finance." National Tax Journal 40(4): 533-546.

State lotteries as they are operated in the United States today involve four distinct aspects: legalization of lottery games, monopolistic provision by the state, marketing of lottery products, and extraction of a portion of the surplus they derive from sales for state revenue. In this paper the authors use conventional tools of applied public finance to examine the implicit tax levied by lottery agencies through this fourth function. They examine the incidence of the implicit lottery tax, focusing on the dominant lottery games used in the 1980s. The authors find that the implicit tax is regressive in virtually all cases. They then consider whether the implicit tax rate on lotteries is too high, comparing that rate to excise tax rates on alcohol and tobacco.

Clotfelter, C. T. and P. J. Cook (1989). Selling Hope. Cambridge, MA, Harvard University Press. Scrutinizes state lotteries as both consumer commodity and government activity. Provides a way of thinking about the roles of state lotteries and provides evidence for assessing the attributes of those roles. Presents a comprehensive, factual analysis of state lotteries and a framework for considering the public policy issues related to state lotteries. Examines the magnitude of the lottery phenomenon; the rise, fall, and resurgence in

public acceptance of lotteries in the United States; the major products sold by lotteries; why and how people play the lottery; the demand for lottery products; winners and losers; the politics of adopting a state lottery; the structure and operation of state lottery agencies; the promotion of lottery products; the lottery in its role as revenue raiser; and available policy choices for those states that have, or are considering adopting, a lottery.

Clotfelter, C. T. and P. J. Cook (1990). "On the Economics of State Lotteries." Journal of Economic Perspectives **4**(4): 105-119.

Clotfelter, C. T. and P. J. Cook (1990). "Redefining "Success" in the State Lottery Business." Journal of Policy Analysis and Management **9**(1): 99-104.

Clotfelter, C. T. and P. J. Cook (1991). "Lotteries in the Real World." Journal of Risk and Uncertainty **4**(3): 227-232.

Observed patterns of lottery play suggest that many players believe they can improve their chance of winning by adjusting their bets according to which numbers have won in recent drawings, or in response to their dreams or other portents. This skill orientation is encouraged by state lottery advertising, which tends to be misleading in other respects as well. Patterns of lottery play and the content of lottery commercials provide readily available illustrations of psychological tendencies in risky decision-making that have been documented in laboratory experiments.

Clotfelter, C. T. and P. J. Cook (1993). "The 'Gambler's Fallacy' in Lottery Play." Management Science **39**: 1521-1525.

Combs, K. L., J. Kim, et al. (2008). "The Relative Regressivity of Seven Lottery Games." Applied Economics **40**(1-3): 35-39.

We study the implicit tax incidence of raising state revenue through a monopoly state-run lottery using a new dataset on individual Minnesota lottery game sales by zip code. We use the bootstrap to compute SEs and construct confidence intervals for Suits Indices of seven lottery products. We conclude that the implicit tax on each product is regressive, and find statistically significant differences in regressivity between some products. Minnesota's newly introduced G3 instant scratch product, printed at time and place of purchase, is also the most regressive lottery game.

Cook, P. J. and C. T. Clotfelter (1993). "The Peculiar Scale Economies of Lotto." American Economic Review: 634-643.

Cooper, S. and E. Cohn (1994). "Equity and Efficiency of State Lotteries: Review Essay." Economics of Education Review **13**(4): 355-362.

Corazzini, L., M. Faravelli, et al. (2010). "A Prize to Give For: an Experiment on Public Good Funding Mechanisms." Economic Journal **120**(547): 944-967.

This article investigates fund-raising mechanisms based on a prize as a way to overcome free riding in the private provision of public goods. We focus on an environment

characterised by income heterogeneity and incomplete information about income levels. Our analysis compares experimentally the performance of a lottery, an all-pay auction and a benchmark voluntary contribution mechanism. We find that prize-based mechanisms perform better than voluntary contribution in terms of public good provision. Contrary to the theoretical predictions, contributions are significantly higher in the lottery than in the all-pay auction, both overall and by individual income types.

Coughlin, C. C. and T. A. Garrett (2009). "Income and Lottery Sales: Transfers Trump Income from Work and Wealth." Public Finance Review **37**(4): 447-469.

The effect of income on lottery expenditures has generally been studied using an aggregate measure of income, usually personal income. Reasons exist for thinking that lottery expenditures do not respond equally to all sources of income. This article examines lottery consumption and income from three sources, namely income from earnings, wealth, and transfer payments. Using county-level data for seven states and controlling for demographic and other characteristics, we find that each source of income has a different effect on lottery ticket expenditures. A noteworthy finding is that purchases are most strongly influenced by transfer payments. Several policy implications follow from our results.

Coughlin, C. C., T. A. Garrett, et al. (2003). Spatial Probit and the Geographic Patterns of State Lotteries. Federal Reserve Bank of St. Louis, Working Papers.

We implement a spatial probit model to differentiate states with a lottery from those without a lottery. Our analysis extends the basic spatial probit model by allowing spatial dependence to vary across geographic regions. We also separate the spatial effects of neighbors versus non-neighbors. The methodology provides consistent and efficient coefficient estimation in light of the simultaneity in spatial dependence. We find evidence of spatial dependence and spatial heterogeneity in lottery usage, and we find that spatial patterns differ significantly by geographic region. The importance of spatial dependence in state lottery usage suggests the need to consider spatial effects in empirical models examining the use of any policy tool by subnational governmental units.

Coughlin, C. C., T. A. Garrett, et al. (2006). "The Geography, Economics, and Politics of Lottery Adoption." Federal Reserve Bank of St. Louis Review **88**(3): 165-180.

Since New Hampshire introduced the first modern state-sponsored lottery in 1964, 41 other states plus the District of Columbia have adopted lotteries. Lottery ticket sales in the United States topped \$48 billion in 2004, with state governments reaping nearly \$14 billion in net lottery revenue. In this paper the authors attempt to answer the question of why some states have adopted lotteries and others have not. First, they establish a framework for analyzing the determination of public policies that highlights the roles of individual voters, interest groups, and politicians within a state as well as the influence of policies in neighboring states. The authors then introduce some general explanations for the adoption of a new tax that stress the role of economic development, fiscal health, election cycles, political parties, and geography. Next, because the lottery adoption decision is more than simply a tax decision, a number of factors specific to this decision are identified. State income, lottery adoption by neighboring states, the timing of

elections, and the role of organized interest groups, especially the opposition of certain religious organizations, are significant factors explaining lottery adoption.

Cox, J. C. and S. Epstein (1989). "Preference Reversals without the Independence Axiom." American Economic Review **79**(3): 408-426.

Creigh-Tyte, S. and L. Farrell (2003). Is the UK National Lottery Experiencing Lottery Fatigue? The Economics of Gambling. New York, NY, Routledge: 165-181.

In this chapter recent innovations to the UK National Lottery on-line lotto game are considered. We suggest that innovations are necessary to prevent players from becoming tired of the game and therefore to keep sales healthy. We also examine how the lottery operators have tried to stimulate the wider betting and gaming market and maintain interest in the on-line game, through the introduction of periphery games and products. In summary, we conclude that the UK lottery market has been stimulated and expanded in line with all the available evidence from lotteries elsewhere in the world.

Dale, D. J. (2003). Testing the Fungibility of Earmarked Lottery Revenue. Proceedings of the Pennsylvania Economic Association 2003 conference, May 29-May 31, 2003, West Chester University, West Chester, Pa. Edinboro, PA, Pennsylvania Economic Association: 22-31.

Dale, D. J. (2004). "Charitable Lottery Structure and Fund Raising: Theory and Evidence." Experimental Economics **7**(3): 217-234.

Do fixed-prize charitable lotteries generate more net revenue than do revenue-dependent lotteries? I present the results of an experiment designed to test a theoretical prediction of the relationship between the prize structure of a lottery funding a public good and individuals' participation in the lottery. I find that a fixed-prize lottery configuration induces significantly greater participation and a significantly higher level of public good funding than does a revenue-dependent lottery.

Daniels, R. L. and L. R. Keller (1990). "An Experimental Evaluation of the Descriptive Validity of Lottery-Dependent Utility Theory." Journal of Risk and Uncertainty **3**(2): 115-134.

This article compares the performance of the expected utility (EU) and lottery-dependent expected utility (LDEU) models in predicting the actual choices of experimental subjects among risky options. In the process, we present two approaches for calibrating the LDEU model for an individual decisionmaker. The results indicate that while LDEU exhibits a higher potential for correctly predicting choice, the version of the model calibrated by indifference judgments does not outperform EU. We suggest a functional form for the parametric functions that defines the LDEU model, and discuss ways in which this function can be incorporated into choice-based assessment approaches to improve predictions.

Davis, J. R., J. E. Filer, et al. (1992). "The Lottery as an Alternative Source of State Revenue." Atlantic Economic Journal **20**(2): 1-10.

In this study, the authors investigate two aspects of state lotteries. First, the propensity of states to adopt lotteries as a source of additional revenue rather than raising other existing

taxes is analyzed. Second, a model generated from this analysis is used to estimate net spendable revenue from a lottery in each of the 18 states without a state lottery. In addition, the model is used to determine the effects of parimutuel betting and tourism on actual and predicted revenues from state lotteries.

DeBoer, L. (1985). "Administrative Costs of State Lotteries." National Tax Journal **38**(4): 479-487.

A Cobb-Douglas cost function is estimated using pooled time-series cross-section data on state lottery sales and administrative costs. Strong evidence of economies of scale is found: administrative costs per lottery sales dollar decline as sales increase. Further tests reveal that economies of scale are not exhausted at the current sales level of any state. The results imply a low marginal cost of lottery production. At reasonable lottery demand elasticities, the monopoly pricing formula shows that lottery profits may be increased by reductions in take-out rates from current levels. In addition, the existence of economies of scale means that small states can reduce their administrative costs by combining their lottery operations.

DeBoer, L. (1986). "Lottery Taxes May Be Too High." Journal of Policy Analysis and Management **5**(3): 594-596.

DeBoer, L. (1986). "When Will State Lottery Sales Growth Slow?" Growth and Change **17**(1): 28-36.

DeBoer, L. (1990). "Lotto Sales Stagnation: Product Maturity or Small Jackpots?" Growth and Change: 73-77.

New York State lotto data are examined to determine whether the sales slowdown experienced by many state lotteries between 1985 and 1987 was due to a decline in interest by bettors or to a scarcity of large jackpots. Regression analysis shows that lotto sales accelerate as jackpots grow. Rising bettor participation causes fewer rollovers and smaller jackpots; this was the primary cause of the sales slowdown in New York. Increasing the odds against winning generates larger prizes and sales growth.

Dee, T. S. (2004). "Lotteries, Litigation, and Education Finance." Economic Journal **70**(3): 584-599.

In 1993, the state of Georgia instituted a lottery that earmarked new funds for instructional and capital expenditures in public schools. In that same year, Tennessee began court-ordered education finance reforms that were also designed to promote instructional and capital expenditures. Using district-level panel data, this study presents empirical evidence on how these disparate policies influenced the patterns of educational revenues by source and expenditures by function. The results suggest that both state policies increased the state aid to the poorest districts and promoted some spending on the targeted functions. However, the results also suggest that these reforms influenced spending in several other functional areas.

Depken, C. A. I. and P. R. Dorasil (2007). "The Luck of the Texan: An Empirical Analysis of Texas Lottery Games." Journal of Gambling Business and Economics 1(3): 171-184.

This paper provides an empirical analysis of the relationships between three popular lottery games in the state of Texas: Lotto Texas, Texas Two Step, and the multi-state Mega Millions game. The analysis suggests complementarity between the Lotto Texas and Mega Millions; habitual players tend to play relatively safer games; the 2006 Lotto Texas rule change decreased revenue substantially; and that only at low effective ticket prices do players purchase more tickets for high stakes/low odds games. We simulate the effective prices at which two games would sell the same number of tickets in the state of Texas. The results suggest that Mega Millions and Lotto Texas are expected to sell more tickets than Texas Two Step, and that Lotto Texas is expected to sell more tickets than Mega Millions at all feasible price levels.

Donaldson, S. (2007). "Contested Governance and Definitions of Need in the Distribution of Funding: Investigating the Regeneration-Funding Paradox and the Role of UK National Lottery Funding in Regeneration." Environment and Planning C: Government and Policy 25(2): 212-232.

The author explores the paradox of a burgeoning accepted definition of regeneration need together with a finite pot of money with which to fund it, and debates as to what consequently constitute the best funding-distribution structures and funding-allocation principles. This in turn provides the backdrop for an examination of aspects of the previously unresearched role of UK National Lottery funding in regeneration, as a potential variant in the contested-funding context. With the aid of results of an interview-based research project and a broader analysis of nationwide press reporting, it is concluded that Lottery funding plays both a qualitative and a quantitative role in regeneration. This is by enabling practical contestation of the status quo but also by supporting and complementing it, illustrating the validity of various dimensions of the debates. Such a capacity is explicable in terms of its unusual, part-independent, part-dependent (on government) governance configuration and positioning. However, Lottery funding is no panacea, for it exhibits as well as relieves certain tensions and trade-offs associated with the paradox. In terms of wider debates, the author demonstrates that governance and power are neglected in conventional discussions concerned with the formulaic assessment of funding need. It is also concluded that, in contrast to moves towards rationalisation and simplification, there is value in having a variety of funding streams (structures and distribution principles), albeit with consideration of how to make this work better.

Eadington, W. R. (1998). "Contributions of Casino-Style Gambling to Local Economies." Annals of the American Academy of Political and Social Science 556: 53-65.

This study examines the underlying economic and political dynamics that have led to the rapid proliferation of permitted gambling in the United States and other countries over the past decade. It notes that much of the justification for gambling has come from an attempt to exploit the economic rents and spillover benefits that accompany the legalization of gambling, and little is accorded the value that accrues to consumers of the commodity. A framework is developed to evaluate the impact of such considerations on

the community and the region where gambling is permitted. Different types of casino-style gambling--destination resort casinos, urban casinos, and widely dispersed gaming devices--are evaluated in light of their relative impacts.

Eamsopana, P. (2005). "Understanding after Lottery by Lottery Players: Evidence from Construction Workers in Phralchanong District, Bangkok Thailand."

The purpose of this dissertation and study is to provide an examination of the motivations and rationale behind habitual lottery play. The paper also looks at the variety of impacts the lottery has on its players. The study has discovered that most of the regular lottery players surveyed tend to use the lottery in an attempt to improve their economic status. Among these players, however, there is a widespread lack of understanding of the principal characteristics of the lottery including independent random change and poor odds. Once subjects gained an understanding of these salient lottery features, they often changed behavior and tended not to play the lottery again. In addition, the study discovered that subjects experience a variety of negative impacts related to their habitual lottery play. The regressive nature of the lottery as a form of government taxation is revealed as well. This is especially disconcerting since a large majority of the lottery players surveyed hold the misconception that this government revenue generation program is instead a government program designed to assist the poor. Other negative impacts such as youth gambling, debt, family disagreements, and the deterioration of the work ethic are prevalent. At the end of this research and analysis assortment of possible government policy recommendations is proposed that could help alleviate the negative impacts of the lottery.

Eckblad, G. F. and A. L. von der Lippe (1994). "Norwegian Lottery Winners: Cautious Realists." Journal of Gambling Studies 10(4): 305-322.

The study investigated 261 lottery winners of prizes of NKR 1 million (US \$150,000) or more in the years 1987–91 in a postal survey. The modal Norwegian winners were middle-aged married men of modest education, living in small communities. Emotional reactions to winning were few, aside from moderate happiness and relief. Winners emphasized caution, emotional control and unobtrusive spending, e.g. paying debts and sharing with children. There was only a slight increase in economic spending. A wish for anonymity was frequent, together with fear of envy from others. Betting was modest both before and after winning. Experiences with winning were predominantly positive. Life quality was stable or had improved. An age trend was observed, accounting for more variance than any other variable. The older winners seemed to represent a puritan subculture of caution, modesty and emotional restraint. A slightly more impatient pattern of spending was characteristic of younger winners. The results support Kaplan's 1987 and others' findings that lottery winners are not gamblers, but self-controlled realists and that tenacious, negative cultural expectations to the contrary are myths, but perhaps also deterrents of uncontrolled behavior.

Elliott, D. S. and J. C. Navin (2002). "Has Riverboat Gambling Reduced State Lottery Revenue?" Public Finance Review 30(3): 235-247.

Ellison, C. G. and K. Nybroten (1999). "Conservative Protestantism and Opposition to State-Sponsored Lotteries: Evidence from the 1997 Texas Poll." Social Science Quarterly **80**(2): 356-369.

Erekson, O. H. and K. M. DeShano (2002). "Fungibility of Lottery Revenues and Support of Public Education." Journal of Education Finance **28**(2): 301-311.

Erekson, O. H., G. Platt, et al. (1999). "Factors Influencing the Adoption of State Lotteries." Applied Economics **31**(7): 875-884.

This paper explores the factors influencing the adoption of state lotteries in the United States. The conceptual framework utilizes a common utility framework in which a representative legislator maximizes utility derived from the current and expected fiscal position of a state, subject to a political constraint. The empirical results support the theoretical hypotheses, including the finding that changes in the fiscal health of the state, the predicted profit potential of a lottery, and the political climate of the state all affect the likelihood that a lottery is adopted. By introducing a sound conceptual framework, using better data than used in previous studies, utilizing an appropriate estimation technique, and obtaining strong results, this study advances our knowledge of why states adopt lotteries.

Evans, W. N. and P. Zhang (2002). The Impact of Earmarked Lottery Revenue On State Educational Expenditures. NBER Summer Institute.

Over the past four decades there has been a rapid growth in both the number and size of state lotteries in the United States. In 1964, New Hampshire became the first state since the late 1800s to run a lottery. Since then, 37 other states and the District of Columbia have instituted lotteries. Gross sales of lottery tickets now exceed \$37 billion a year, adding about \$12 billion a year to state budgets. Many states deposit lottery profits into their general funds, but 16 states earmark lottery profits for primary and secondary education. Given the fungibility of money, economists have questioned the effectiveness of the earmarking policies. In this paper, we use a panel data set of the states with lotteries to examine the impact of earmarking lottery revenues on state educational spending. We have two primary results. First, we find that about 50 to 80 cents out of an earmarked dollar is spent on public education. These results are consistent with the large literature in public finance on the "flypaper effect." Second, states with lotteries spend a higher share of the marginal lottery dollar on education than income generated from other sources such as alcohol and cigarette taxes. For example, states spend on average about 16 percent of revenues on K-12 education, and our estimates indicate that each additional dollar raised from sin taxes increases K-12 spending by about the same fraction. In contrast, each dollar of lottery profit increases school spending by about 30 - 50 cents. Using a Bayesian estimation procedure for inequality restrictions in the normal linear least squares model, we find there is a high likelihood that a dollar of earmarked lottery profits generates less than a dollar of spending on K-12 education, but more than the spending generated from a dollar of lottery profits put into the general fund. Our results are fairly stable across different sample periods, control groups, and different estimators.

Evans, W. N. and P. Zhang (2007). "The Impact of Earmarked Lottery Revenue on K-12 Educational Expenditures." Education Finance and Policy **2**(1): 40-73.

Of thirty-eight states with lotteries, sixteen earmark lottery profits for primary and secondary education. In this article, we use a panel data set of states with lotteries to examine the impact of earmarking lottery revenues on state educational spending. We can reject the hypothesis that spending increases dollar for dollar with earmarked profits, but there is a high likelihood that earmarking increases school spending more than non-earmarking. We find that 50-70 cents out of an earmarked dollar finds its way to local school districts. In contrast, each dollar of lottery profits increases state revenues to schools by about 30 cents in states that deposit profits into the general fund. Of the lottery dollars that reach local school districts, we find that at least 80 percent of it is spent on schools.

Farrell, L., R. Hartley, et al. (2000). "The Demand for Lotto: The Role of Conscious Selection." Journal of Business and Economic Statistics **18**(2): 228-241.

This article presents estimates of the elasticity of demand for lottery tickets using time series data in which there is variation in the expected value of a lottery ticket induced by rollovers. An important feature of our data is that there are far more rollovers than expected given the lottery design. We find strong evidence that individuals do not choose their lottery numbers uniformly from a uniform distribution---that is, conscious selection. We use our estimates to derive the inverse supply function for the industry, and this enables us to identify the demand elasticity. We find the price elasticity to be close to unity, which implies that the operator is revenue maximizing---which is the regulator's objective.

Farrell, L., E. Morgenroth, et al. (1999). "A Time Series Analysis of UK Lottery Sales: Long and Short Run Price Elasticities." Oxford Bulletin of Economics and Statistics **61**(4): 513-526.

This paper estimates the long- and short-run elasticities for Lotto. It is particularly concerned with the dynamic response to price variations since, for some goods, this has sometimes been used to infer the presence of addiction. The price elasticity is identified through variation in the expected value of a Lotto ticket induced by rollovers whose high frequency results in surprisingly high variation in the expected value of holding a ticket. Unit root tests are applied to the series in order to identify their time series properties and to avoid a spurious regression problem. The series are found to be stationary. We apply instrumental variables to account for the endogeneity which arises due to correlation between the expected value and the dependent sales variable. The estimated long-run elasticity exceeds the short-run elasticity and this supports the hypothesis that there is an element of addictive behaviour in sales. The Lottery is regulated and the regulator's objective is to maximize sales. Our estimated long-run price elasticity of demand is inconsistent with revenue maximization and we find that greater revenue for the "good causes" could be raised from the game if a smaller proportion of sales revenue were allocated to them.

Farrell, L. and I. Walker (1997). It could be you! But what's it worth? The welfare gain from Lotto. Institute for Fiscal Studies Working Papers.

This research is concerned with the demand for lottery tickets and uses data for the UK National Lottery that records the behaviour, incomes and characteristics of almost 10,000 individuals. Some of the data relates to people surveyed during a "double rollover" - the jackpot had been enhanced by adding the jackpots from the previous two weeks which had not been won. This allows us to estimate how the demand for lottery tickets varies with the rate of return since this return is higher in rollover draws. It is noticeable that richer people appear to be more likely to play in rollover weeks and we need to control for income in order to obtain unbiased estimates of the price elasticity. We find that the demand for the UL National Lottery is quite sensitive to changes in the financial rate of return arising from rollovers: a typical rollover increases the rate of return by about 10% and generates an additional 16% in sales. The income effect is negative - a lottery ticket is an example of an "inferior" good where the rich buy less than the poor: an 10% increase in income generates a fall in demand of 1.2%. But, to offset this negative income effect we find that some characteristics associated with high income (e.g. being middle aged) are positively correlated with lottery demand. We use the estimates to compute the welfare gain from the introduction of the lottery. The idea behind this is that participation in the lottery is voluntary, so only those who feel that it is beneficial to buy tickets will buy them. The implication of this is that, although consumers are, on average, ex post financially worse off after buying lottery tickets (since they are an extremely poor investment with a return that is usually approximately -55% per week) they feel better off ex ante when they buy them because of the pleasure associated with doing so. We do not know what these pleasures are but can presume that they exist from the fact that people buy this commodity with such a poor financial return. Our estimates imply that the pleasure is worth an average of 71p per draw per adult: which works out as \$1.8 billion per annum - this is about what a 1p reduction in the income tax rate would be worth on average. Moreover, the gain is largest for those that spend the most - although the gain from successive tickets falls. Thus, the biggest spenders, which are the middle income group, gain most. However, this arises because the data confounds the lifecycle effect and the income effect: our estimates imply that those with the highest income over their lifetime will buy fewest tickets over their lifetime. Thus, the largest lifetime gains will be to those with lowest permanent incomes

Farrell, L. and I. Walker (1999). "The Welfare Effects of Lotto: Evidence from the UK." Journal of Public Economics **72**(1): 99-120.

This paper estimates the demand for lottery tickets using pooled cross-section data that contain individual incomes and extensive information about characteristics. One of the cross sections corresponded to a draw that was a 'double rollover'--the jackpot was enhanced by adding the two previous draws' jackpots that had not been won. Together, these datasets provide sufficient observations facing different 'prices' to allow the authors to estimate the 'price' elasticity as well as the income elasticity of demand. They estimate Tobit and other specifications and use the estimates to evaluate the welfare effects arising from the introduction of the lottery.

Feehan, P. and D. Forrest (2007). "Distribution of UK National Lottery Grants across Local Authority Areas." Applied Economic Letters **14**(4-6): 361-365.

Much of the high taxation on UK national lottery products is hypothecated to 'Good Causes' distribution funds which make grants for projects in fields such as sport, the arts and heritage. We examine the distribution of grants across 376 local authority areas in England and Wales. The proportion of highly educated people and social class composition are shown to be determinants of an area's grant receipts. The results indicate regressivity in the spending of lottery taxation.

Filer, J. E., D. L. Moak, et al. (1988). "Why Some States Adopt Lotteries and Others Don't." Public Finance Quarterly **16**(3): 259-283.

In 1963, New Hampshire reintroduced the state-sponsored lottery in the United States. By late 1986, more than half of the 50 states had lotteries in operation or had approved lotteries through referenda. Of the scholarly journal articles that have analyzed the economics of state lotteries, most have been concerned with the regressivity of the implicit lottery tax. In this article, we address the more important question of why any such regressive tax, especially one in the form of legalized gambling, would be adopted in lieu of higher sales, property, or income taxes. Using a model of rational legislator behavior developed from public choice theory, we generate and test empirical models that explain the pattern of lottery adoption across states and the timing of such adoptions. In general, a given state will have a higher probability of adopting a lottery as an alternative source of state revenue, and will tend to adopt a lottery earlier, the greater the overall tax burden on the voters of the state, the greater the expected return from a lottery in the form of spendable revenue, the greater the difficulty in raising tax rates on other bases, and the fewer the number of poor people in the state.

Fink, S. and J. Rork (2003). "The Importance of Self-Selection in Casino Cannibalization of State Lotteries." Economics Bulletin **8**(10): 1-8.

This note extends the work of Elliott and Navin (2002) on the substitutability of commercial casinos and state lotteries by controlling for a potential negative selection bias. We utilize a Heckman two-step selection correction in which our first stage probit involves whether or not a state has legalized commercial casinos. Results indicate that a \$1 increase in state casino tax revenue will reduce net lottery proceeds by \$0.56. This estimate is 33% smaller than what has been found in other studies, which is consistent with a negative selection bias.

Fink, S. C., A. C. Marco, et al. (2004). "Lotto Nothing? The Budgetary Impact of State Lotteries." Applied Economics **36**(21): 2357-2367.

Lottery revenues are often touted as an independent revenue source for states. Using 32 years of state financial data, the fallacy of such thinking is demonstrated. Being the first to control for the self-selection of being a lottery state, it is found that overall tax revenues decline with increased lottery sales. Moreover, it is discovered that this decline is driven by a decrease in revenues from general sales and excise taxes, which is only partially offset by increases in income tax receipts. Such findings are attributed to a combination of behavioural and political responses following the lottery's implementation.

Forrest, D. (2003). Time Series Modeling of the Demand for Lotteries. The Economics of Betting. L. Vaughan Williams. London, Routledge: 182-203.

Forrest, D. and D. Alagic (2007). "The History of a Lottery Game that was Seldom Won." Journal of Gambling Business and Economics **1**: 57-68.

Forrest, D., O. D. Gulley, et al. (2000). "Elasticity of Demand for UK National Lottery Tickets." National Tax Journal **53**(4): 853-863.

This paper examines sales patterns in the first three years of the UK National Lottery in order to estimate price elasticity of demand. Our long-run estimate is very close to the value of minus one required for revenue maximization. We find that the UK Government has succeeded in setting a framework for the National Lottery that maximizes turnover and therefore the amount of money available for both Exchequer revenue and "Good Causes."

Forrest, D., O. D. Gulley, et al. (2000). "Testing for Rational Expectations in the UK National Lottery." Applied Economics **32**(3): 315-326.

The concept of rational expectations has typically been assumed, without testing, in the analysis of consumer demand and market efficiency in betting markets, including betting on lottery games. Lottery games offer an excellent opportunity to test how participants process the information that is available to them. Using the UK National Lottery as our particular case, we find that participants, in general, efficiently process available information. Specifically, they act as if they can, on average, forecast the level of sales for a given drawing.

Forrest, D., O. D. Gulley, et al. (2004). "Substitution between Games in the UK National Lottery." Applied Economics **36**(7): 645-651.

Virtually all lottery agencies offer a variety of games to suit the tastes of players in an attempt to maximize revenue to the government. Using the UK National Lottery, which offers a variety of on-line and scratchcard games, the extent to which there is substitution or complementarity between games is evaluated. Employing weekly data from the three UKNL lottery games offered over the sample period, it is found that own-game characteristics have, by far, the largest influence on sales. Some evidence is found suggesting that the lotto and scratchcard games are partial substitutes for one another. Thunderball sales appear independent of the other two games. Some evidence is also found that the Wednesday and Saturday drawings of the lotto game are substitutes. The overall conclusion is that Camelot has successfully designed and marketed three games that each appeal to bettors in different ways. Thus, sales from one game do not seem to seriously cannibalize the sales of the other games, with the exceptions noted above. Further, the introduction of another, temporary game (Big Draw 2000) contributed to net sales. These results also suggest that the games do not appear to be complements to each other, indicating that the various arguments as to why the games may be so (transactions costs, brand awareness, and the portfolio effect) do not appear to be very strong.

Forrest, D., O. D. Gulley, et al. (2010). "The Relationship between Betting and Lottery Play." Economic Inquiry **48**(1): 26-38.

We apply a novel daily time series data set of daily turnover from one of Britain's leading bookmakers to analyze potential substitution between lottery play and bookmaker betting. We find some evidence that bettors do substitute away from horse race, soccer and numbers betting when the effective price of lottery tickets is unusually low, that is, when there is a rollover or other special draw. This substitution has a highly specific pattern of timing that varies by sector. Our results further suggest that bettors rationally engage in forward-looking substitution within their betting portfolios.

Forrest, D. and I. McHale (2007). "The Relationship Between a National and a Multistate Lotto Game." Journal of Gambling Business and Economics **1**(3): 207-216.

The United Kingdom National Lottery is a member of a lottery block that offers a weekly lotto game, known as EuroMillions, for which tickets are now sold across nine countries. The paper examines whether the game has cannibalised sales in the pre-existing national lotto game and whether, with both products in place, players treat them as substitutes or complements. No evidence is found of cannibalisation and UK Saturday Lotto and EuroMillions are found to be complements rather than substitutes.

Forrest, D., L. Perez, et al. (2010). "Evaluating the Effects of Game Design on Lotto Sales: A Case Study from Spain." Journal of Gambling Business and Economics **4**(2): 1-19.

In February, 2005 the Spanish National Lottery Agency (LAE) made several modifications to the design of one of its lotto games. The entry fee was not changed but the familiar 6/49 format was replaced by 5/54 + 1/10. This considerably lengthened the odds against winning a share of the grand prize. However, extra lower tiers of prizes were added and a guaranteed jackpot of €5m introduced. The change in rules provides an unusual opportunity to study the effect on sales of features of lotto games other than entry fee and pay-back rate. The changes in design appear in this case to have allowed the operator to achieve higher and more stable sales. Reasons for this are explored through estimation of demand models. Results indicate that gains to the operator had been achieved by better satisfying players' preference for skewness in the distribution of returns.

Forrest, D. and R. Simmons (2003). "Sport and Gambling." Oxford Review of Economic Policy **19**(4): 598-611.

Forrest, D., R. Simmons, et al. (2002). "Buying a Dream: Alternative Models of Demand for Lotto." Economic Inquiry **40**(3): 485-496.

Existing lotto demand models utilize effective price, computed as the face value of a ticket minus the expected value of prize money per ticket, as their primary explanatory variable. By contrast, this article proposes a key role for consumption benefit or "fun" in the demand for gambling in general and lotto demand in particular. It develops an alternative model of lotto demand that focuses on the maximum possible

prize. When this is tested against the traditional model using data from the U.K. National Lottery, we find that jackpot considerations exert an influence over and above that of variations in effective price.

Frees, E. W. and T. W. Miller (2004). "Sales Forecasting Using Longitudinal Data Models." International Journal of Forecasting **20**(1): 99-114.

This paper shows how to forecast using a class of linear mixed longitudinal, or panel, data models. Forecasts are derived as special cases of best linear unbiased predictors, also known as BLUPs, and hence are optimal predictors of future realizations of the response. We show that the BLUP forecast arises from three components: (1) a predictor based on the conditional mean of the response, (2) a component due to time-varying coefficients, and (3) a serial correlation correction term. The forecasting techniques are applicable in a wide variety of settings. This article discusses forecasting in the context of marketing and sales. In particular, we consider a data set of the Wisconsin State Lottery, in which 40 weeks of sales are available for each of 50 postal codes. Using sales data as well as economic and demographic characteristics of each postal code, we forecast sales for each postal code.

French, P. E., S. Moon, et al. (2004). "Utilizing Logistic Regression For Explaining Lottery Adoption In The Volunteer State." International Journal of Public Administration **27**(5): 353-367.

Objective: The purpose of this research is to explain the adoption of lottery policies among counties in Tennessee. Methodology: Various socio-demographic variables were measured through the use of logistic regression analysis for determining lottery adoption among all the counties in Tennessee. Results: The results of the logistic regression model suggest that the most significant variables contributing to the adoption of the state lottery in Tennessee are party affiliation of voters and the region of the state in which voters reside. Limitations: Since the findings of this manuscript are concerned only with the state of Tennessee, one should proceed with caution when trying to generalize these results to other states that have recently adopted a state lottery. Conclusion: The contributions of this research suggest that political and regional indicators are the best predictors in understanding lottery adoption among counties in Tennessee. These findings are consistent with results that have attempted to explain lottery and casino adoption across the American states. In addition, this study contributes to the current literature by suggesting that intercultural political difference may have contributed significantly to the adoption of a state lottery in Tennessee.

French, P. E. and R. E. Stanley (2002). "An Empirical Assessment of Lottery Proceeds on Education in the American States." Chicago Policy Review **6**(1): 45-59.

Freund, E. A. and I. L. Morris (2005). "The Lottery and Income Inequality in the States." Social Science Quarterly **86**(Supplement): 996-1012.

Since the early 1970s, income inequality in the United States has increased dramatically. We examine the impact of state lotteries on income inequality in the American states from 1976-1995. We use cross-sectional time-series data to evaluate the effect of lotteries

as well as those of other state tax policies, redistributive programs, and demographic factors on income inequality. We find that state lotteries foster income concentration. Ceteris paribus, states with lotteries have higher levels of income inequality than those states without a lottery. We also find that additional demographic and policy factors have an impact on income inequality in the states. One of the most important policy-oriented determinants of income inequality is the lottery and a significant portion of the increase in income inequality over our two-decade time period is attributable to the increasing prevalence and popularity of state lotteries.

Freund, E. A. and I. L. Morris (2006). "Gambling and Income Inequality in the States." Policy Studies Journal **34**(2): 265-276.

Since the early 1970s, income inequality in the United States has increased dramatically. We examine the impact of gambling on income inequality in the American states from 1976 to 1995. Using state-level data over time to evaluate the effects of various types of legalized gambling, from slot machine parlors to lotteries, we find clear evidence that lotteries foster inequality but no evidence of a similar effect for other types of gambling. These results suggest that the increasing prevalence of various forms of nonlottery gambling will have little effect on income inequality.

Friedman, M. and L. J. Savage (1948). "The Utility Analysis of Choices Involving Risk." Journal of Political Economy **56**: 279-304.

Fullenkamp, C., R. Tenorio, et al. (2003). "Assessing Individual Risk Attitudes Using Field Data from Lottery Games." Review of Economics and Statistics **85**(1): 218-226.

We use information from the television game show with the highest guaranteed average payoff in the United States, Hoosier Millionaire, to analyze risktaking in a high-stakes experiment. We characterize gambling decisions under alternative assumptions about contestant behavior and preferences, and derive testable restrictions on individual risk attitudes based on this characterization. We then use an extensive sample of gambling decision to estimate distributions of risk-aversion parameters consistent with the theoretical restrictions and revealed preferences. We find that although most contestants display risk-averse preferences, the extent of the risk aversion implied by our estimates varies substantially with the stakes involved in the different decisions.

Furaker, B. and A. Hedenus (2009). "Gambling Windfall Decisions: Lottery Winners and Employment Behaviour." UNLV Gaming Research and Review Journal **13**(2): 1-15.

Furlong, E. J. (1998). "A Logistic Regression Model Explaining Recent State Lottery Gaming Adoptions." Policy Studies Journal **26**(3): 371-383.

Gardner, J. and A. Oswald (2007). "Money and Mental Wellbeing: A Longitudinal Study of Medium-Sized Lottery Wins." Journal of Health Economics **26**(1): 49-60.

One of the famous questions in social science is whether money makes people happy. We offer new evidence by using longitudinal data on a random sample of Britons who

receive medium-sized lottery wins of between L1000 and L120,000 (that is, up to approximately US\$ 200,000). When compared to two control groups--one with no wins and the other with small wins--these individuals go on eventually to exhibit significantly better psychological health. Two years after a lottery win, the average measured improvement in mental wellbeing is 1.4 GHQ points.

Garrett, T. A. (1999). "A Test of Shirking under Legislative and Citizen Vote: The Case of State Lottery Adoption." Journal of Law and Economics **42**(1): 189-208.

Legislators vote on numerous issues, many of which are not offered for citizen vote. As a result, most previous studies of legislative shirking have used only data on legislators' votes and the characteristics of the legislators' constituencies. The case of state lottery adoption allows a direct test of how well legislators voted according to the preferences of their constituencies, since both voters and legislators voted on the issue. In addition, the legislative vote on lottery adoption occurred before the citizen vote, thus forcing legislators to accurately forecast constituency preferences. Examining West Virginia legislators, I first find the lottery preferences of each legislator's average and core constituencies. I then compare each legislator's actual vote on lottery adoption to his or her predicted vote. After considering all possible determinants of legislators' votes, I find an average of 28 percent of West Virginia legislators still failed to vote according to their constituencies' majority preferences.

Garrett, T. A. (2001). "An International Comparison and Analysis of Lotteries and the Distribution of Lottery Expenditures." International Review of Applied Economics **15**(2): 213-227.

Lotteries are found in nearly half of the world's countries, with annual worldwide lottery ticket sales topping \$115 billion. Despite the global presence of lottery games, there has been little research conducted on any international aspect of lotteries. This paper presents the first-ever examination and comparison of lottery games from around the world. Differences in both absolute and relative lottery expenditures are presented. Estimates for the income elasticity of demand for lottery tickets provide evidence on the distributional burden of lottery expenditures. These estimates consider each country by continental location and country income level. Further analysis reveals that lower income countries could adopt Lotto games in order to increase revenues. Recognizing that the distributional impact of lottery games is one of the greatest concerns surrounding lotteries, it is shown that the introduction of Lotto games does not significantly affect the distributional burden of lottery ticket expenditures. Given the international scope of lotteries and the availability of international lottery game data, the paper concludes by discussing future research on international lottery games.

Garrett, T. A. (2001). "The Leviathan Lottery? Testing the Revenue Maximization Objective of State Lotteries as Evidence for Leviathan." Public Choice **109**(1-2): 101-117.

Unlike other governmental units, state lottery agencies publicly acknowledge that their primary objective is revenue maximization. This claim and the inherent monopoly power of lottery agencies provides a unique arena to test for Leviathan. With data obtained from United States lottery games, I perform a Laffer curve analysis to derive the optimal

lottery tax rates for different categories of games. These optimal tax rates and Monte Carlo simulations are then used to test whether the current tax structure of lottery games is indeed the revenue maximizing structure. I find strong empirical evidence for the "Leviathan Lottery".

Garrett, T. A. and C. C. Coughlin (2009). "Inter-temporal Differences in the Income Elasticity of Demand for Lottery Tickets." National Tax Journal **62**(1): 77-99.

We estimate annual income elasticities of demand for lottery tickets using county-level panel data for three states and find that the income elasticity of demand (and, thus, the tax burden) for lottery tickets has changed over time. This is due to changes in a state's lottery game portfolio and the growth in consumer income more so than competition from alternative gambling opportunities. Trends in the income elasticity for instant and online lottery games appear to be different. Our results raise doubts about the long-term growth potential of lottery revenue and have policy implications for state governments and those concerned about regressivity.

Garrett, T. A. and T. L. Marsh (2002). "The Revenue Impacts of Cross-Border Lottery Shopping in the Presence of Spatial Autocorrelation." Regional Science and Urban Economics **32**(4): 501-519.

In this paper we perform the first-ever analysis of cross-border lottery shopping. We directly estimate the lottery revenue gains and losses between a state and its neighbors using models that account for spatial dependence between cross-sectional units. This methodology has been rarely used in studies exploring regional public finance issues and is shown to improve upon standard OLS estimation of cross-sectional data. We find that cross-border lottery shopping can lead to significant reductions in lottery revenue. Given that 37 states rely on lotteries to fund certain state programs, our results have significant policy implications for state officials and lottery operators.

Garrett, T. A. and R. S. Sobel (1999). "Gamblers Favor Skewness, Not Risk: Further Evidence from United States' Lottery Games." Economics Letters **63**(1): 85-90.

Theoretical models of risk have attempted to explain why risk-averse individuals take unfair gambles. Using all United States' lottery games, we find theoretical and empirical evidence that skewness of prize distributions explains why risk averse individuals may play the lottery.

Garrett, T. A. and R. S. Sobel (2004). "State Lottery Revenue: The Importance of Game Characteristics." Public Finance Review **32**(3): 313-330.

Previous studies find state lottery sales are significantly influenced by socioeconomic characteristics of the population. We extend this literature by examining how the overall expected value, the top prize, and the total combinations influence sales after controlling for these other socioeconomic factors. We perform our empirical analysis on an unparalleled set of data that includes information for 135 on-line lottery games in the United States. Our results show that sales are significantly influenced the top prize amount and odds of winning it, but that sales are not significantly affected by the

expected value of the remaining lower prizes.

Garrett, T. A. and G. A. Wagner (2004). "State Government Finances: World War II to the Current Crises." Federal Reserve Bank of St. Louis Review **86**(2): 9-25.

This article examines the current state budget crises from a historical perspective. The role of major expenditures and revenue sources in the context of the current slowdown and how reliance on various revenue sources has changed since World War II are addressed. Tax revenue variability over the business cycle and the use of nontraditional revenue sources, such as state lotteries and casino gaming, are also discussed. The article further comments on the role of fiscal institutions, such as tax and expenditure limitation laws, rainy day funds, and balanced budget rules, in state budgeting and finance.

Georgellis, Y., J. G. Sessions, et al. (2005). "Windfalls, Wealth, and the Transition to Self-Employment." Small Business Economics **25**(5): 407-428.

We examine the transition to, and survival in, self-employment among a sample of British workers. We find evidence of capital constraints, with wealthier individuals being more likely to transit *ceteris paribus*. Windfall gains raise the probability of transition at a decreasing rate--gains of more than £20000-22000 reduce the probability of transition--and larger gains reduce the probability of transition amongst relatively wealthier respondents. We also find peculiarities in the effects of particular types of windfall; redundancy payments and inheritances raise the probability of transition, whilst lottery wins reduce the probability of (especially male) transitions. In contrast, inheritances (lottery wins) hinder (augment) self-employment survival.

Geronikolaou, G. and G. Papachristou (2007). "On the Demand for Lotteries in Greece." International Journal of Business and Economics **6**(3): 255-259.

Demand for lotteries has been estimated in several countries, an important issue being whether operators set lottery payouts optimally. The question is tackled by means of a traditional demand equation in effective price and recently by a demand equation variant in jackpots, both specifications indicating that in many countries operators set their payout ratio more or less correctly and slightly on the generous side. The objective of this paper is to provide evidence on the lottery demand parameters in Greece and to assess the optimality of the current payout-allocating rules.

Ghent, L. S. and A. P. Grant (2007). "Are Voting and Buying Behavior Consistent? Evidence from the South Carolina Education Lottery." Public Finance Review **35**(6): 669-688.

This article uses voting and sales data from the South Carolina Education Lottery to test whether the vote for a new lottery is driven by latent demand for lottery products or whether it reflects free-riding behavior or other public finance considerations. Including the predicted component of the lottery vote adds no explanatory power to a lottery sales regression. Given the dissimilarity of coefficients between vote and sales regressions, we conclude that there are significant differences in individuals' voting and buying behaviors. We find that the lottery vote is significantly higher in counties with underperforming schools and in counties along the state's borders, where cross-border shopping is an issue. We conclude that much of the variation in the vote is driven by

these public finance issues. Finally, we discover that creation of the South Carolina lottery drew substantial revenues from North Carolina shoppers and stemmed an outflow of revenue to Georgia.

Ghent, L. S. and A. P. Grant (2010). "The Demand for Lottery Products and Their Distributional Consequences." National Tax Journal **63**(2): 253-268.

This study examines the distributional impact of three types of lottery games operated by the South Carolina Education Lottery (SCEL). We find significant sales variation by game type across both age and race. We also find each of the three types to be regressive, but with substantial differences in the degree of regressivity across games. By estimating the determinants of lottery sales using variables that capture the distribution of income rather than simply its level, our analysis provides a more complete description of the incidence of lottery sales. Our results suggest that lotteries may not be as regressive as suggested by the earlier literature.

Giacopassi, D., M. W. Nichols, et al. (2006). "Voting for a Lottery." Public Finance Review **34**(1): 80-100.

State lotteries have been adopted by thirty-eight states, primarily as a means of funding "good causes" or closing budgetary gaps. While several studies have identified the regressive nature of lotteries and factors responsible for their expansion, less is known about the underlying voting patterns that have driven this expansion. This article examines county-level voting patterns from the 2002 Tennessee lottery referendum and county-level lottery expenditures to determine whether voting reflects a latent demand for lottery or is a deliberate attempt to shift the tax burden. The results indicate that the percentage voting for lottery approval and lottery expenditure is not correlated with income and negatively correlated with education. Voting patterns are therefore similar to lottery participation, suggesting that voting reflects a latent demand for lottery. Lottery expenditure patterns for border counties exhibit familiar cross-border shopping patterns. Casino gambling is a substitute for instant but not online games.

Glickman, M. M. and G. D. Painter (2004). "Do Tax and Expenditure Limits Lead to State Lotteries? Evidence from the United States: 1970-1992." Public Finance Review **32**(1): 36-64.

The past three decades have seen the widespread introduction of both state-level and local-level tax and expenditure limits (TEs). Over the same time period, 37 states have legalized state lotteries to raise revenues. The authors assert that the combination of TEs and lotteries may be an optimal strategy for a median voter attempting to lower his or her tax burden while lowering the cost of monitoring the behavior of government officials. They find consistent evidence that the existence of a limit on the increase of property assessments is a positive predictor of the adoption of a lottery, and they also find some evidence that state limits and limits on property tax revenues also influence states to pass lotteries. Other local TEs have a little estimated impact on the lottery decision.

Gribbin, D. W. and J. J. Bean (2006). "Adoption of State Lotteries in the United States, with a Closer Look at Illinois." Independent Review **10**(3): 351-364.

The rebirth of state lotteries in the 1960s was promoted with claims that lotteries would

balance budgets, improve public education, and reduce gambling. The universal result of state lotteries, however, has been not to end the allegedly precipitating "crises" but to create new government programs and increase the rate of spending, as the case of the Illinois state lottery illustrates.

Gripaios, P., P. Bishop, et al. (2010). "A Lottery within a Lottery? An Examination of the Distribution of Lottery Funds in England." Applied Economics **42**(1-3): 63-71.

The UK National Lottery has been in operation since 1994. An examination of the regional distribution of awards per head of population suggests marked spatial disparities with London doing particularly well and Scotland, Northern Ireland, Wales, and the North East faring much better than other regions. Such disparities also exist at English Local Authority level with London and some major provincial centres doing much better than more rural authorities. Such inequalities may give grounds for concern, given that they appear to replicate those for other types of Government spending. The results of an empirical model designed to explain the spatial distribution of awards suggest that, in addition to a London effect, levels of deprivation have a positive impact. Another important explanatory variable which has a positive impact on lottery funding is the qualifications of residents which might plausibly reflect the quality of lottery bids received from an area. However, once these factors are taken account of, there is little evidence that rural areas fare badly.

Grote, K. R. and V. A. Matheson (2006). "Dueling Jackpots: Are Competing Lotto Games Complements or Substitutes?" Atlantic Economic Journal **34**(1): 85-100.

This paper considers the relationship that exists between two lottery products offered simultaneously in the same state, a smaller lottery game run by the individual state and a larger multi-state game run in coordination with other states. The primary issue is whether the two different products should be considered substitutes or complements for one another. The question is considered from two different perspectives that lead to a conclusion that while the two products do tend to be complements to one another, overall the individually run state lottery games experience a reduction in sales from the presence of the multi-state game.

Grote, K. R. and V. A. Matheson (2006). "In Search of a Fair Bet in the Lottery." Eastern Economic Journal **32**(4): 673-684.

Grote, K. R. and V. A. Matheson (2007). "Examining the 'Halo Effect' in Lotto Games." Applied Economic Letters **14**(4-6): 307-310.

The 'Halo Effect' occurs when lotto ticket sales are unexpectedly high following a large jackpot. An examination of the Powerball lottery finds evidence that the halo effect exists and that it is the result of bettors exchanging prize winnings for new tickets.

Gulley, O. D. and F. A. Scott, Jr. (1989). "Lottery Effects on Pari-mutual Tax Revenues." National Tax Journal **42**(1): 89-93.

Gulley, O. D. and F. A. Scott, Jr. (1993). "The Demand for Wagering on State-Operated Lotto

Games." National Tax Journal **46**(1): 13-22.

A number of studies have attempted to estimate demand functions for state-operated lottery games, usually with quarterly or annual data. A few include the price of a lottery bet as an independent variable, with generally unsatisfactory results. This is because the price of a lottery bet will be roughly constant over quarterly or annual time intervals. Focusing on one type of lottery game (lottos), the authors show that if the demand for betting on lottos is estimated on a drawing-by-drawing basis, a price variable can be included on the right-hand side. Doing so allows them to estimate a true demand function and to compute price elasticities. As a result, the authors can evaluate the extent to which state lottery agencies have structured their lotto games so as to maximize tax revenues.

Guryan, J. and M. S. Kearney (2006). "Lucky Stores, Gambling and Addiction: Empirical Evidence from State Lottery Sales." Atlantic Economic Journal: 85-100.

There is a large body of literature in both psychology and economics documenting mistaken perceptions of randomness. In this paper we demonstrate that people appear to believe that "lightning will strike twice" when it comes to lottery jackpots. First, we show that in the week following the sale of a winning ticket, retailers that sell a winning jackpot ticket experience relative increases in game-specific ticket sales of between 12 and 38 percent, with the sales response increasing in the size of the jackpot. In addition, the increase in sales experienced by the winning vendor increases with the proportion of the local population comprised of high school dropouts, elderly adults, and households receiving public assistance. We further show that this increase in retail-game sales initially reflects an increase in total sales at the retail and zip code level. Second, we show that the increase in sales is persistent at the winning retailer. However, the data do not provide clear evidence that the increase in sales at the zip code level is persistent. It thus appears that in the long run, consumers are persistent in their habit of buying lottery tickets at the "lucky" store; however, as the shock to total gambling dissipates, there is no evidence that lottery gambling itself is habit forming or addictive.

Guryan, J. and M. S. Kearney (2008). "Gambling at Lucky Stores: Empirical Evidence from State Lottery Sales." American Economic Review **98**(1): 458-473.

We show that the week after selling a large-prize Texas Lotto winning ticket, a retailer experiences a 12 to 38 percent relative increase in ticket sales. Some increase persists for up to 40 weeks. We document that the sales response increases with jackpot size and is larger in areas with more economically disadvantaged populations. Sales patterns across games and across retailers are not consistent with most advertising explanations. Furthermore, response patterns are not consistent with representativeness-based explanations for the hot hand or gambler's fallacy; we suggest an alternative explanation for the observed "lucky store" effect.

Guryan, J. and M. S. Kearney (2010). "Is Lottery Gambling Addictive?" American Economic Journal: Economy Policy **2**(3): 90-110.

We present an empirical test for the addictiveness of lottery gambling that exploits an exogenous shock to local market consumption of lottery gambling. It uses the sale of a winning jackpot ticket in a zip code as an instrument for present consumption and tests

for a causal relationship between present and future consumption. This test estimates the time path of persistence nonparametrically. Data from the Texas State Lottery suggests that after 6 months, roughly half of the initial increase in lottery consumption is maintained. After 18 months, roughly 40 percent of the initial shock persists, though estimates become less precise.

Haas, M., D. Heidt, et al. (2000). Estimating Michigan Lottery Revenues When New Casinos Open. Proceedings: Ninety-second Annual Conference on Taxation, Atlanta, Georgia, October 24-26, 1999, and minutes of the annual meeting of the National Tax Association, Sunday, October 24, 1999. Washington, D.C., National Tax Association: 191-197.

Haisley, E., R. Mostafa, et al. (2008). "Myopic Risk-Seeking: The Impact of Narrow Decision Bracketing on Lottery Play." Journal of Risk and Uncertainty 37(1): 57-75.

In two experiments conducted with low-income participants, we find that individuals are more likely to buy state lottery tickets when they make several purchase decisions one-at-a-time, i.e. myopically, than when they make one decision about how many tickets to purchase. These results extend earlier findings showing that "broad bracketing" of decisions encourages behavior consistent with expected value maximization.

Additionally, the results suggest that the combination of myopic decision making and the "peanuts effect"--greater risk seeking for low stakes than high stakes gambles--can help explain the popularity of state lotteries.

Hansen, A. (1995). "The Tax Incidence of the Colorado State Lottery Instant Game." Public Finance Quarterly 23(3): 385-398.

Hansen, A., A. D. Miyazaki, et al. (2000). "The Tax Incidence of Lotteries: Evidence from Five States." Journal of Consumer Affairs 34(2): 182-203.

The nature of revenue generation for state-sponsored lotteries has been an issue of public debate for quite some time. Although most studies have found lotteries to have a regressive tax incidence, several have concluded otherwise. Unfortunately, the vast majority of academic studies address this concern by examining the tax incidence of only one state's lottery and/or by using only one time period's data. In addition, many assessments of the tax impact of lotteries fail to consider other demographic variables that may influence purchase patterns and, thus, be of interest to policymakers. To remedy this, the current paper assesses the incidence of the lottery excise tax for five states using county level data spanning multiple years. Also assessed are changes in incidence across demographic groups as the lotteries matured. Lottery tax incidence is assessed with multiple regression estimates of the income elasticity of demand for lottery products. The predominant finding is that the lottery tax for these states had a regressive incidence. Otherwise, few consistencies in either change in lottery tax incidence or purchase patterns across demographic variables were found.

Harris, W. T. (1992). "A Public Choice Analysis of the Evolution of Tort Law: Liabilities, Lotteries, and Redistribution." American Journal of Economics and Sociology 51(1): 101-108.

Economic analysis has generally concluded that most loss shifting under current

standards of personal injury liability is allocatively non-Pareto optimal. The economic and legal arguments that support this conclusion are reviewed and an explanation is offered of why our legal system has evolved over time into an inefficient institution. It is argued that state sponsored lotteries and current personal injury liability laws have enough in common to be similarly viewed as a system of income redistribution demanded by the citizenry and supplied by the public sector.

Hartley, R. and L. Farrell (2002). "Can Expected Utility Theory Explain Gambling?" American Economic Review **92**(3): 613-624.

We investigate the ability of expected utility theory to account for simultaneous gambling and insurance. Contrary to a previous claim that borrowing and lending in perfect capital markets removes the demand for gambles, we show expected utility theory with nonconcave utility functions can explain gambling. When the rates of interest and time preference are equal, agents seek to gamble unless income falls in a finite set of values. When they differ, there is a range of incomes where gambles are desired. Different borrowing and lending rates can account for persistent gambling provided the rates span the rate of time preference.

Hartley, R. and G. Lanot (2003). "On the Design of Lottery Games." Journal of Operational Research Society **54**: 89-100.

Hauser-Rethaller, U. and U. Konig (2002). "Parimutuel Lotteries: Gamblers' Behavior and the Demand for Tickets." German Economic Review **3**(2): 223-245.

In a parimutuel lottery, players face a strategic situation. We investigate how rational lottery players should choose combinations of numbers. Using data from the Austrian Lotto we compare this to actual behavior. We propose a relationship between the number of tickets and the expected loss of taking part, based on both theoretical and empirical findings about players' behavior. Rollovers introduce exogenous price variation allowing to estimate properties of a demand function sensitive to the expected loss. Contrary to previous work our model accounts for conscious selection.

Heavey, J. F. (1978). "The Incidence of State Lottery Taxes." Public Finance Quarterly **6**(4): 415-426.

Heberling, M. (2002). "State Lotteries: Advocating a Social Ill for the Social Good." Independent Review **6**(4): 597-606.

State lotteries were sold to voters as a means of raising revenues without raising taxes. After lottery fever cooled, however, most states found themselves spending heavily on advertising to lure new players and raising taxes.

Hersch, P. L. and G. S. McDougall (1988). "Voting for 'Sin' in Kansas." Public Choice **57**: 127-139.

Hersch, P. L. and G. S. McDougall (1989). "Do People Put Their Money Where Their Votes Are? The Case of Lottery Tickets." Southern Economic Journal **56**(1): 32-38.

Vote and sales data pertaining to a state-operated lottery are used to examine the consistency between voting behavior and market decisions. Regression results indicate that religious convictions influence voting, but not sales; low and high income groups support establishment of a lottery, but purchase relatively fewer tickets than middle income groups; and votes capture aspects of tastes not reflected in commonly-used socioeconomic demand control variables. An additional analysis of the relationship between voter turnout and the residuals from sales equations supports the hypothesis that nonvoters acted as rational free-riders in the establishment of the lottery.

Hersch, P. L. and G. S. McDougall (1997). "Decision Making under Uncertainty When the Stakes Are High: Evidence from a Lottery Game Show." Southern Economic Journal **64**(1): 75-84.

Illinois Instant Riches, a television game show based on the Illinois State Lottery, provides a natural setting for analyzing decision-making under uncertainty when the stakes are high. Instant Riches is comprised of games of chances where contestants can accept wagers with potential winnings reaching \$100,000 and losses, \$35,000. The decision to accept a wager is regressed on a wager's expected value and a proxy for household income. Additionally, assuming contestants maximize expected utility, alternative utility functions are used to estimate the Pratt-Arrow coefficient of risk aversion. Overall, the weight of evidence suggests contestants are relatively risk neutral.

Huck, S. and G. Weizsacker (1999). "Risk, Complexity, and Deviations from Expected-Value Maximization: Results of a Lottery Choice Experiment." Journal of Economic Psychology **20**(6): 699-715.

Varying several parameters of single-stage lottery choice tasks we investigate the question which features of a decision task lead subjects to deviate from maximizing expected monetary value (EV). Despite small differences in EV between the two lotteries in the choice sets, the subjects on average chose the lottery with the higher EV in every task. Risk avoidance occurs, but not consistently over all tasks. Further results are that subjects prefer less complex lotteries over more complex ones, and that risk matters the more the less complex the decision task is.

Huck, S. and G. Weizsacker (2002). "Do Players Correctly Estimate What Others Do? Evidence of Conservatism in Beliefs." Journal of Economic Behavior and Organization **47**(1): 71-85.

Imbens, G. W., D. B. Rubin, et al. (2001). "Estimating the Effect of Unearned Income on Labor Supply, Earnings, Savings, and Consumption: Evidence from a Survey of Lottery Players." American Economic Review **91**(4): 778-794.

This paper provides empirical evidence about the effect of unearned income on earnings, consumption, and savings. Using an original survey of people playing the lottery in Massachusetts in the mid-1980s, we analyze the effects of the magnitude of lottery prizes on economic behavior. The critical assumption is that among lottery winners the magnitude of the prize is randomly assigned. We find that unearned income reduces labor earnings, with a marginal propensity to consume leisure of approximately 11 percent, with larger effects for individuals between 55 and 65 years old. After receiving about half

their prize, individuals saved about 16 percent.

Jackson, J. D., D. S. Saurman, et al. (1994). "Instant Winners: Legal Change in Transition and the Diffusion of State Lotteries." Public Choice **80**(3-4): 245-263.

This paper investigates the determinants of legal change in a public choice framework. An empirical model explaining the timing and probability of decisions to adopt state-operated lotteries is developed. Employing a Tobit estimator and explicitly considering the effects of state-specific constitutional and political structures, spending and tax policies, and federal revenue importation, evidence is presented showing that legal change is much like economic change: lotteries are more likely to be adopted and to be adopted earlier where the costs are lowest relative to expected benefit. State legislatures appear to be the main beneficiaries of this public choice process.

Jackson, R. (1994). "Demand for Lottery Products in Massachusetts." Journal of Consumer Affairs **28**(2): 313-325.

The characteristics of demand are examined for the state lottery in Massachusetts, which leads the nation in per capita sales. Cross-sectional OLS regressions of sales per capita are calculated for 1983 and 1990 for each lottery product using explanatory variables representing education, income, race, ethnicity, and age. The results suggest that the lottery no longer exhibits the degree of tax progressivity it had in earlier years and is currently a regressive source of government revenue. While sales of all lottery products consistently decrease with increasing education levels, this inverse relationship has moderated over time. Ethnicity and race are also becoming less of a factor though race is perhaps still important for lottery products combining relatively small payoffs with a high probability of sinning. From 1983 to 1990, the 65 and over age group became a significant factor in raising per capita sales of the Massachusetts lottery, thus raising issues of generational and distributional equity.

Kades, E. (1999). "Windfalls." Yale Law Journal **108**(7): 1489-1568.

There is a widespread belief that the law should, and does, protect windfalls (unexpected gains) every bit as much as it protects property earned by effort and enterprise. This Article takes issue with both claims. Windfalls present an efficient source of government revenue: Since recipients do not expect windfalls, taxing them does not distort taxpayer behavior. Moreover, risk-averse citizens will prefer sharing windfalls to the lottery-like alternative of leaving them in the hands of the lucky few. While private common-law litigation cannot capture and redistribute windfalls, public legislation can. And governments have adopted policies to capture windfalls, from reserving undiscovered mineral rights, to the Crude Oil Windfall Profits Tax of 1980, to the just compensation standard of eminent domain law. Opportunities to capture and redistribute windfalls should grow in tandem with modern governments' expanding ability to collect and process information.

Karcher, A. J. (1989). Lotteries. New Brunswick, NJ, Transaction.

Provides a brief overview of the history of lotteries and a comparison of present lottery systems. Discusses lotteries as a response to new federalism and explores how large of a

role state lottery revenues play in their respective budgets. Examines lotteries as state tax policy and the place of state lottery operation within the framework of traditional government structures. Explores the marketing of lotteries now and in the future. Discusses the present advertising practices of lotteries. Presents a variety of reforms that focus on taxes, the budgetary process, marketing, and advertising.

Kearney, M. S. (2005). "The Economic Winners and Losers of Legalized Gambling." National Tax Journal **58**(2): 281-302.

This paper reviews the government role in the legalized gambling sector and addresses some of the major issues relevant to any normative analysis of what the government role should be. In particular, the paper reviews evidence identifying the economic "winners" and "losers" associated with the three largest sectors of the industry: commercial casinos, state lotteries, and Native American casinos. The paper also includes a discussion of the growing internet gambling industry. In addition to reviewing existing literature and evidence, the paper raises relevant questions and policy issues that have not yet been adequately addressed in the economics literature.

Kearney, M. S. (2005). "State Lotteries and Consumer Behavior." Journal of Public Economics **89**(11-12): 2269-2299.

This paper investigates two central issues regarding state lotteries. First, analyses of multiple sources of micro-level data demonstrate that household lottery spending is financed primarily by a reduction in non-gambling expenditures, not by a reduction in expenditures on other forms of gambling. The introduction of a state lottery is associated with an average decline of E per month, or 2.4 percent, in household non-gambling expenditures. Low-income households reduce non-gambling household expenditures by 2.5 percent on average, 3.1 percent when the state lottery includes instant games. These households experience statistically significant declines in expenditures on food and on rent, mortgage, and other bills. Second, consumer demand for lottery products responds positively to the expected value of the gamble, controlling for other statistical moments and product characteristics, including the nominal top prize amount. This finding is consistent with informed choice among consumers of lottery products, although other forms of irrational or misinformed choice cannot be ruled out.

Kehoe, T. J., D. K. Levine, et al. (2002). "Lotteries, Sunspots, and Incentive Constraints." Journal of Economic Theory **107**(1): 39-69.

We study a prototypical class of exchange economies with private information and indivisibilities. We establish an equivalence between lottery equilibria and sunspot equilibria and show that the welfare and existence theorems hold. To establish these results, we introduce the concept of the stand-in consumer economy, which is a standard, convex, finite consumer, finite good, pure exchange economy. With decreasing absolute risk aversion and no indivisibilities, we prove that no lotteries are actually used in equilibrium. We provide a simple numerical example with increasing absolute risk aversion in which lotteries are necessarily used in equilibrium. We also show how the equilibrium allocation in this example can be implemented in a sunspot equilibrium.

Kelsey, D. and J. Quiggin (1992). "Theories of Choice under Ignorance and Uncertainty." Journal of Economic Surveys **6**(2): 133-153.

In this paper, Knight's distinction between risk and uncertainty, and its significance for economic analysis are examined. The paper consists of a survey of some recent developments on the theory of choice under uncertainty and some applications of these theories to problems for which Bayesian Decision Theory has not proved entirely satisfactory. Two problems are examined in detail. The first is that of finance and insurance and the second is that of risk-taking behavior with special emphasis on lotteries.

Kim, T. (1996). "Revealed Preference Theory on the Choice of Lotteries." Journal of Mathematical Economics **26**(4): 463-477.

The choice behavior of a decision-maker is said to be consistent with expected utility maximization if there exists a utility function defined on the set of prizes such that the decision-maker chooses lotteries with the highest expected utility. We present a revealed preference characterization of choice behavior that is consistent with expected utility maximization. A necessary and sufficient condition for expected utility maximization is that there does not exist a way to compound lotteries such that the probability distribution over the final prizes generated by the chosen lotteries of each observation is equal to that generated by the rejected lotteries of each observation. Our result is quite general and can be applied to any compact set of prizes and any choice correspondence.

King, J. R. B. (1997). "Participation in the National Lottery--Evidence from the Family Expenditure Survey." Journal of the Royal Statistical Society: Series A (Statistics in Society) **160**(2): 207-212.

The limitations of survey data for monitoring the National Lottery are discussed, including problems of recording expenditure on the National Lottery. Data from the Family Expenditure Survey are used to describe participation in, and levels of expenditure on, the National Lottery.

Kinsey, R. K. (1963). "The Role of Lotteries in Public Finance." National Tax Journal **16**: 11-19.

Kitchen, H. and S. Powells (1991). "Lottery Expenditures in Canada: A Regional Analysis of Determinants and Incidence." Applied Economics **23**(12): 1845-1852.

This article examines two issues; first, it evaluates the statistical significance of a number of socio-economic and demographic variables on the level of household lottery expenditures in the six regions of Canada. While some household characteristics vary in the extent to which they significantly affect the level of lottery expenditures across regions (wealth, age, occupation, mother tongue and urban location, for example), others are significant in every region. Regional consistency exists in the statistical significance of after tax household income, sex and education of the head of household - lottery expenditures increase as incomes increase; lottery expenditures are significantly lower for female heads of households than for their male counterparts, lottery expenditures decline as the education level of the head of household increases. Second, lottery expenditures

are found to be regressive, although the degree of regressivity is less than for lotteries in the United States.

Knight, B. G. and N. Schiff (2010). "Spatial Competition and Cross-border Shopping: Evidence from State Lotteries." NBER Working Papers.

This paper investigates competition between jurisdictions in the context of cross-border shopping for state lottery tickets. We first develop a simple theoretical model in which consumers choose between state lotteries and face a trade-off between travel costs and the price of a fair gamble, which is declining in the size of the jackpot and the odds of winning. Given this trade-off, the model predicts that per-resident sales should be more responsive to prices in small states with densely populated borders, relative to large states with sparsely populated borders. Our empirical analysis focuses on the multi-state games of Powerball and Mega Millions, and the identification strategy is based upon high-frequency variation in prices due to the rollover feature of lottery jackpots. The empirical results support the predictions of the model. The magnitude of these effects is large, suggesting that states do face competitive pressures from neighboring lotteries, but the effects vary significantly across states.

Krautmann, A. C. and J. E. Ciecka (1993). "When are State Lotteries a Good Bet?" Eastern Economic Journal **19**(2): 157-64.

This paper outlines the conditions under which a state-run lottery yields an expected return greater than its costs. The analysis considers the possibility of multiple winners, the fact that lottery winnings are typically paid out over a 10 to 20 year span, the taxation of lottery winnings as income, and the government's vigorish. We also derive the conditions under which it is worthwhile to buy every possible outcome of the litter, hence guaranteeing a winning ticket. We then apply our analysis to the recent \$106.5 million Florida Lottery and the \$27 million Virginia Lottery in which an Australian consortium attempted to buy the pot.

Kumar, A. (2009). "Who Gambles in the Stock Market?" Journal of Finance **64**(4): 1889-1933.

This study shows that the propensity to gamble and investment decisions are correlated. At the aggregate level, individual investors prefer stocks with lottery features, and like lottery demand, the demand for lottery-type stocks increases during economic downturns. In the cross-section, socioeconomic factors that induce greater expenditure in lotteries are associated with greater investment in lottery-type stocks. Further, lottery investment levels are higher in regions with favorable lottery environments. Because lottery-type stocks underperform, gambling-related underperformance is greater among low-income investors who excessively overweight lottery-type stocks. These results indicate that state lotteries and lottery-type stocks attract very similar socioeconomic clienteles.

Laitner, J. (1999). "Means-Tested Public Assistance and the Demand for State Lottery Tickets." Economic Dynamics **2**(1): 273-290.

Empirical evidence suggests that the poor spend a larger fraction of their income on gambling than the well to do. This paper shows that "means tests" for public assistance eligibility could supply part of the explanation. Income support programs can distort

private budget sets, conceivably leading to risk-taking behavior on the part of rational agents with standard, concave utility functions. Latter sections of the paper employ a calibrated life-cycle saving model to study resulting demands for actuarially fair lotteries numerically. The analysis demonstrates that allowing lotteries can simplify model-related computations a great deal.

Land, V. Q. and M. H. Alsikafi (1999). "A Lottery's Impact on Instructional and Noninstructional Expenditures and Unrestricted Revenues for Education." Journal of Education Finance **25**(2): 149-174.

Landry, C. E. and M. K. Price (2007). "Earmarking Lottery Proceeds for Public Goods: Empirical Evidence from U.S. Lotto Expenditures." Economics Letters **95**(3): 451-455.

This study examines motives for lottery play using a state-level panel of lottery expenditures. We find that expenditures per capita are greater in states that earmark proceeds for public goods. Further, we find that casino gambling only impacts lotto play in general fund states.

Lange, A., J. List, et al. (2007). "Using Lotteries to Finance Public Goods: Theory and Experimental Evidence." International Economic Review **48**(3): 901-927.

This study explores the economics of charitable fund-raising. We begin by developing theory that examines the optimal lottery design while explicitly relaxing both risk-neutrality and preference homogeneity assumptions. We test our theory using a battery of experimental treatments and find that our theoretical predictions are largely confirmed. Specifically, we find that single- and multiple-prize lotteries dominate the voluntary contribution mechanism both in total dollars raised and the number of contributors attracted. Moreover, we find that the optimal fund-raising mechanism depends critically on the risk postures of potential contributors and preference heterogeneity.

Larsson, B. (2011). "Becoming a Winner but Staying the Same: Identities and Consumption of Lottery Winners." American Journal of Economics and Sociology **70**(1): 187-209.

This article discusses how large lottery winnings are experienced and used by the winners. The study draws on a survey of 420 Swedish winners, which is analyzed against the background of previous research from the USA and Europe. The analyses show that winners are cautious about realizing any dreams of becoming someone else somewhere else. This result contradicts theories suggesting that identities are being liquefied by the commercially driven consumer culture in affluent Western societies. In contrast, the article concludes that winners generally try to stay much the same, but on a somewhat higher level of consumption. The critical situation that large winnings produce is generally met by an attempt to hold on to one's identity and social relations. In addition, the article shows that lump sum winners tend to save and invest large parts of their winnings, compared with winners of monthly installments who are more likely to spend on leisure and consumption. These results indicate that "wild" lump sums make winners "tame" their winnings more firmly, whereas "domesticated" monthly instalments can be spent more thoughtlessly without changing identity or becoming an unfortunate winner.

Lauth, T. P. and M. D. Robbins (2002). "The Georgia Lottery and State Appropriations for Education: Substitution or Additional Funding?" Public Budgeting and Finance **22**(3): 89-100.

This article examines the use of lottery proceeds for funding public education in Georgia, with specific focus on the state's effort to guard against fungibility of lottery proceeds. The Georgia lottery earmarks proceeds for education and Georgia is among the states requiring a high level of transparency at each stage of the budget and appropriations process. Based upon comparisons of spending before and after the lottery was put in place, we conclude that lottery spending has not been completely offset by substitution. Lottery funds appear to have stimulated additional spending in the target areas. Budget fungibility has been constrained by the transparency of the budget and appropriations process, gubernatorial commitment to supplement not supplant, the policy architecture of the lottery-for-education program, and a relatively strong state economy that renders substitution unnecessary.

Layton, A. and A. Worthington (1999). "The Impact of Socio-economic Factors on Gambling Expenditure." International Journal of Social Economics **26**(1-2-3): 430-440.

This paper examines the socio-economic determinants of gambling expenditure on lotteries, Lotto and Instant Lotto, TAB/oncourse betting, poker machines and casino-type games. Using a sample of 8,389 Australian households in 1993-1994, the impact of income source and level, sex, age, ethnicity, occupational status and family composition on the decision to gamble is assessed. The results indicate that these variables exert a significant influence on the probability of households gambling. Furthermore, the effect of these same variables is likely to vary across the large range of gambling products currently available.

Lee, C., C.-T. Lin, et al. (2010). "Jackpot Promotion Model for Taiwan Lotto." Applied Economics **42**(4-6): 797-801.

Lotto was inaugurated in January 2002, and immediately became a popular activity in Taiwan; as the big craze following its initial introduction has subsided, the growth of Lotto game sales has slowed. To maintain lottery sales' momentum, operators have conducted numerous jackpot promotions; this study examines the effectiveness of various jackpot promotional strategies. The analytical results can provide a valuable reference for operators and governmental authorities regarding ways of increasing lottery earnings. The empirical findings of this investigation include the following: (1) the effective price elasticity of Lotto is -0.382; Taipei Fubon Bank can increase the revenue gained from Lotto by increasing the effective price; (2) operators can significantly increase lottery sales by declaring the jackpot as an unconditional added fixed or variable bonus.

Lehr, D. (2005). "Towards an Understanding of the Roles of Race and Border Shopping on State Lottery Revenue." Virginia Economic Journal **10**: 15-28.

Given the budgetary difficulties facing many states, and the general unpopularity of tax increases, many state politicians have explored other revenue sources, notably lottery proceeds. In this paper, we explore further the notion of cross-border shopping by examining how the extent of cross border shopping differs for alternative lottery goods, and how this activity could be explained by variations in the prices of complementary

goods across states. In addition, we evaluate and discuss the importance of race as a determinant of lottery sales more completely than previous work. We only find evidence of cross-border pursuit for big jackpots in instances where one state has no lottery offerings. When each state has a big payoff lottery, all cross border shopping occurs for relatively low payoff, daily games. This suggests that cross-state lottery purchases may be an add-on purchase for out-of state travelers. Finally, examining the impact of race on aggregate lottery sales is highly misleading, because this impact depends critically on the type of lottery game examined. African Americans appear to play a disproportionate share of daily number picking games, but not big jackpot or scratch-off games. This result is consistent with the history of gambling in the African American culture in the early decades of the 20th century.

Lima, M. A. M. and M. Resende (2006). "Testes de racionalidade para loterias no Brasil." Economia Aplicada/Brazilian Journal of Applied Economics **10**(2): 181-191.

The paper investigates the prevalence of rational expectations in the case of two Brazilian lotteries (Quina and Mega-Sena). The testing strategy relates to an orthogonality condition between the conditional forecast error and the information set. Specifically, the residual of a equation for net price of a lottery ticket should be uncorrelated with sales. The results favoured the rational expectations hypothesis only in the case of the Mega-Sena that is subject to broad media coverage. Clearly the Quina lottery is associated with a different profile of betters.

Lin, C.-T. and C.-H. Lai (2006). "Substitute Effects between Lotto and Big Lotto in Taiwan." Applied Economics **13**(10): 655-658.

Lotto was inaugurated in January 2002 and immediately became a popular activity in Taiwan. The purpose of this investigation is to examine the effective price elasticity of Big Lotto and the substitute effects between Lotto (6/42) and Big Lotto (6/49). The analytical results can provide suggestions to the Taipei Bank on ways to improve lottery sales. The empirical findings of investigation include: (1) no significant substitutive or complementary relationships exist between Big Lotto and Lotto in Taiwan (2) the effective price elasticity of Big Lotto is 0.145, Taipei Bank can increase the revenue gained from Big Lotto by increasing the effective price.

Lin, C.-Y. and P. D. Berger (1969). "On the Selling Price and Buying Price of a Lottery." American Statistician **23**(5): 25-26.

Lin, E. S. and S.-Y. Wu (2007). "Lottery Expenses and Charitable Contributions--Taiwan's Experience." Applied Economics **39**(16-18): 2241-2251.

Individuals' contributions are affected by their lottery outlays if they consider their spending of lottery funds on charities to be a substitute for or a complement to their direct charitable contributions. This study investigates the effect of lottery outlays on charitable contributions based on the experience of lottery introduction in Taiwan. The estimates reveal that lottery outlays exert a positive effect on charitable contributions while the quantitative impact is significant. This study thus provides evidence ameliorating the pessimistic prospect that people may reduce their direct charitable contributions when

they spend more on lotteries. Possible explanations for the positive effect are also discussed.

Lin, K.-C. and C.-M. Lin (2007). "The Demand for Lottery Expenditure in Taiwan: A Quantile Regression Approach." Economics Bulletin **4**(42): 1-11.

This paper is a pioneering attempt to apply the quantile regression method (QRM) to the demand for lottery expenditure in order to consider the extreme behavior of lottery expenditure as well as clarify the diverse results obtained from previous studies on lottery expenditure. The results of this study reveal that there exists a complementary correlation both between benevolent donations and lottery expenditure, and between entertainment expenditure and lottery expenditure. By contrast, the results from using OLS reveal that benevolent donations do not have a significant impact on lottery expenditure and that entertainment expenditure does not have a negative impact on lottery expenditure. Besides, expenditure on cigarettes and alcohol is found to have a positive impact on lottery expenditure, which coincides with the results of Balabanis (2002).

Lindahl, M. (2005). "Estimating the Effect of Income on Health and Mortality Using Lottery Prizes as an Exogenous Source of Variation in Income." Journal of Human Resources **40**(1): 144-168.

A vast literature has established a strong positive relation between income and health status and a negative relation with mortality. This paper studies the effects of income on health and mortality, using only the part of income variation due to a truly exogenous factor: monetary lottery prizes of individuals. The findings are that higher income causally generates good health and that this effect is of a similar magnitude as when traditional estimation techniques are used. A 10 percent income increase improves health by about 4-5 percent of a standard deviation.

Lindh, T. and H. Ohlsson (1996). "Self-Employment and Windfall Gains: Evidence from the Swedish Lottery." Economic Journal **106**(439): 1515-1526.

Is the decision to become self-employed constrained by access to credit? Swedish microdata suggest that the probability of being self-employed increases when people receive windfall gains in the form of lottery winnings and inheritances. The data, therefore, are consistent with the hypothesis that liquidity constraints are binding on the decision to become and stay self-employed.

Livernois, J. R. (1986). "The Taxing Game of Lotteries in Canada." Canadian Public Policy **12**(4): 622-627.

Provincial governments have been placing increasing emphasis on the use of lotteries as an alternative to traditional forms of taxation. It is argued in this paper that lotteries are not a form of voluntary taxation, as is often believed, but generate revenues which are equivalent to, and therefore substitutable for, revenues from other sources. The paper then goes on to investigate the question of regressivity. On the basis of evidence from Canada and the U.S., it is concluded that lotteries are a regressive means of generating public revenue. Because of this, it is argued that provincial governments should change their policies towards the pricing of lottery games.

Livernois, J. R. (1987). "The Redistributive Effects of Lotteries: Evidence from Canada." Public Finance Quarterly **15**(3): 339-351.

MacLean, L. C., W. T. Ziemba, et al. (1992). "Growth Versus Security in Dynamic Investment Analysis." Management Science: 1562-1585.

Mador, G., D. Sonsino, et al. (2000). "On Complexity and Lotteries' Evaluation--Three Experimental Observations." Journal of Economic Psychology **21**(6): 625-637.

We present experimental evidence suggesting that human subjects penalize lotteries for complexity. Our results contradict the assumption that human agents follow the discounted expected utility model in multi-period choice with uncertainty. In particular, we show that the buying price offered for an inferior, simple multi-period lottery may sometimes significantly exceed the buying price offered for a better, yet more complicated, alternative, when the lotteries are sold to a group of subjects in a first-price auction. We discuss the possibility to modify the existing models of choice to this "complexity effect."

Maeda, A. (2008). "Optimal Lottery Design for Public Financing." Economic Journal **118**(532): 1698-1718.

This article develops a model of optimal lottery design for public financing, on the assumption that economic agents view buying lottery tickets as a form of entertainment. Given that lotteries are optimally designed, it offers two findings: (1) the fundraising potential of a lottery is independent of its type (specifically, of whether it is a fixed-prize type or a pari mutuel); and (2) the ratio of the optimal winning prize amount in each prize class to total lottery sales is equalised to the elasticity of demand for lottery ticket purchases with respect to the winning prize in each prize class.

Markowitz, H. M. (1952). "The Utility of Wealth." Journal of Political Economy **60**(2): 151-158.

Marshall, K. (1996). "A Sure Bet Industry." Perspectives on Labour and Income **8**(3): 37-41.

Gambling is a growth industry that is creating new jobs and generating increasing revenue for government. This article explores the industry's employment growth and the characteristics of its workers and jobs, as well as the revenue generated by lotteries, casinos and video lottery terminals.

Marshall, K. (1998). "The Gambling Industry: Raising the Stakes." Perspectives on Labour and Income **10**(4): 7-11.

Since the introduction of casinos and video lottery terminals in the 1990s, growth in gambling has outstripped that of most other industries. This article updates an earlier examination of employment and government revenue for this industry, as well as average household spending on games of chance.

Martin, R. and B. Yandle (1990). "State Lotteries as Duopoly Transfer Mechanisms." Public Choice **64**(3): 253-264.

Marx, A. and H. Peeters (2008). "An Unconditional Basic Income and Labor Supply: Results from a Pilot Study of Lottery Winners." Journal of Socio-Economics 37(4): 1636-1659.

Proponents of an unconditional basic income see its introduction as the most desirable way to redesign existing labor markets, arguing that its effects on labor supply might engender full employment. Opponents, on the other hand, argue that an unconditional basic income would result in an economic crisis due to a severe reduction in labor supply. So far no empirical data were available to assess these claims. This article proposes an empirical research strategy, i.e., surveying specific types of lottery winners, to investigate the empirical consequences of introducing an unconditional basic income. The results of a pilot survey are presented.

Mason, P. M., J. W. Steagall, et al. (1997). "The Elasticity of Demand for Lotto Tickets and the Corresponding Welfare Effects." Public Finance Review 25(5).

The results of an analysis of lotto demand for the state of Florida during the first 254 weeks of its lotto suggest that the price elasticity of demand is near unity when employing a measure of lotto ticket price that is superior (at least for the state of Florida) to that used by others. The results imply that, relative to other states, Florida's lotto has room for increases in the odds to increase the price elasticity of demand to the revenue-maximizing level. However, revenue maximization is not the goal that the state should seek. Rather, the data indicate that Florida could potentially improve social welfare through increasing the odds, thereby expanding the consumer surplus of ticket buyers and reducing the excess burden associated with the lottery tax.

Mason, P. M., J. W. Steagall, et al. (2005). "Evaluating the Life Cycles of Education-Supporting Lotteries." Public Finance Review 33(2): 255-271.

This article examines the history of total lottery sales for eleven education-supporting lottery states. Controlling for the influence of multistate games, state income differentials, and unemployment, unbalanced fixed-effects models investigating four measures of lottery sales indicate that nominal lottery sales continue to climb, but sales adjusted for inflation are either falling or soon will. Per capita sales across all states have not grown much beyond the first several years in the lottery life cycles, but per student sales are still rising due to declining school-age populations and purchases of lottery tickets made by other than state residents. Forecasts for real per capita lottery sales are provided for each of the states in the sample through 2030.

Mason, P. M. and H. Stranahan (1996). "The Effects of Casino Gambling on State Tax Revenue." Atlantic Economic Journal 24(4): 336-348.

A theoretical model of state tax structure implies that revenue enhancement due to the introduction of casino gambling is less likely in states where income taxes do not exist and where casino tax rates are lower than the corresponding tax rates on sales taxable and excise taxable goods. Further, it is clear that casino gambling is likely to adversely impact lottery tax revenues earmarked for education. Due to the cross-price effects of gambling, tax revenues will likely decline in states that introduce nontaxable casino gambling on Indian reservations. In the longer term, as casino gambling proliferates increasing

competition among states, there will be negative revenue consequences due to fewer tourism and employment dollars.

Matheson, V. A. (2001). "When are State Lotteries a Good Bet? (Revisited)." Eastern Economic Journal **27**(1): 55-70.

Matheson, V. A. and K. R. Grote (2003). "Jacking up the Jackpot: Are Lotto Consumers Fooled by Annuity Payments?" Public Finance Review **31**(5): 550-567.

State lotteries typically pay lotto jackpot winners with annuity payments over a 20- to 30-year period. Because lottery associations advertise the jackpot to be the nominal sum of these payments, lottery associations can increase the size of the advertised jackpot simply by increasing the annuity length. Because ticket sales increase with the size of the advertised jackpot, longer annuity lengths should lead to higher ticket sales. The results suggest that lotto players are not fooled by this sleight of hand so that lottery associations cannot increase revenues by artificially inflating the advertised jackpot in this manner.

Matheson, V. A. and K. R. Grote (2004). "Lotto Fever: Do Lottery Players Act Rationally around Large Jackpots?" Economics Letters **83**(2): 233-237.

"Lotto fever" occurs when an increase in ticket sales reduces the expected value of a lottery ticket despite a higher jackpot. An examination of 17,538 lotto drawings in the United States finds that examples of lotto fever are exceedingly rare.

Matheson, V. A. and K. R. Grote (2005). Rationality and Efficiency in Lotto Games. Information Efficiency in Financial and Betting Markets L. Vaughan Williams. New York, NY, Cambridge University Press: 313-338.

Matheson, V. A. and K. R. Grote (2007). "Gamblers' Love for Variety and Substitution among Lotto Games." Journal of Gambling Business and Economics.

This paper considers the whether offering multiple lotto games within a state by joining a multi-state lottery increases total ticket sales compared to offering a single state game. The question is considered from two different perspectives, which both lead to the conclusion that states do tend to benefit from increased ticket sales overall by joining a multi-state lottery association. There is, however, a noted difference in the magnitude of that effect depending on the size of the average jackpots of the previously existing state games.

McConkey, C. W. and W. E. Warren (1987). "Psychographic and Demographic Profiles of State Lottery Ticket Purchasers." Journal of Consumer Affairs **21**(2): 314-327.

Data from a national mail panel are used to develop psychographic and demographic profiles of heavier, lighter, and nonpurchasers of state lottery tickets. The research is limited to the sixteen states that offered a lottery at the time the study was completed. The resulting profiles indicate that each of the groups has identifiable characteristics. The findings tend to dispel some of the stereotyped characteristics of lottery players--that they are poor, uneducated, and unemployed.

McGowan, R. A. (2001). Government and the Transformation of the Gaming Industry. Northampton, MA, Edward Elgar.

Examines the economics of the gaming industry and the cultural, social, and political environment facing the industry in the United States. Provides a history of U.S. gambling. Discusses the U.S. "gambling" industry's ongoing attempt to transform itself into the "gaming" industry. Discusses alternative forms of casino gambling, the new giant "super casinos" or mega resorts, and the casino firms. Examines lotteries and the various strategies for conducting lotteries. Analyzes the pari-mutuel betting industry segment. Presents a model that outlines the major political and social issues that could affect the gambling industry. Examines how a national warning-label proposal could affect the industry, analyzing the effects that warning-label requirements have had on lottery sales in states. Presents policy recommendations that could prove helpful to the customers of the gaming industry as well as to the industry itself.

McHale, I. G. and D. A. Peel (2010). "Habit and Long Memory in UK Lottery Sales." Economics Letters **109**(1): 7-10.

Long memory processes can occur as a consequence of aggregation over heterogeneous agents. We examine the UK lottery and, by estimating the level of fractional differencing, find evidence of the long memory property in lottery sales, a result that has broader implications on the estimation of demand models for lotteries.

Miers, D. (1996). "The Implementation and Effects of Great Britain's National Lottery." Journal of Gambling Studies **12**(4): 343-373.

Mikesell, J. (1989). "A Note on the Changing Incidence of State Lottery Finance." Social Science Quarterly **70**(2): 513-521.

Mikesell, J. (2001). "Lotteries in State Revenue Systems: Gauging a Popular Revenue Source after 35 Years." State and Local Government Review **33**(2): 86-100.

Mikesell, J. and M. A. Pirog-Good (1990). "State Lotteries and Crime: The Regressive Revenue Producer Is Linked with a Crime Rate Higher by 3 Percent." American Journal of Economics and Sociology **49**(1): 7-19.

The impact of having a state lottery on the rate of crime against property in that state is estimated. Arguments in the standard economic model of criminal activity employed here include the unemployment rate, real income per capita, presence of the death penalty in the state as a proxy for general severity of punishment, policy officers per capita, the percentage of population between the ages of 5 and 24, and the presence of a state lottery. Because the decision of a state to operate a lottery may correlate with crime rates, a selectivity model was run to extract any bias, but no such bias was found. The analysis used data for the 50 states plus the District of Columbia from 1970 through 1984. The results suggest that presence of a state lottery is associated with a crime rate higher by about 3 percent, an effect both statistically significant and practically important.

Mikesell, J. L. (1987). "The Effect of Maturity and Competition on State Lottery Markets."

Journal of Policy Analysis and Management **6**(2): 251-253.

Mikesell, J. L. (1994). "State Lottery Sales and Economic Activity." National Tax Journal **47**(1): 165-171.

Mikesell, J. L. and C. K. Zorn (1986). "State Lotteries as Fiscal Savior or Fiscal Fraud: A Look at the Evidence." Public Administration Review **46**: 311-320.

Twenty-two states plus the District of Columbia, including almost 60 percent of the nation's population, are conducting state lotteries in 1986. These lotteries enjoy a popularity rare among revenue sources in this or any political era. Does this revenue source promise fiscal relief in a difficult financial environment for states, or do lotteries remain a "fickle form of finance" with fluctuating and low returns? This paper provides background on state lotteries and analyzes revenue performance in each state. It also reviews the cases made by proponents and opponents of the lottery as a state operation. The result is a set of conclusions that the lottery is a source of limited government revenues and is of doubtful merit in some states.

Mikesell, J. L. and C. K. Zorn (1987). "State Lottery Sales: Separating the Influence of Markets and Game Structure." Growth and Change **18**(4): 10-19.

State lotteries are the fiscal gimmick for the 1980s, receiving widespread popular and legislative approval. Unfortunately, the impact of structural and external influences on lottery sales is not well understood. This analysis sheds light on these influences, demonstrating that state economic activity, age of the game, interstate lottery competition, and game portfolios significantly affect sale and, consequently, benefit to the state.

Mikesell, J. L. and K. Zorn (1988). "State Lotteries for Public Revenue." Public Budgeting and Finance **8**(1): 38-47.

Lotteries, the state fiscal gimmick of the eighties, operate in jurisdictions encompassing substantially more than half the nation's population and enjoy considerable public acceptance. The revenue they generate is small, rarely more than two percent of state general revenue, it is subject to major year-to-year swings, and it is very expensive to generate, particularly when vendor commissions are recognized as part of cost. Furthermore, lotteries bear a high implicit excise tax rate and, because of the pattern of play across income classes, appear to worsen the overall equity of the revenue system. Their economic impact appears to be that of an internal transfer, although states with major lottery equipment suppliers have most to gain, particularly if they do not operate their own lottery. Lotteries are not destined to become mainstays of government finance, although their spread is likely, even with the fiscal questions they raise.

Miller, D. E. and P. A. Pierce (1997). "Lotteries for Education: Windfall or Hoax?" State and Local Government Review **29**: 34-42.

Miller, J. D. and M. R. Morey (2003). "Power Markets: Transferring Systematic Risk to Lottery Players." Public Budgeting and Finance **23**(2): 118-133.

This article shows how a state could design a lottery that absorbs some of the financial market's systematic risk. Under this lottery, prizes would be positively correlated with the stock market. This lottery could be a profitable complement to existing state lotteries.

Minabe, S. (1975). "A Time Deposit with Lottery Ticket." Public Finance **30**(2): 222-230.

Mixon, F. G., Jr., S. B. Caudill, et al. (1997). "The Rise (or Fall) of Lottery Adoption within the Logic of Collective Action: Some Empirical Evidence." Journal of Economics and Finance **21**(1): 43-49.

This paper builds upon previous work on the economics of lottery by adoption by incorporating the collective action logic developed in an important series of works by Mancur Olson. Public choice research points out that legislators are rational maximizers, and act within a cost-benefit framework in attempting to implement means of budget finance. Discrete-time hazard models presented suggest that lottery adoption is more likely to occur in older states where rent seeking groups are older and more organized, and can more effectively engage in efforts for collective action (and benefits). By implementing lotteries as tax-shifting mechanisms, the role of government and the direction of social evolution are also altered.

Mobilia, P. (1992). "Trends in Gambling: The Pari-mutuel Racing Industry and Effect of State Lotteries, a New Market Definition." Journal of Cultural Economics **16**(2): 51-62.

This paper is a study of the incidence of gambling at pari-mutuel thoroughbred tracks in the United States from 1950 through 1987 and at greyhound tracks from 1972 through 1986. The effect of lotteries on pari-mutuel attendance and handle is addressed. The paper follows a discussion of market delineation for the tracks with a description of the data and empirical approach, and then a presentation of the results and a summary section. The analysis reveals that lotteries negatively affect attendance at tracks; however, lotteries have no significant effect on the real handle per attendee. This would suggest that the low dollar amount bettors stop attending tracks and switch their wagers to lottery opportunities, while the heavy bettors continue to wager at tracks.

Modesti, P. (2003). "Lottery-Dependent Utility via Stochastic Benchmarking." Theory and Decision **55**(1): 45-57.

The possibility to interpret expected and nonexpected utility theories in purely probabilistic terms has been recently investigated. Such interpretation proposes as guideline for the Decision Maker the comparison of random variables through their probability to outperform a stochastic benchmark. We apply this type of analysis to the model of Becker and Sarin, showing that their utility functional may be seen as the probability that an opportune random variable, depending on the one to be evaluated, does not outperform a non-random benchmark. Further, the consequent choice criterion is equivalent to a sort of probability of ruin. Possible interpretations and financial examples are discussed.

Moore, P. G. (1997). "The Development of the UK National Lottery: 1992-96." Journal of the Royal Statistical Society: Series A (Statistics in Society) **160**(2): 169-185.

This paper outlines the build-up of the National Lottery launch, from the government 1992 white paper, the subsequent Parliamentary procedures leading to the National Lottery Act, the choice of Camelot as the operator in May 1994 and the nationwide launch of the lottery in November 1994. The paper outlines the achievements of the lottery and some longer-term issues that it faces.

Morgan, J. (2000). "Financing Public Goods by Means of Lotteries." Review of Economic Studies **67**(4): 761-784.

When viewed as taxes, lotteries are routinely criticized as being both inequitable and inefficient. But is this an entirely fair comparison? Frequently lotteries are used in lieu of voluntary contributions by private charities and governments when taxes are not feasible. When heterogeneous individuals with quasi-linear preferences participate in lotteries whose proceeds will be used to fund a public good, we find that, relative to voluntary contributions, wagers in the unique lottery equilibrium (a) increase the provision of the public good, (b) are welfare improving, and (c) provide levels of the public good close to first-best as the lottery prize increases.

Morgan, J. and M. Sefton (2000). "Funding Public Goods with Lotteries: Experimental Evidence." Review of Economic Studies **67**(4): 785-810.

Why do individuals participate in charitable gambling activities? We conduct a laboratory investigation of a model that predicts risk-neutral expected utility maximizers will participate in lotteries when they recognize that lotteries are being used to finance public goods. As predicted by the model, we find that public goods provision is higher when financed by lottery proceeds than when financed by voluntary contributions. We also find support for other comparative static predictions of the model. In particular we find that ticket purchases vary with the size of the fixed prize and with the return from the public good: lotteries with large prizes are more effective, and ticket purchases drop dramatically when the public good is not valued by subjects.

Murphy, A. L. (2005). "Lotteries in the 1690s: Investment or Gamble?" Financial History Review **12**(2): 227-246.

In 1693 Thomas Neale, Groom Porter to their Majesties, organised a lottery that offered to its lucky winner a prize of L3,000. The scheme proved a great success, encouraging a variety of entrepreneurs to float similar projects. Indeed, by 1698 lotteries that offered tickets costing as little as one penny allowed all but the most destitute to indulge in dreams of wealth. Although these schemes may be seen as a mere manifestation of the contemporary love of gambling and games of chance, this article argues that they can also reveal much about the nature and progress of the Financial Revolution.

Ng, Y.-K. (1965). "Why Do People Buy Lottery Tickets? Choices Involving Risk and the Indivisibility of Expenditure." Journal of Political Economy **73**(5): 530-535.

Nibert, D. (2000). Hitting the Lottery Jackpot: State Governments and the Taxing of Dreams. New York, NY, Monthly Review Press.

Uses a sociological perspective influenced by Marxian theory to critique state lotteries.

Examines the history of lotteries in the United States and the factors that have contributed to their revival in the late twentieth century. Indicts state governments for promoting lotteries, arguing that they are unfair to those with few resources because they are a regressive form of taxation. Describes how state lotteries help to legitimate inequality in the United States. Considers what people with low and moderate incomes can do to stem the growth of lotteries in the twenty-first century and to promote social justice.

Novarro, N. K. (2005). "Earmarked Lottery Profits: A Good Bet for Education Finance?" Journal of Education Finance **31**(1): 23-44.

This article studies the effects of earmarking state lottery profits for education. Because educational expenditures generally exceed the funds earmarked for education by a wide margin, nothing prevents state legislators from using earmarked funds to replace rather than augment funds that would have gone to education in the absence of earmarking. Conventional economic reasoning therefore implies that this policy should have no effect on overall educational spending. However, this study found that \$1 of lottery profits earmarked for education increases current educational spending by roughly \$0.79, whereas a nonearmarked dollar of lottery profits increases educational spending by only \$0.43. Furthermore, the hypothesis that a dollar of profits specifically earmarked for noneducational uses has no effect on educational expenditures cannot be rejected. States that operate lotteries may want to reassess their existing legislation regarding the use of lottery proceeds given the economic implications of their earmarking policies.

Olson, M. (1965). The Logic of Collective Action: Public Goods and the Theory of Groups. Cambridge, MA, Harvard University Press.

Oster, E. (2004). "Are All Lotteries Regressive? Evidence from the Powerball." National Tax Journal **57**(2): 179-187.

The regressivity of lotteries has become an increasingly important issue in the U.S. as the number of state-run lotteries has increased. Despite this, we still know relatively little about the nature of lottery regressivity. I use a new dataset on Powerball lotto sales to analyze how regressivity varies with jackpot size within a single lotto game. I find that this large-stakes game is significantly less regressive at higher jackpot sizes. Out-of-sample extrapolation of this result suggests the possibility of progressivity at jackpots substantially higher than those currently experienced. This may indicate that concerns about regressivity might be allayed by concentrating lotto games to produce higher average jackpots.

Packel, E. (1981). The Mathematics of Games and Gambling. Washington, D.C., The Mathematical Association of America.

Pallais, A. (2009). "Taking a Chance on College: Is the Tennessee Education Lottery Scholarship Program a Winner?" Journal of Human Resources **44**(1): 199-222.

Most policies seeking to improve high school achievement historically either provided incentives for educators or punished students. Since 1991, however, over a dozen states, comprising approximately a quarter of the nation's high school seniors, have

implemented broad-based merit scholarship programs that reward students for their high school achievement with college financial aid. This paper analyzes one of these initiatives, the Tennessee Education Lottery Scholarships, using individual-level data from the ACT exams. The program did not achieve one of its stated goals, inducing more students to prefer to stay in Tennessee for college, but it did induce large increases in performance on the ACT. Policies that reward students for performance do affect behavior and may be an effective way to improve high school achievement.

Pantuosco, L., W. Seyfried, et al. (2007). "The Impact of Lotteries on State Education Expenditures: Does Earmarking Matter?" Review of Regional Studies **37**(2): 169-185.

In this paper, we estimate the impact of earmarking lottery revenue to education as opposed to filtering lottery revenue through a state's general fund. A unique facet of this investigation is the comparison of states with lottery revenue earmarked for spending on K-12 education and states with lotteries for general funds. This approach enables us to investigate the effect of state lottery revenues on education and other budgetary components in a more controlled environment by mitigating lottery preference differences across states. Consistent with previous research, we find that earmarking lottery proceeds for K-12 education has little or no impact on actual state K-12 funding. We also find that lottery revenue does seem to increase K-12 funding in states that deposit the revenues into their general funds.

Papachristou, G. (2004). "The British Gambler's Fallacy." Applied Economics **36**(18): 2073-2077.

People facing choices under uncertainty, and gamblers in particular, are often subject to statistical fallacies. This paper explores the hypothesis that if lotto players were subject to the "gambler's fallacy", predictable fluctuations in the number of jackpots would occur. Evidence, based on a Poisson regression model in which the number of winning bets is conditional on the history of draws, indicates that number selection in the UK is only marginally affected by the history of draws.

Papachristou, G. (2006). "Is Lottery Demand Elasticity a Reliable Marketing Tool? Evidence from a Game Innovation in Greece." International Review of Economics and Business **53**(4): 627-640.

Demand for lotteries and especially lotto has been extensively studied in an international context, an important question being whether lottery providers correctly price their product. In Greece a lotto game has been offered since 1990 whereas a new version was introduced seven years later with a clearly more skewed payoff. The objective of this paper is to analyze whether demand estimates from the original game help explain the subsequent innovation and to assess, in that sense, the reliability of demand estimates as a marketing tool.

Papachristou, G. (2009). "Scale Economies of Lotto Once More." Applied Economic Letters **16**(1-3): 319-323.

Under the assumption of random number selection, higher moments of a lotto ticket payoff seem to exhibit a peculiar behaviour; variance (and probably skewness) rises up to

some number of bets before approaching its limit from above. A close inspection of the 'simplest' expression obtained by means of a hypergeometric summation algorithm suggests that the payoff variance (and probably skewness) is unimodal and attains its highest at a realistic scale.

Papachristou, G. and D. Karamanis (1998). "Investigating Efficiency in Betting Markets: Evidence from the Greek 6/49 Lotto." Journal of Banking and Finance **22**: 1597-1615.

In this paper we investigate the existence of profit opportunities in the Greek market for the 6/49 Lotto. Under the assumption of random number selection we find evidence suggesting that the market is efficient. Because number selection is found to deviate from randomness, we further investigate the existence of profit opportunities due to number unpopularity. The evidence suggests that although unpopular numbers exist, they are not sufficiently unpopular so as to generate positive expected payoffs.

Paton, D., D. S. Siegel, et al. (2002). "A Policy Response to the E-Commerce Revolution: The Case of Betting Taxation in the UK." Economic Journal **112**(480): 296-314.

Several environmental changes in the 1990s--including the introduction of a national lottery, the rise of Internet gambling, and the reduction of trade barriers within the EU--induced the UK government to initiate a large-scale review of betting duty. As a result of this review, the government recently announced a significant reduction in betting taxes. They also decided to replace the current general betting duty (GBD), levied as a proportion of betting stakes, with a gross profits tax (GPT), based on the net revenue of bookmakers. We examine the economic rationale behind these decisions and demonstrate how these tax changes have broad implications regarding optimal levels of taxation for other sources of government revenue.

Paton, D., D. S. Siegel, et al. (2010). "Gambling, Prediction Markets and Public Policy." Southern Economic Journal **76**(4): 878-883.

The recent worldwide increase in gambling and prediction markets, including casinos, sports betting, lotteries, elections, and wagering on financial instruments has stimulated an important debate regarding the public policy implications of these activities. Some critical research questions concern the efficiency of such markets, heterogeneity in risk attitudes among agents engaged in these activities, the factors that influence performance in gambling, and the desirability of using prediction markets. This special issue provides empirical evidence on these issues.

Paulsen, R. (2008). "Economically Forced to Work: A Critical Reconsideration of the Lottery Question." Basic Income Studies **3**(2).

The lottery question asks whether you would stop working, continue working in the same job or continue working in a different job if you won a sum of money large enough to allow you to live on it comfortably for the rest of your life without working. This literature review reports the results of 22 surveys carried out between 1955 and 2005 where this issue was raised in connection with basic income, and devotes specific attention to how the results have hitherto been analyzed. Used as a measure of employability, other dimensions of the lottery question, such as occupational discontent

and satisfaction beyond economic necessity, have been largely overshadowed despite their prominence in the statistical material. The prevalence of non-financial employment commitment (NEC) has also been overestimated because of an analytical dichotomy between those who would continue working and those who would stop working completely if finances permitted. Suggestions for further studies include a clear distinction between non-financial commitment to current employment and to employment as such.

Peacock, M. S. (2000). "Charity Ends with the Lottery: It Ain't What You Give, It's the Way That You Give It." New Economy 7(2): 120-123.

Pecorino, P. and A. Temimi (2007). "Lotteries, Group Size, and Public Good Provision." Journal of Public Economic Theory 9(3): 451-465.

We analyze the effect of group size on public good provision under the Morgan (2000) lottery mechanism. For a pure public good, the lottery performs quite well as public good provision is found to increase in group size, even when the lottery prize is held constant. By contrast, for fully rival public goods, per capita provision is found to decrease in group size, even when the lottery prize is proportional to group size. Further, the per capita level of provision will approach zero when group size is sufficiently large.

Peel, D. A. (2010). "On Lottery Sales, Jackpot Sizes and Irrationality: A Cautionary Note." Economics Letters 109(3): 161-163.

Jackpot size has a greater impact than expected price as a determinant of lottery sales suggesting that agents exhibit irrational lotto mania. We demonstrate why this conclusion is problematical by considering the reduced form obtained if agents are described by Cumulative Prospect Theory.

Peel, D. A. and D. Law (2009). "On Skewness of Return and Buying More Than One Ticket in a Lottery." Applied Economic Letters 16(10-12): 1029-1032.

The purpose in this article is to demonstrate that buying more than one ticket in a lottery is readily explicable in models of utility that permit gambling at actuarially unfair odds. However, contrary to popular view, we show this choice cannot be explained in terms of a variance-skew trade-off.

Peeters, H. and A. Marx (2006). "Lottery Games as a Tool for Empirical Basic Income Research." Basic Income Studies 1(2): 1-7.

Peltzman, S. (1976). "Towards a More General Theory of Regulation?" Journal of Law and Economics 19(2): 211-240.

Peppard, D. M., Jr. (1987). "Government as Bookie: Explaining the Rise of Lotteries for Revenue." Review of Radical Political Economics 19(3): 56-68.

The principal new form of legalized gambling in the past twenty years is the lottery. This article uses a Marxist framework to explain the spread of state-sponsored lotteries since 1964. It develops a complex understanding of a variety of events in the past 20

years to explain the recent popularity of lotteries. Among the phenomena of interest are state and local fiscal crises, caused in part by deindustrialization and capital mobility, and a system-wide crisis characterized by falling real earnings and rising unemployment. The first crisis influenced some states to want to use lotteries for revenue, while the second crisis helped overcome opposition to the legalization of lotteries. Understanding the appeal of lotteries in each case requires brief analyses of the causes of fiscal crises and the ways in which needs are created and satisfied in capitalism.

Pierce, P. A. and D. E. Miller (1999). "Variations in the Diffusion of State Lottery Adoptions: How Revenue Dedication Changes Morality Politics." Policy Studies Journal **27**(4): 696-706.

Pirog-Good, M. A. and J. Micksell (1995). "Longitudinal Evidence of the Changing Socio-Economic Profile of a State Lottery Market." Policy Studies Journal **23**(3): 451-465.

This longitudinal study of Indiana lottery expenditures tracks that market from a time when all play was in games offered by other states until the state offered a full portfolio of games. Both the socio-economic characteristics of players and the nature of their play have changed. Participation doubled when the Indiana games began, and it continues to increase, albeit more slowly. Lottery play is regressive, and has become increasingly regressive over time. An increasing proportion of lottery revenues comes from low-income players and heavy bettors, although small bets are still the norm. While college graduates play the lottery less than do other individuals, the initial large gap in play rates for these two groups is diminishing as college graduates increase their participation in the lottery. Similarly, women and individuals between the ages of 44 and 65 are continuing to increase their participation in lotteries. Patterns associated with increased regressivity, with increased play among low-income players, and with higher reliance on heavy bettors, suggest a need for special policy vigilance as the games mature.

Pjesky, R. J. (2009). "Should We Put Lotteries for Education on the Honor Roll or in the Corner?" Journal of Economics **35**(2): 23-40.

Many states have passed lotteries for education in the hopes of increasing education funding and ultimately improving educational outcomes. This paper looks at real per capita state and local direct education spending and finds strong evidence that lotteries for education have increased per capita education spending in those states that passed a lottery for education between 1978 and 2000. Further evidence in the paper suggests that money flowing into state and local budgets from a new source such as a lottery will be used to fund new spending, tax cuts, and deficit reduction.

Prescott, E. C. and K. Shell (2002). "Introduction to Sunspots and Lotteries." Journal of Economic Theory **107**(1): 1-10.

This introduces the symposium on sunspots and lotteries. Two stochastic general-equilibrium concepts, sunspot equilibrium (SE) and lottery equilibrium (LE), are compared. It is shown that, for some general, pure-exchange economies which allow for consumption nonconvexities or moral hazards, the set of LE allocations is equivalent to the set of SE allocations provided that the randomizing device can generate events of any probability.

Price, D. I. and E. S. Novak (1999). "The Tax Incidence of Three Texas Lottery Games: Regressivity, Race, and Education." National Tax Journal **52**(4): 741-751.

Zip code aggregated data were used to measure the regressivity of three Texas lottery games using both Suits Indices of Progressivity and regression analysis. Per capita purchases of the individual games were regressed against variables measuring income, black and Hispanic populations, educational levels, gender, age, and the purchases of other lottery products. The results reveal that each of the games is highly regressive and that one, the instant game, should be classified as an inferior good. Furthermore, differences among the games indicate the more regressive games are purchased more than proportionately by black and Hispanic minorities, by people with lower educational levels, and by older people. Finally, the results reveal that the various lottery products are complementary goods.

Price, D. I. and E. S. Novak (2000). "The Income Redistribution Effects of Texas State Lottery Games." Public Finance Review **28**(1): 82-92.

Purfield, C. and P. Waldron (1999). "Gambling on Lotto Numbers: Testing for Substitutability or Complementarity Using Semi-weekly Turnover Data." Oxford Bulletin of Economics and Statistics **61**(4): 527-544.

The impact on the demand for a gambling product of the introduction of a competing product is a topical issue in Britain, Ireland and elsewhere. We consider empirically the demand for Lotto itself and for fixed-odds betting on the Lotto draw. The evidence suggests that these products are complements. Problems are posed by the need to rely on turnover data instead of price and quantity data in testing for substitutability or complementarity and by the semi-weekly nature of Lotto draws, which raises the possibility of a "seasonal" unit root in the turnover time series.

Quiggin, J. (1991). "On the Optimal Design of Lotteries." Economica **59**(229): 1-16.

In recent years, the expected utility model of choice under risk has been generalized to cope with phenomena such as probability weighting. In the present paper, one such generalized approach, the rank-dependent expected utility model, is applied to the problem of lottery gambling. The model is used to derive an optimal prize structure for lotteries, involving a few large prizes and a large number of small prizes. Other forms of gambling, such as racetrack betting, are discussed in the light of this result.

Ramos Palencia, F. (2010). "Azar y fortuna en Espana: La Loteria Nacional, 1850-2000. (The Spanish National Lottery, 1850-2000. With English summary.)" Investigaciones de Historia Economica(17): 149-185.

This article examines the determinants of the Spanish National Lottery between 1850 and 2000. The sales data are from Gaceta de Madrid (1850-1920), Cuentas de Tesoreros (Seccion de Hacienda) of Administracion General Estado Archive (1939-1955) and the Annual Reports from LAE (1985-2000). The results provide a detailed examination of the socioeconomic and demographic characteristics of lottery players--income, educational levels, urbanisation, number of lottery retail outlets in the province, age, and

religion--that historically determine lottery ticket purchases in Spain. This study uses standard OLS estimation and models that account spatial dependence between a province and its neighbors.

Robson, A. J. (1996). "The Evolution of Attitudes to Risk: Lottery Tickets and Relative Wealth." Games and Economic Behavior **14**(2): 190-207.

Individual attitudes to risk are examined in an evolutionary model. Males obtain more offspring as a consequence of greater wealth both directly and because this attracts more mates. The second effect induces gambling driven by relative wealth and can create Pareto inefficiency. Fair bets involving small losses and large gains are taken if any fair bets at all are taken. Altogether, the model accords with observations concerning bets taken and declined by typical individuals despite settings of widely varying per capita wealth.

Rodgers, W. M. and C. Stuart (1995). "The Efficiency of a Lottery as a Source of Public Revenue." Public Finance Quarterly **23**(2): 242-254.

Roger, P. (2011). "La demande de grilles d'Euromillions: Une comparaison internationale. (The Demand of Euromillions Lottery Tickets: An International Comparison. With English summary.)" Revue Economique **62**(1): 29-55.

We analyze the demand of Euromillions lottery tickets, a European lotto-like game launched in 2004 and played simultaneously in nine countries with the same rules and the same draws. Using first the effective price methodology, we show that price elasticities are very different across countries. Especially, Spain and Portugal exhibit a low price elasticity and high mean sales, meaning a low sensitivity to jackpot increases. On the contrary, Ireland and the United Kingdom exhibit a very high long-run elasticity and a large sensitivity to jackpot variations. The interpretation of these results is linked to lower per capita GDP in the two former countries, to the large development of syndication play in Spain and to the special tax regime in Portugal. For UK and Ireland, bookmaking activities and the highly competitive betting market partly explain the results. We then show that cumulative prospect theory (Tversky and Kahneman [1992]), though allowing to explain participation to the lottery, does not improve the estimation of the demand function.

Rubenstein, R. and B. Scafidi (2002). "Who Pays and Who Benefits? Examining the Distributional Consequences of the Georgia Lottery for Education." National Tax Journal **55**(2): 223-238.

This paper examines the incidence of the implicit lottery tax and the distribution of benefits from lottery funded programs in Georgia. Georgia's lottery is unique in that revenues are earmarked for three educational programs--HOPE College Scholarships, universal pre-kindergarten, and education infrastructure. We estimate separate models of household-level lottery purchases and of household benefits from lottery funded programs. Our estimates suggest that lower income and non-white households tend to have higher purchases of lottery products while receiving lower benefits, as compared to higher income and white households. Benefits of HOPE Scholarships, in particular,

accrue disproportionately to higher income and more educated households.

Sanders, W. V. (2003). Testing the Fungibility of Earmarked Lottery Revenue: Comments. Proceedings of the Pennsylvania Economic Association 2003 conference, May 29-May 31, 2003, West Chester University, West Chester, Pa. Edinboro, PA, Pennsylvania Economic Association: 32.

Sawkins, J. W. and V. A. Dickie (2002). "National Lottery Participation and Expenditure: Preliminary Results Using a Two Stage Modelling Approach." Applied Economics Letters **9**(12): 769-773.

Using data from the Family Expenditure Survey, this paper analyses participation in, and expenditure on, the UK National Lottery by individuals for the period 1995/1996 to 1999/2000. Probit and truncated Tobit models are employed in a two part estimation. The results highlight the importance of gender, age, education, marital status and occupation in individual participation and expenditure decisions.

Scoggins, J. F. (1994). "Upping the Ante for Lotto: A Strategy for Enhancing State Revenues." Public Finance Quarterly **22**(2): 258-264.

Scoggins, J. F. (1995). "The Lotto and Expected Net Revenue." National Tax Journal **48**(1): 61-70.

Would a state's revenues be enhanced by changing the percentage of gross revenues allocated to the grand prize of a lotto? To answer this question I construct a multiperiod model of lotto sales. Using data from the Florida Lotto, I estimate the parameters for a lotto revenue equation and for a limited-dependent-variable equation to estimate the probability that the grand prize will roll over. Including the latter equation is a significant improvement over models by other authors because by recognizing that lotto players overselect certain integer combination selections, it provides for an unbiased estimate of expected net revenues. A further improvement over models by other authors is the multiperiod aspect of the model. The finding is that expected net revenues will be increased by allocating a greater percentage of sales to the grand prize.

Scott, F. and J. Garen (1994). "Probability of Purchase, Amount of Purchase, and the Demographic Incidence of the Lottery Tax." Journal of Public Economics **54**(1): 121-143.

When consumers' indifference curves are discontinuous at zero, perhaps due to stigma or fixed costs of purchase, then factors influencing the amount purchased will have a different effect on the probability of purchase. Estimation of the demand for a commodity like lottery tickets requires a procedure that accounts for this. Tobit estimation, commonly used in this literature, does not allow for this generalization. We investigate individual lottery ticket purchases using data from a survey of households. Our results are quite disparate from earlier studies regarding the effects of many demographic variables on probability of play, level of play, and expected lottery ticket purchases, and imply a different demographic incidence of the lottery tax than previous studies suggest.

Scott, F. A., Jr. and O. D. Gulley (1995). "Testing for Efficiency in Lotto Markets." Economic Inquiry **33**(2): 175-188.

State-sponsored lotto games, because they are pari-mutuel and because jackpots with no winners are rolled over into the next drawing, present an excellent opportunity to test for market efficiency. Using data from Massachusetts, Kentucky, and Ohio, the authors investigate bettors' responses and test for weak-form efficiency. Lotto bets do not have positive net expected returns, thus weak-form efficiency exists. To evaluate strong-form efficiency, the authors utilize the concept of a rational expectations equilibrium. They find that, in general, lotto bettors' decisions to play generate a level of sales that conform to their original forecasts of expected value.

Seelig, M. Y. and J. H. Seelig (1998). "Place Your Bets! On Gambling, Government and Society." Canadian Public Policy **24**(1): 91-106.

This article outlines the major public policy issues in the renaissance of one of the oldest of human activities: gambling. It analyzes four factors which have shifted gambling from its role as a private pastime into the center of the Canadian public agenda: (i) the public sector's active participation in gambling both as a promoter of lotteries, casinos, and raffles, and as a regulator of those activities; (ii) addiction, crime, and other problems associated with gambling; (iii) gambling's rapid proliferation, which has made it a major factor in many provincial budgets; and (iv) the extent to which public goods, including cultural institutions and amateur sport, are funded through gambling. We examine where Canadian society is heading in terms of its reliance on gambling, present likely trends in gambling revenues and activities, and review the implications of youth gambling. The paper concludes with recommendations for further study and legislative action.

Shapira, Z. and I. Venezia (1992). "Size and Frequency of Prizes as Determinants of the Demand for Lotteries." Organizational Behavior and Human Decision Processes.

Shonkwiler, J. S. (1992). "A Structural Time Series Model of Nevada Gross Taxable Gaming Revenues." Review of Regional Studies **22**(3): 239-249.

Nevada gross taxable gaming revenues constitute an important revenue source for the state, just as revenues from lottery sales and taxable sales of service industries make major contributions to the general funds of other states. Typically, these data series are nonstationary and can exhibit periods of accelerating growth. The local linear, or stochastic, trend is proposed as an alternative to other time series methods such as the VAR approach. The inherent feature of the stochastic trend is that it provides a local approximation to a linear trend by allowing the level and slope to evolve over time according to a random walk mechanism. This type of structural time series model was used to forecast gaming revenues. It was found that forecasting performance exceeded that of a VAR model and that forecasts were adaptable to changing business conditions.

Shveitser, V. (1992). "Fighting Inflation with a Lottery: An Alternative Approach to Macroeconomic Stabilisation in Former Centrally Planned Economies." Communist Economies and Economic Transformation **4**(1): 151-155.

Siegel, D. and G. Anders (1999). "Public Policy and the Displacement Effects of Casinos: A Case Study of Riverboat Gambling in Missouri." Journal of Gambling Studies **15**(2): 105-121.

A critical issue in assessing the economic impact of casinos is whether gambling activity displaces consumer expenditure from conventional retail establishments. We test this hypothesis using industry-level, time series data for eleven counties in Missouri, a state that recently introduced riverboats. Our results are generally inconsistent with the displacement hypothesis. However, we do find evidence of substitution between gambling and other businesses in the entertainment and amusement sector. This conclusion lends credence to the view that gaming serves as a substitute for other forms of entertainment. Our results also imply that the search for displacement should probably be focused on activities that constitute the closest consumer substitutes. We conclude with a discussion of the policy implications for state regulation of this new source of revenue.

Siegel, D. and G. Anders (2001). "The Impact of Indian Casinos on State Lotteries: A Case Study of Arizona." Public Finance Review **29**(2): 139-147.

Simmons, S. A. and R. Sharp (1987). "State Lotteries' Effects on Thoroughbred Horse Racing." Journal of Policy Analysis and Management **6**(3): 446-448.

Simon, J. (1998). "An Analysis of the Distribution of Combinations Chosen by UK National Lottery Players." Journal of Risk and Uncertainty **17**(3): 243-276.

This paper is concerned with the behaviour of lottery players when they get to choose their own numbers. Most lotto players do not pick combinations at random, but prefer more idiosyncratic techniques when they fill in the play grid. This is highlighted when the actual distribution of combinations for a single draw in the UK National Lottery is examined. A new model of gambler choice is developed and specified, and the resulting distribution of combinations fitted to the empirical data. Various implications of the model are discussed, such as the expected value of lotto tickets for different types of players.

Siow, A. (1989). "Fixed Cost of Work and the Demand for Lotteries." Economics Letters **29**(4): 299-302.

A fixed cost of work is sufficient to induce risk-averse individuals, who obey the expected utility hypothesis, to demand lotteries. The critical assumption needed to generate this demand is that leisure is a normal good.

Skidmore, M. and M. S. Tosun (2008). "Do New Lottery Games Stimulate Retail Activity? Evidence from West Virginia Counties." Journal of Regional Analysis and Policy **38**(1): 45-55.

In this study we examine the impact of lottery sales and the introduction of new lottery games on the retail activity using panel data on all West Virginia counties over the 1987-2001 period. We find that the introduction of video lottery spurred retail activity in those counties that have been granted the authority to offer video lottery. Empirical analysis also suggests that there is a positive relationship between lottery sales and retail activity, and that generally the introduction of new lotteries or lottery games in neighboring states

reduced retail activity in West Virginia border counties.

Smith, D. J. (1987). "Risk-Efficient Lottery Bets?" Journal of Portfolio Management **14**(1): 25-28.

Spindler, C. J. (1995). "The Lottery and Education: Robbing Peter to Pay Paul?" Public Budgeting and Finance **15**(3): 54-62.

Despite the promises of some states to use lottery revenues to fund education, they may be guilty of robbing Peter to pay Paul. This study examines the question of revenue fungibility in the case of state lotteries. Using time-series analysis, the research suggests that education is not a big winner in state lotteries. Two different patterns of fungibility emerge from the analysis that are suggestive of underlying budgetary politics.

Spiro, M. H. (1974). "On the Tax Incidence of the Pennsylvania Lottery." National Tax Journal **27**(1): 57-61.

Sprowls, R. C. (1970). "On the Terms of the New York State Lottery." National Tax Journal **23**(1): 74-82.

Stanley, R. E. and P. E. French (2002). "An Empirical Assessment of Lottery Proceeds on Education in the American States." Chicago Policy Review **6**(1): 45-60.

State operated lotteries have recently been classified as panaceas for eradicating revenue disparities existing across public school districts in the American states. The research question posed in this study is as follows: "are state operated lotteries impacting per pupil expenditures in the American states?" The purpose of this research project is to empirically confirm these accusations for attributing credibility to this revenue-generating device because educational disparity portrays a grave injustice in the United States. Pooled time series cross sectional regression analysis is the methodological mechanism employed to test the data in this research project. This study suggests that state operated lotteries are not having the financial impact on education that many practitioners and scholars originally anticipated.

Stanley, R. E. and P. E. French (2002). "Lotteries, the American States and the Federal Government: A Formula For Perpetual Success or Inevitable Destruction in Education Policy?" Journal of Public Budgeting, Accounting and Financial Management **14**(1).

Lotteries have gained immense popularity for enhancing fiscal resources for social intervention programs such as education. However, the fiscal significance of lotteries for accomplishing educational equity across the American states has been empirically challenged. Much of the literature on lotteries suggests that financial reliance on state operated lotteries for educational embellishment may actually hinder the process of educational egalitarianism. Through pooled time series regression analysis this project intends to demonstrate that states earmarking lottery dollars for education are receiving fewer fiscal allocations for education from the federal government than states opting to by-pass adopting a lottery for education. The data for this project will include fourteen variables over a twenty-year period covering all fifty states. Due to the relatively small

amount of federal spending on education, (9 percent or \$38 billion) critics may argue that this project is limited because it fails to offer any real solutions for eradicating the fiscal burden of financing education across the American states.

Stanley, R. E. and P. E. French (2003). "Can Students Truly Benefit from State Lotteries: A Look at Lottery Expenditures Towards Education in the American States." Social Science Journal **40**(2): 327-333.

State operated lotteries are popular revenue generating devices used by many state governments to supplement per pupil education expenditures with "voluntary" tax dollars. States without lotteries are stipulating that gaming revenues offer a windfall of hope for per pupil funding disparities across the American states. This research suggests that most state operated lotteries are failing to meet policymaker's expectations as an alternative supplemental source of revenue for education.

Stark, S. R., R. C. Wood, et al. (1993). "The Florida Education Lottery: Its Use As a Substitute for Existing Funds and Its Effects on the Equity of School Funding." Journal of Education Finance **18**(Winter): 231-242.

Steinnes, D. N. (1998). "Have Native American Casinos Diminished Other Gambling in Minnesota? An Economic Answer Based on Accessibility." Regional Analysis and Policy **28**(1): 18-32.

Over the last decade Native American casinos have been more successful than most envisioned. In some states questions have been raised about social costs and lost sales tax revenues as a result of expenditures being transferred from taxable businesses to reservation casinos. This paper addresses the more specific concern of whether casinos have diminished other forms of gambling in Minnesota that are sources of tax revenue. A model is developed and tested based on accessibility to Native American casinos for the 87 counties of Minnesota. While Native American casinos are found to have adversely affected the lottery and charitable gambling in the state between 1988 and 1993, the diminution is less than two percent and, thus, inconsequential.

Stigler, G. J. (1971). "The Theory of Economic Regulation." Bell Journal of Economics and Management Science **2**(1): 3-21.

Stover, M. E. (1987). "Revenue Potential of State Lotteries." Public Finance Quarterly **15**(4): 428-440.

Stover, M. E. (1990). "Contiguous State Lotteries: Substitutes or Complements?" Journal of Policy Analysis and Management **9**(4): 565-568.

Stranahan, H. A. and M. O. Borg (1998). "Separating the Decisions of Lottery Expenditures and Participation: A Truncated Tobit Approach." Public Finance Review **26**(2): 99-117.

Based on Musgrave's traditional definition of horizontal equity, this paper estimates whether the lottery tax results in a differential tax burden by race, educational attainment, or age within households that have equal economic positions. A second question that is

addressed is whether lottery advertising intensifies any horizontal inequities that exist. Indeed, this study finds that, among individuals with otherwise identical characteristics, African Americans bear a significantly higher lottery tax burden. Other minority groups and individuals with the lowest educational attainment also bear a larger lottery tax burden, although the difference is not significant at the ten percent level. In addition, the results suggest that lottery advertising has its greatest impact on African Americans, thus intensifying the horizontal inequity of the lottery tax and resulting in a greater tax burden for African Americans as compared to identical Caucasians.

Stranahan, H. A. and M. O. Borg (2004). "Some Futures Are Brighter than Others: The Net Benefits Received by Florida Bright Futures Scholarship Recipients." Public Finance Review **32**(1): 105-126.

Using a choice-based sample of households in Florida, the authors provide new empirical evidence on the budgetary incidence of lottery-funded merit scholarships. Specifically, they estimate the benefits received from the Florida Bright Futures (FBF) scholarship and the lottery taxes paid for three typical households in Florida. They find that high socioeconomic (SES) households receive a net program benefit of almost \$2,200, whereas low SES households incur a net program loss of almost \$700. This result obtains because lower SES households tend to pay more in lottery taxes but are less likely to receive scholarships. Also, the lower SES households with members who do receive the FBF scholarship are more likely to receive the 75% partial scholarship (vs. the 100% full scholarship) than the higher SES households. The results indicate that lottery-funded merit scholarships redistribute income from lower income, non-white, and less educated households to higher income, White, well-educated households.

Stranahan, H. A. and M. O. M. Borg (1998). "Horizontal Equity Implications of the Lottery Tax." National Tax Journal **51**(1): 71-82.

Based on Musgrave's traditional definition of horizontal equity, this paper estimates whether the lottery tax results in a differential tax burden by race, educational attainment, or age within households that have equal economic positions. A second question that is addressed is whether lottery advertising intensifies any horizontal inequities that exist. Indeed, this study finds that among individuals with otherwise identical characteristics, African Americans bear a significantly higher lottery tax burden. Other minority groups and individuals with the lowest educational attainment also bear a larger lottery tax burden, although the difference is not significant at the ten percent level. In addition, the results suggest that lottery advertising has its greatest impact on African Americans, thus intensifying the horizontal inequity of the lottery tax, and resulting in a greater tax burden for African Americans as compared to identical Caucasians.

Suits, D. B. (1977). "Gambling Taxes: Regressivity and Revenue Potential." National Tax Journal **30**(1): 19-35.

Suits, D. B. (1979). "Economic Background for Gambling Policy." Journal of Social Issues **35**(3): 43-61.

Summers, S. R., D. S. Honeyman, et al. (1995). "An Examination of Supplantation and Redistribution Effects of Lottery Allocations To a Community College System." Journal of Education Finance **21**(Fall): 236-253.

Szakmary, A. and C. M. Szakmary (1995). "State Lotteries as a Source of Revenue: A Re-examination." Southern Economic Journal **61**(4).

This study extends earlier literature on the fiscal characteristics of state lotteries by examining the impact of lotto on revenue generation and by analyzing lottery revenues in a portfolio context. The authors find that the introduction of lotto results in a substantial one-time, permanent increase in lottery revenue. Contrary to conventional wisdom and implications in previous studies, they find that lotteries do not increase the volatility of overall state revenues because the high stand-alone variability of lottery income is offset by its low correlation with other revenue sources.

Terrell, D. (1994). "A Test of the Gambler's Fallacy: Evidence from Pari-mutuel Games." Journal of Risk and Uncertainty **8**(3): 309-317.

The "gambler's fallacy" is the belief that the probability of an event is decreased when the event has occurred recently, even though the probability is objectively known to be independent across trials. Clotfelter and Cook (1991, 1993) find evidence of the gambler's fallacy in analysis of data from the Maryland lottery's "Pick 3" numbers game. In the Maryland lottery, the payout to all numbers is equal at \$250 on a winning fifty-cent bet, so the gambler's fallacy betting strategy costs bettors nothing. This article looks at the importance of the gambler's fallacy in the New Jersey lottery's three-digit numbers game, a pari-mutuel game where a lower amount of total wagering on a number increases the payout to that number. Results indicate that the gambler's fallacy exists among bettors in New Jersey, although to a lesser extent than among those in Maryland.

Thaler, R. H. and W. T. Ziemba (1988). "Parimutuel Betting Markets: Racetracks and Lotteries." Journal of Economic Perspectives **2**(2): 161-174.

Thalheimer, R. and M. M. Ali (1995). "The Demand for Parimutuel Horse Race Wagering and Attendance." Management Science **41**(1): 129-143.

Thiel, S. E. (1991). "Policy, Participation and Revenue in Washington State Lotto." National Tax Journal **44**(2): 225-235.

The main result of this paper is to develop and exhibit a model of state Lotto sales, both for a single drawing and for the dynamic structure of the game as the jackpot accumulates. The main policy result is that a decision to reduce the odds of winning in an effort to generate more interest in Lotto will work whether or not the large jackpots change public attitudes about tickets. However, there is no clear way to choose among that and other revenue-enhancing measures.

Thompson, W. N. (1998). "Casinos de Juegos del Mundo: A Survey of World Gambling." Annals of the American Academy of Political and Social Science **556**: 11-21.

Legalized gambling is expanding throughout the world. There is considerable variation in

the patterns of gambling operations found in different places. This article examines the difference between the mass-marketed casinos of North America and the very restricted casinos of Europe. Explanations for the different styles are suggested. Casinos in other developed nations as well as in the less developed nations are also examined, as are lottery operations. It is suggested that the North American pattern, although appealing to entrepreneurs, will not soon be adopted in Europe or in any wide-spread way in other parts of the world.

Tosun, M. S. and M. Skidmore (2004). "Interstate Competition and State Lottery Revenues." National Tax Journal **57**(2): 163-178.

In this article we use data on lottery sales for all 55 counties in West Virginia over the period 1987-2000 to examine in a dynamic framework the determinants of lottery revenues. While we examine more generally the determinants of lottery revenues, we focus on the effects of the introduction of new neighboring state lottery games on West Virginia lottery revenue generating capabilities. Our findings indicate that border state competition is an important determinant of lottery sales. The introduction of new competing games within West Virginia also has significant effects on sales of traditional lottery games.

Vasche, J. D. (1985). "Are Taxes on Lotteries Too High?" Journal of Policy Analysis and Management **4**(2): 269-271.

Vasche, J. D. (1990). "The Net Revenue Effect of California's Lottery." Journal of Policy Analysis and Management **9**(4): 561-564.

Vaughan Williams, L. (2005). Semi-strong and Strong Form Information Efficiency in Betting Markets. Information Efficiency in Financial and Betting Markets. L. Vaughan Williams. Cambridge, Cambridge University Press: 123-155.

Vaughan Williams, L. (2005). Weak Form Information Efficiency in Betting Markets. Information Efficiency in Financial and Betting Markets. L. Vaughan Williams. Cambridge, Cambridge University Press: 84-122.

Vrooman, D. H. (1976). "An Economic Analysis of the New York State Lottery." National Tax Journal **29**(4): 482-489.

Walker, D. M. and J. D. Jackson (1999). "State Lotteries, Isolation and Economic Growth in the U.S." Review of Urban and Regional Development Studies **11**(3): 187-192.

This paper uses a Granger causality test adapted for use with cross-section time series data, to (1) test the relationship between lottery revenue and state economic growth (per capita income), and (2) address the importance of cross-border purchases in the relationship. Neither issue has been empirically tested previously. Previous evidence (Caudill, et al., 1995) suggests that states surrounded by lotteries are more likely than isolated states to introduce lotteries. But the empirical results here suggest that lotteries do not contribute to economic growth unless the state is isolated from other state lotteries.

The importance of isolation suggests that cross-border purchases (exports) of lottery tickets have a significant impact on the effectiveness of lotteries as fiscal policies, and that "defensive" lotteries (those introduced to keep citizens from buying tickets from neighboring states) are ineffective.

Walker, D. M. and J. D. Jackson (2008). "Do U.S. Gambling Industries Cannibalize Each Other?" Public Finance Review **36**(3): 308-333.

Many states facing recent fiscal crises have looked to legalized gambling in an attempt to ease fiscal constraints. Although there has been some research on the economic effects of gambling, no study has offered a comprehensive analysis of the interindustry relationships of lotteries, casinos, horse racing, and greyhound racing. In this article, we use seemingly unrelated regression (SUR) estimation to analyze the relationships among gambling industries in the United States. Our results indicate that some industries "cannibalize" each other (e.g., casinos and lotteries, and horse and dog racing), whereas other industries help each other (e.g., casinos and horse racing, dog racing and lotteries, and horse racing and lotteries). The study also examines the effects of adjacent-state gambling and a variety of demographic variables. This analysis provides a foundation for further research on how to optimize tax revenues from legalized gambling.

Walker, D. M. and J. D. Jackson (2011). "The Effect of Legalized Gambling on State Government Revenue." Contemporary Economic Policy **29**(1): 101-114.

Legalized gambling is an attractive option to state governments facing tightening fiscal constraints. Yet, the empirical evidence on the effect of gambling on state revenues is limited. Most studies examine a single industry in a single state, and for a relatively short period of time. This study provides a more general analysis of gambling industries and their effects on state revenues. We use data on gambling volume and state government revenues net of federal government transfers for all 50 states from 1985 to 2000. We find that lotteries and horse racing tend to increase state revenues, while casinos and greyhound racing tend to decrease state revenues.

Walker, I. (1998). "The Economic Analysis of Lotteries." Economic Policy **13**(27): 357-401.

Walker, I. (1998). "Lotteries: Determinants of Ticket Sales and the Optimal Payout Rate." Economic Policy: A European Forum **27**: 357-392.

Walker, I., K.-G. Lofgren, et al. (1998). "The Economic Analysis of Lotteries." Economic Policy **13**(27): 359-392.

Walker, I. and J. Young (2001). "An Economist's Guide to Lottery Design." Economic Journal **111**(475): 700-722.

This paper outlines the issues relevant to the design of pari-mutuel lottery games and makes inferences about game design effects from estimates of how rollovers affect sales. Lottery tickets sales depend positively on the proportion of revenue returned as prizes, positively on the skewness of the prize distribution (which depends largely on how much

of the prize money goes to the jackpot), and negatively on the variance in the prize distribution (which depends largely on how much goes on smaller prizes). We simulate the effects of envisaged game design changes on sales revenue and find potentially large effects.

Wan, J. (2010). "The Incentive to Declare Taxes and Tax Revenue: The Lottery Receipt Experiment in China." Review of Development Economics **14**(3): 611-624.

Indirect tax such as sales tax collection is difficult as the government has difficulty monitoring the actual economic dealings. To bring out private information on transaction only known to a firm and a consumer, China's government has set up a lottery receipt system which has been tried out in many areas. This paper empirically examines the validity of this new system. Estimation is performed based on panel data for different periods during 1998-2003 from a total of 37 districts in Beijing and Tianjin. It is found that the lottery receipt experiment (LRE) has significantly raised the sales tax and the growth of sales tax and total tax revenues.

Wang, J.-H., L. Y. Tzeng, et al. (2006). "Willingness to Pay and the Demand for Lotto." Applied Economics **38**(10): 1207-1216.

Why do many bettors participate in an unfair gamble, in particular a lotto game, while at the same time purchase insurance? The willingness-to-pay for lotto is analysed to find a 'rational' explanation for a (local) risk-averter's participation in an unfair bet. A reasonable case is found where bettors' preference can be approximately characterized as a locally risk-averse and sufficiently prudent cubic function. Such bettors dislike risk but prefer standard third moment of the payoff. The result suggests that the traditional effective price for lotto demand may omit important explanatory variables. We thus propose an alternative method to examine the demand for lotto by incorporating the second and the third moments of lotto's payoff. Evidence from Taiwan Lotto data supports that lotto bettors could be both (locally) risk-averse and rational.

Wang, J.-S. and M.-Y. Lin (2006). "Number Selection Strategy of Lottery Players: An Empirical Study of the Taiwan Lottery." Taiwan Economic Forecast and Policy **37**(1): 49-67.

This paper focuses on the change in the selection behavior of lottery players in Taiwan. First, we test the structural change in the time series of the sales to find the break point of the selection strategy. By estimating a generalized rollover probability function set by Scoggins (1995), we indicate that the lottery players initially pick numbers by way of conscious selection and later change their behavior to random selection. The results also show the demand elasticity under conscious selection is significantly larger than that under random selection, and both are larger than 1.

Warneryd, K.-E. (1996). "Risk Attitudes and Risky Behavior." Journal of Economic Psychology **17**(6): 749-770.

In economic theory, risk aversion is a characteristic of the typical utility function of money. Observations of how people deal with risks in real life have cast some doubts on the prevalence of risk aversion. People buy insurance, but they also gamble and take investment risks. Many of the conclusions in the discussions of utility derive from

experiments employing some kind of lottery choices. While the experiments have given interesting ideas for theory, there has been little testing of the extent to which the obtained measures of risk attitudes correlate with actual behavior. Data from the VSB panel were used to answer three questions: (1) Can hypothetical risky choice questions be meaningfully answered by ordinary survey respondents? (2) What are the relationships between different measures of risk attitudes and actual portfolio choices of risky assets? (3) What is the relationship between risk attitude and playing in lotteries, lotto, etc.?

Watson, R. D. (1973). "Lotteries: Can the Public and State Both Win?" Federal Reserve Bank Business Review of Philadelphia: 3-11.

Weinbach, A. P. and R. J. Paul (2008). "Running the Numbers on Lotteries and the Poor: An Empirical Analysis of Transfer Payment Distribution and Subsequent Lottery Sales." Atlantic Economic Journal **36**(3): 333-344.

State lottery revenues are shown to increase during the week transfer payments are distributed. The timing of the increase in lottery purchases suggests a portion of the transfer payments is used to purchase lottery tickets. In addition to providing information on the timing of lottery purchases, this study finds sales of Pick 3 and Pick 4 tickets increase during the period, while sales of Pick 5 and Pick 6 games do not, suggesting a general preference for the relatively higher probability, smaller jackpot games for the group.

Whitaker, R. B. (2007). "Three Perspectives on Government Run Lotteries: State Lotteries and Agency Costs: Hidden Costs to Nonparticipants." American Journal of Economics and Sociology **66**(3): 533-544.

Some nonparticipants support lotteries because they expect the lottery will shift a portion of their tax burden to participants. The principal-agent model suggests that lotteries will result in an above normal increase in state expenditures. This paper finds that 77 percent of net lottery proceeds are utilized for above normal spending increases, suggesting that tax benefits to nonparticipants are greatly diminished.

Wilcox, N. T. (1993). "Lottery Choice: Incentives, Complexity and Decision Time." Economic Journal **103**(421): 1397-1417.

This paper reports the results of an experiment on lottery choice in which decision cost is measured as decision making time. A simple decision cost model motivates this measurement and the experiment, and predicts relationships between incentive mechanism manipulations and decision making time which are borne out in the experiment. The decision cost model also suggests that decisions will change in the face of the incentive manipulations in the experiment. This suggestion is borne out in a complex decision-making environment, but not in a simple one. Specification tests demonstrate that observed changes in subjects' behavior are not merely due to changes in subject-specific error variance. One may conclude from this that the 'payoff dominance' problem is a real issue in complex decision making experiments.

Williams, R. J. and R. T. Wood (2007). "The Proportion of Ontario Gambling Revenue Derived

from Problem Gamblers." Canadian Public Policy **33**(3): 367-387.

The proportion of gambling revenue derived from problem gamblers is an important issue when considering the appropriateness of government-sponsored gambling. Figures obtained from prior research are tentative due to methodological problems and the mismatch between reported expenditures and actual gambling revenue. Using improved methods for assessing the prevalence of problem gambling and the accuracy of self-reported gambling expenditures, the present study estimates that the 4.8 percent of problem gamblers in Ontario in 2003 accounted for approximately 36 percent of Ontario gambling revenue. This proportion varied as a function of game type, with a lower proportion for lotteries, instant win tickets, bingo, and raffles, and a higher proportion for horse racing and slot machines.

Wisman, J. D. (2006). "State Lotteries: Using State Power to Fleece the Poor." Journal of Economic Issues **40**(4): 955-966.

Weakening of religious and moral opposition to government supported gambling has permitted the development and rapid expansion of state lotteries over the past four decades, yielding a growing new source of state revenues. This article examines why state lotteries are disproportionately played by the financially less well off. It finds that low payouts mean that state lotteries serve as highly regressive taxes, violating the principle of vertical equity. They also violate the principle of horizontal equity--equal treatment of equals. While fueling an ideology of equal opportunity, state lotteries make a mockery of the freedom they pretend to celebrate. The rise of state lotteries fits into the general shift in political power that has led to government measures that augment increasing inequality in income, wealth, and privilege in the United States.

Wohlenberg, E. H. (1992). "Recent U.S. Gambling Legalization: A Case Study of Lotteries." Social Science Journal **29**(2): 167-184.

Worthington, A., K. Brown, et al. (2007). "Gambling Participation in Australia: Findings from the National Household Expenditure Survey." Review of Economics of the Household **5**(2): 209-221.

Regression modeling is used to predict gambling patterns in Australia on the basis of the unit record files underlying the Australian Bureau of Statistics' Household Expenditure Survey of 6,892 households. The four largest categories of gambling expenditure are examined, namely: lottery tickets, lotto-type games and instant lottery (scratch cards), TAB (pari-mutuel wagering) and related on course betting, and poker (slot) machines and ticket machines. Determining factors analyzed include the source and level of household income, family composition and structure, welfare status, gender, age, ethnicity and geographic location. Apart from the determinants of expenditure varying widely across the different types of gambling activity, the results generally indicate that the source of household income is more important than the level of income and that household composition and regional location are likewise significant in determining gambling expenditure.

Wu, R. Y. (1979). "A Cross-Section Study on the Demand for State Lottery Tickets." American

Economist **23**(2): 6-12.

One basic economic issue concerning lotteries and other forms of gambling activities is "Who participates, why, and how much?" In the literature, there are several competing hypotheses which give utility interpretations on the question "why". These hypotheses also have their implications for the questions "who" and "how much." The purpose of this study is to establish some quantitative relationships between the consumer's demand for lottery tickets and his social, economic characteristics by analyzing a sample collected in the Baltimore area. These relationships will help us to test the alternative hypotheses on why people buy lottery tickets, and to identify the factors which determine who purchases lottery tickets and how many tickets he purchases.

Ziembra, W. T., S. L. Brumelle, et al. (1986). Dr. Z's 6/49 Lotto Guidebook. Vancouver, Dr. Z's Investment, Inc.