George C. Fearon
P. O. Box 1
Union Springs, NY 13160

Franklin Keel, Regional Director
Eastern Regional Office
Bureau of Indian Affairs
545 Marriott Drive, Suite 700
Nashville, Tennessee 37214

"DEIS Comments, Cayuga Indian Nation of New York Trust Acquisition Project"

Mr. Franklin Keel:

I am a Cayuga County Legislator representing the towns of Ledyard, Scipio and Springport. I live in the Town of Springport.

In section 3.8 G, the DEIS claims, "The Nation's LakeSide Trading and LakeSide Entertainment operations at its Seneca Falls and Union Springs properties generate economic activities that benefit the counties, and the state of New York, as a whole."

This DEIS claim is false. The direct changes projected in area employment and spending did not take into account the negative impact of lost jobs and spending in the two counties caused by unfair competition from Cayuga Indian Nation enterprises. Many competing businesses have experienced sales losses, or, in some cases, such as in Union Springs, have actually gone out of business completely. To be legitimate the DEIS would need to address all positive and negative aspects of Cayuga Indian Nation enterprises and report the real gain or loss.

LakeSide Trading in both Cayuga and Seneca counties replaced businesses that were already in place before being purchased by the Cayuga Indian Nation. Therefore, the jobs currently reported are not new jobs in the two counties.

The DEIS states, "Because the Nation is a sovereign tax-exempt entity, no sales taxes are paid on the Nation's purchases or collected on sales made by the Nation." Several United States Supreme Court decisions in the last three decades confirm that such taxes are applicable when sales are made to non-Indians.

The DEIS states that the gaming operations in Union Springs and in Seneca County have been "closed temporarily" and are "therefore not considered in the analysis of the current effects of the Nation's business activities." The Cayuga Indian Nation could easily expand its temporarily closed gaming facility in Union Springs countless times in the more than one hundred adjacent, undeveloped acres in Union Springs.

The Cayuga Indian Nation's application for land in trust states their intent to reopen gaming operations in both counties. I believe that the DEIS is grossly deficient for not analyzing the effects of gaming operations that were in place and that are intended to be re-established. It is a gross deficiency that the DEIS does not address any potential expansions of land in trust or expansions of the use of such lands by

the Cayuga Indian Nation. When something is set up that is supposed to last forever, valid projections must use mote than past and present data. For the DEIS to be valid, it is imperative that projections are made regarding likely and expected future expansion of land in trust and the effects of expansion of the uses of such lands.

Research conducted by economists not underwritten by the gambling industry itself concludes that gaming has a negative effect on the general economy. Such research done by noted, unbiased economists concludes that the social costs are at least 1.9 times greater than the benefits. The DEIS fails to take into account any negative financial and social aspects of gaming. Failure to address such matters distorts the conclusions made in the DEIS.

Attached are three appendices of research done by noted economists who received no funding from the gaming industry. Consider the entire text of each appendix a part of my submission to the BIA.

Appendix #1

Grinols, Earl L., and David B. Mustard. "Business Profitability Versus Social Profitability: Evaluating Industries with Externalities, The Case of Casinos." Managerial and Decision Economics 2001: 143-162. 20 June 2009 <http://www.terry.uga.edu/~mustard/profitability.pdf>.

Appendix #2

Grinols, Earl L., David B. Mustard, and Cynthia Hunt Dilley. Casinos, Crime, and Community Cost. June 2000. 20 June 2009 <http://www.uspact.org/Grinols-Crime2004.pdf>.

Appendix #3

Grinols, Earl L., and David B. Mustard. Measuring Industry Externalities: The Curious Case of Casinos and Crime. March 2001. 1-35. 20 June 2009 <http://casinofacts.org/casinodocs/Grinols-Mustard-Casinos_And_Crime.pdf>.

The most comprehensive study of the economic costs and benefits of gambling in America may be found in the following:

Grinols, Earl L. Gambling in America Costs and Benefits. New York: Cambridge University Press, 2004.

The validity of FEIS could be greatly improved over the DEIS if it took into account the research results reported in this book. I am not submitting a copy of this book. For the record, consider the above title, in its entirety, to be part of my submission.

Recommendation:

Speaking for myself as an individual and also representing the towns of Ledyard, Scipio and Springport in the Cayuga County Legislature:
For each and/or any of the foregoing reasons, I hereby recommend that *ALTERNATIVE 2: NO ACTION* be taken.

Under this alternative, the BIA would take no action, and the Nation's properties would not be taken into trust by the United States.

George C. Fearon
P.O. Box 1
Union Springs, New York 13160

Appendix #1

Grinols, Earl L., and David B. Mustard. "Business Profitability Versus Social Profitability: Evaluating Industries with Externalities, The Case of the Casinos." Managerial and Decision Economics 2001: 143-162. 20 June 2009 <http://www.terry.uga.edu/~mustard/profitability.pdf>.

MANAGERIAL AND DECISION ECONOMICS
Manage. Decis. Econ. **22:** 143–162 (2001)
DOI: 10.1002/mde.1004

Business Profitability versus Social Profitability: Evaluating Industries with Externalities, The Case of Casinos

Earl L. Grinols[a,*] and David B. Mustard[b,*]

[a] *Department of Economics, University of Illinois, USA*
[b] *Department of Economics, Terry College of Business, University of Georgia, USA*

Casino gambling is a social issue, because in addition to the direct benefits to those who own and use casinos, positive and negative externalities are reaped and borne by those who do not gamble. To correctly assess the total economic impact of casinos, one must distinguish between business profitability and social profitability. This paper provides the most comprehensive framework for addressing the theoretical cost–benefit issues of casinos by grounding cost–benefit analysis on household utility. It also discusses the current state of knowledge about the estimates of both the positive and negative externalities generated by casinos. Lastly, it corrects many prevalent errors in the debate over the economics of casino gambling. Copyright © 2001 John Wiley & Sons, Ltd.

INTRODUCTION

Between 1990 and 1998, commercial casino revenues increased from $8.7 billion to over $22.2 billion, or 156%.[1] The number of counties with casinos rose from 26 to almost 200 in the same time. Including Class III American Indian casinos,[2] casino revenues totaled $29.5 billion in 1998, representing expenditures of $153 per adult aged 20 or over.

The rapid expansion of casinos to new parts of the country generated extensive debates about the impact of casinos on a range of social, economic, and political issues.[3] These concerns were sufficiently pronounced to cause Congress to establish the National Gambling Impact Study Commission (NGISC) in 1996 to conduct an exhaustive study of the impact of casinos.[4] At the conclusion of its investigation, the commission recommended a national moratorium on the expansion of gambling and more study of gambling's effects, costs and benefits, before making further decisions about it.

The literature on the costs and benefits of casino gambling is fraught with inadequacy and confusion. Even studies that purport to evaluate the economic impact of casinos commonly exhibit a great deal of misunderstanding about what should be included among benefits and costs, and provide little or no guidance about how the costs and benefits relate to one another or should be computed. Many studies pay a great deal of attention, for example, to estimating the number of direct and indirect jobs that casinos create and to tallying the taxes casinos pay, but do not explain the social value of an additional job or calculate the lost taxes of competing non-casino businesses.[5] In general, the costs and benefits discussed are casually listed, vary by study, and are commonly presented with little or no justification of how they were selected or why other potential costs and benefits were excluded.

A recent paper, Eadington (1999), is instructive. It identified three principal benefits of casinos: (1)

* Correspondence to: [a]Department of Economics, University of Illinois, 1206 S. 6th Street, Champaign, Illinois 61820. E-mail: grinols@uiuc.edu; [b]Department of Economics, Terry College of Business, University of Georgia, 528 Brooks Hall, Athens, Georgia 30602. E-mail: mustard@terry.uga.edu

gain in utility (for those gambling in moderation for entertainment), (2) ancillary economic benefits such as 'job creation, investment stimulation, tourism development, economic development or redevelopment, urban or waterfront revitalization, or the improvement of the economic status of deserving or underprivileged groups', and (3) additional revenues to the public sector. He lists two principal costs: (1) 'moral disapproval' and (2) 'fears of adverse social impacts', such as pathological gambling, crime, or political corruption. The net increase in profits to business, unless this is meant to be part of ancillary economic benefits, is absent from the list of benefits.[6] Although Eadington lists gain in utility (clearly internal to the individual or household) as a benefit, he writes that 'many of the costs identified are internal to the individual or the household, as opposed to external—borne by society—and are therefore difficult to place into a cost/benefit framework'. This view of costs (including the references to moral disapproval and fears of consequences instead of the actual consequences) suggests that the author believes costs are more subtle and possibly less tangible than benefits. However, because the process to determine how items are included is not explained, there is little theoretical guidance about how the identified cost–benefit components relate to one another in an overall assessment of the impact of casinos or how competing costs and benefits are reconciled. We will show how cost–benefit components based on utility can be placed into the evaluation framework.

To bring uniformity and more theory to bear on the cost–benefit treatment of casinos, this paper demonstrates the construction of an exhaustive and utility-grounded framework to identify costs and benefits. It outlines an explicit taxonomy for costs and benefits based on the principle of real resource use, and reviews the available studies that contain original research estimating one or more cost–benefit components. Although the primary purpose of this paper is to rectify theoretical cost–benefit reasoning as it applies to casinos, the methodology applies more generally to the evaluation of projects in other industries. We also review existing empirical estimates of the costs and benefits of casinos arranged according to the theoretically grounded principles. Unfortunately, there has been relatively little research on many of the most important social cost–benefit components, while much of research has examined less significant issues or issues that are not even part of a properly defined analysis of social costs and benefits. Some research that purports to evaluate costs or benefits actually examines local and not total social costs or benefits. Another concern is that much of the research has been conducted by organizations with a vested interest in the outcome of the research, institutes with industry ties, or state agencies. Relatively little research is in peer-reviewed journals. A review of the empirical literature that estimates correctly defined components of social costs and benefits indicates that the costs of casinos are at least 1.9 times greater than benefits.

The remainder of the paper is arranged as follows. The next section constructs a theoretical cost–benefit measure based on economic fundamentals. The third and fourth sections examine the social benefits and costs of casino gambling, respectively. The fifth section concludes by summarizing our contributions and outlining the implications of this work for future research.

THEORY

Linking Cost–Benefit to Utility

In this section, we lay out the foundations of cost–benefit analysis for casino gambling. To avoid the mistakes that have plagued cost–benefit analyses, especially confusion about what can be included on each side of the cost–benefit ledger and how each item should be computed, we start from the most fundamental cost–benefit concept possible—individual utility. The framework we employ can be as comprehensive and general as desired, although our objective is to provide just enough detail to include all of the major elements commonly considered relevant to the economic effects of gambling and enough explanation to indicate what would change in a more detailed application of the framework.

Our starting point is the change in the individual's utility, $u^1 - u^0$, where superscripts distinguish utility in two situations. In one, casinos are widespread geographically (alternative 1) and in the other, casinos are less widely spread (alternative 0). We assume that $u(x)$ is a continuous utility function representing locally non-satiable preferences defined on consumption $x \in R^n$. A positive element of x denotes consumption of a good or service, while a negative component stands for the

provision of a good or service.[7] For example, the provision of 10 hours of labor by the individual would appear as -10 in the labor component of x. We define the expenditure function $e(d, p, u)$ as the minimum expenditure needed to achieve utility u when the consumer buys and sells at prices p, and d is the distance to the nearest casino. It is strictly monotonic in u for any choice of fixed d and p. The sign of $e(d^1, p^1, u^1) - e(d^1, p^1, u^0)$ is, therefore, identical to the sign of $u^1 - u^0$. In other words, for fixed distance and prices d and p, $e(d, p, u(x))$ is a utility function whose natural money metric records utility in dollars.[8]

We compare the social welfare between the two situations. We presume for simplicity that gambling is a standardized good; casinos offer gambling on essentially the same terms as casinos in other locations.[9] The primary advantage to the consumer of more casinos, therefore, is closer proximity to the nearest one. Let d_i^1 be the distance to the nearest casino for consumer i in the post casino alternative 1. Our measure of social profitability is the change in welfare for all consumers

$$\Delta W = \sum_i w_i[e_i(d_i^1, p_i^1, u_i^1) - e_i(d_i^1, p_i^1, u_i^0)],$$

where $\Sigma_i w_i = m$, and m is the number of consumer households. Equation (1) allows for different weights for dollar gains to different households, a topic to which we will return below. However, in applying (1) to produce a working measure of social profitability, we explicitly address many issues left unspoken in some studies and that are a source of confusion in others. The initial model provides the simplest framework for analyzing the impact of casinos. We list our assumptions at the outset for clarity.

- We assume that a dollar of utility to one household is equal to a dollar of utility to another.[10] With respect to Equation (1) this implies that $w_i = 1$ for all households. It also means that firm profits do not need to be assigned artificial premia or discounts based on which individuals or households happen to own them.
- Firm profits are equally important to social welfare regardless of which firm generates them. For example, casino profits are valued the same as the profits of a non-casino firm.
- To allow for regional tax differences, consumers and firms may face different prices. In the limit, each firm and household could have a different, personalized set of prices. Household i faces price vector p_i, firm j faces price vector p_j, and endowments are traded at prices p_Ω.
- We allow for the possibility that consumers may be constrained in their labor supply decisions, resulting in unemployment. People have a reservation wage but cannot always find a job at that wage, and lowering their wage will not increase the chances of their getting a job.
- Firms and economy endowments are owned by households. Household i owns share θ_{ij} of firm j, $\Sigma_i \theta_{ij} = 1$ and endowment $\Omega_i \in R_+^n$, where $\Sigma_i \Omega_i = \Omega$, the economy endowment vector.
- The government spends tax revenues to purchase goods and services, and private households receive utility from these expenditures. To implement this assumption, we employ the artificial device of having the government return tax dollars to households in a lump-sum fashion. Households then spend the transfers as part of their income and experience utility gains based on their purchases.
- In addition to direct benefits and costs, casinos may generate positive or negative externalities. Positive externalities add value to the economy not reaped by the agent creating them, while negative externalities remove value not paid by the causing agent, following the usual definition. For example, if a casino's presence reduces crime in an area, leading to less need for police presence, this frees real resources to the rest of the community and represents a positive externality. If the reverse is true, and the casino increases the need for police, real resources are removed from final consumption x, and this is a negative externality. The third and fourth sections discuss the nature of benefits and costs in more detail. The net resources gained or lost to the system are denoted by g. If $g > 0$ negative externalities outweigh positive externalities, which decrease the resources available for consumption x, and thereby lower social welfare. Social cost accounting in real terms requires

$$x + g = y + \Omega + z,$$

where $x \equiv \Sigma_i x_i$ is aggregate consumption, and $y \equiv \Sigma_j y_j$ is aggregate production. For each

firm j, y_j is the associated production vector[11]; z is the economy trade vector.[12]

The above remarks provide the simplest framework that is sufficiently inclusive to discuss an economy's social costs and benefits of gambling.

Application

Consider now the following carefully chosen identity, a telescoping sum where each term cancels part of the preceding term.

$$\sum_i [e_i(d_i^1, p_i^1, u_i^1) - e_i(d_i^1, p_i^1, u_i^0)] =$$

$$\sum_i [e_i(d_i^1, p_i^1, u_i^1) - p_i^1 \cdot x_i^1] \quad (2.1)$$

(Consumption Constraints in Situation 1)

$$+ \sum_i [p_i^1 \cdot x_i^1 - p_i^0 \cdot x_i^0] \quad (2.2)$$

(Income Effects)

$$+ \sum_i [p_i^0 \cdot x_i^0 - e_i(d_i^0, p_i^0, u_i^0)] \quad (2.3)$$

(Consumption Constraints in Situation 0)

$$+ \sum_i [e_i(d_i^0, p_i^0, u_i^0) - e_i(d_i^1, p_i^0, u_i^0)] \quad (2.4)$$

(Distance Benefits)

$$+ \sum_i [e_i(d_i^1, p_i^0, u_i^0) - e_i(d_i^1, p_i^1, u_i^0)] \quad (2.5)$$

(Consumer Surplus)

Expression (2.1) measures the welfare impact of constraints on the consumer's choice that prevent him from being at his optimal bundle given the prices he faces. The primary example of this kind of constraint is unemployment. $e_i(d_i^1, p_i^1, u_i^1)$ by definition is the *least* costly way of achieving the utility achieved in situation 1. Consumption bundle x_i^1 satisfies $u^1 = u(x_i^1)$ and also achieves utility u^1. Because choice of x_i^1 was constrained (in the case of unemployment, by the consumer's ability to supply labor), it will lead to a greater expenditure than $e_i(d_i^1, p_i^1, u_i^1)$. Therefore, the difference in expression (2.1) is the amount of money the individual would be willing to pay to remove the constraint. The same argument applies to expression (2.3) in situation 0.

Expression (2.4) measures the value to the consumer of having the nearest casino distance d_i^1 away compared to distance d_i^0. For example, in the initial situation the consumer needed $e_i(d_i^0, p_i^0, u_i^0)$ to reach initial utility. When the nearest casino is closer, distance $d_i^1 < d_i^0$, the income needed to maintain original utility, $e_i(d_i^1, p_i^0, u_i^0)$, is smaller (presuming the individual gambles). The difference in expression (2.4), therefore, is the amount the consumer would be willing to pay to have the nearest casino closer.

Expression (2.5) is the conventional measure of consumer surplus. The only difference between the two terms in the expression is the price vector. If prices p_i^1 are better for the household than prices p_i^0 (lower for goods purchased and/or higher for goods sold, such as labor), then expression (2.5) is positive and measures the amount of money the consumer would be willing to give up to have the better set of prices.

Now examine expression (2.2). Use the household budget identity

$$p_i \cdot x_i = \sum_j \theta_{ij} \Pi_j + p_\Omega \cdot \Omega_i + T_i - E_i \quad (3)$$

to transform the income effects in (2.2) where Π_j is the profit of firm j, $p_\Omega \cdot \Omega_i$ is earning from the household's endowment, T_i is the household's share of taxes, and E_i is the household's share of the cost of gambling-induced externality expenditures. Summing (3) over households and differencing between the initial and final situations[13] yields

$$\sum_i [p_i^1 \cdot x_i^1 - p_i^0 \cdot x_i^0] = \sum_j \Delta\Pi_j \text{ (}\Delta\text{Profits)}$$

$$+ \Delta p_\Omega \cdot \Omega \text{ (Endowment Capital Gains)}$$

$$+ \Delta T \text{ (}\Delta\text{Taxes)} - \Delta E \text{ (}\Delta\text{Externality Costs)} \quad (4)$$

Substituting (4) into (2); writing the distance effects in differential form and rearranging gives the taxonomy of cost–benefit elements that we seek:

$$\sum_i [e_i(d_i^1, p_i^1, u_i^1) - e(d_i^1, p_i^1, u_i^0)] \equiv \Delta W =$$

$$\sum_j \Delta\Pi_j + \sum_i \int_{d_i^0}^{d_i^1} \frac{\partial e_i}{\partial d_i} dd_i + \Delta T - \Delta E$$

$$+ \text{Consumption Constraints} + \Delta p_\Omega \cdot \Omega$$

$$+ \sum_i [e_i(d_i^1, p_i^0, u_i^0) - e_i(d_i^1, p_i^1, u_i^0)], \quad (5)$$

where 'Consumption Constraints' is the sum (2.1) + (2.3).

The seven components in Equation (5) are an exhaustive, exact tabulation of the cost–benefit

elements for evaluating the economic effects of casinos. Moreover (5) shows precisely *how* each term should be computed theoretically. For example, the effect of casino gambling on firm profits should be summed over *all* firms, not just casinos. The increased profits of the casinos should be netted against lost profits of other firms that compete for consumer spending. Comparable statements apply to the computation of employment benefits and costs, taxes, and social costs.

There is one obvious simplification we can make to (5). Because gambling industry revenue (casinos, lotteries, racetracks and other forms of gambling) is relatively small,[14] it will have a negligible effect on creating capital gains or losses on endowments. It is unlikely that the cost of capital, for example, will differ because of the presence or absence of casinos in the economy. A similar statement applies to consumer surplus effects that depend on gambling to influence overall prices.[15] Therefore, for the remainder of the paper we assume that firm and household prices are invariant to the amount of gambling ($p_i^0 = p_i^1$, $p_j^0 = p_j^1$, $p_\Omega^0 = p_\Omega^1$), which means that the last two terms in Equation (5) related to capital gains on endowments and consumer surplus gains and losses drop out.

Conceptual Corrections

Equation (5) allows us to address some common errors and misconceptions of cost–benefit analysis applied to gambling.

The first error is the tendency to identify business profitability, $\Sigma_j \Pi_j$, and its improvement, $\Sigma_j \Delta\Pi_j$, with social profitability. The two are different. Business profitability is clearly important to social profitability and contributes to it, but the two are not synonymous. Failure to account for all of the components of social profitability is perhaps the most common mistake. Casino profits are visible and prominent. Other costs and benefits may be less so.

The second error is to evaluate the economic impact of gambling with respect to the taxes and profits of a subset of firms—typically the profits of firms in one state or region and sometimes the profits of local gambling firms only. Equation (5) sums profits over all firms, not just casinos or firms in one location. Ignoring firms that lose profits due to the expansion of gambling is equivalent to selecting weights for them in Equation (1) that are zero. Because households own these other firms, this violates the assumption that households are treated equally.

The third is to consider only the taxes of a subset of households or regions. It is not uncommon, for example, for studies to focus only on costs within the state, even though casinos that border another state have ramifications for citizens of the neighboring jurisdiction. Equation (5) sums taxes over *all* households and regions.

Evaluations that consider only the costs or benefits of a subset of households or regions are inaccurate and incomplete. For example, the cost–benefit measure in (5) does not treat a job in a given location as more valued than a job in another location. Many economic impact studies perform regional net export multiplier analyses of the effects of casinos. They erroneously report the number of jobs in a given location as a benefit. According to (5) the value of employment in one location (part of the determination of firm profits) must be netted against the value of employment in another location. There is no net gain to the economy from shifting a job from one location to another unless it increases profits to the economy.[16]

The last common error is that much empirical work purports to show casinos decrease unemployment, but fails to prove what employment *would have been* in the absence of casinos. Most casinos were introduced after 1991, when the country was recovering from the recession of 1990–1991. The period from 1991 to 2000 also coincided with the longest economic expansion in American history. As the country emerged from the recession, unemployment declined in areas with and without casinos. If casinos *temporarily* reduced unemployment faster than it would have fallen otherwise, this transitory effect could correctly be counted as a benefit of casinos. However, we know of no study that has made this case. On the contrary, the failure to account for the decline in unemployment that would have occurred anyway leads to a classic *post hoc, ergo propter hoc* fallacy of logic. For a more detailed example, see Appendix A, which discusses The Evans Group (1996). Although it argued that casinos reduced unemployment, it did not report that areas without casinos with comparable starting unemployment rates experienced comparable, and in many cases, larger reductions in the unemployment rate.

BOUNDING BENEFITS

This section reviews the studies that estimate the benefits from casinos based on the theoretically correct cost–benefit computation in Equation (5). We discuss in order the net increase in firms' profits plus taxes paid due to the presence of casinos, the consumer distance benefits of nearer casinos, employment benefits and total benefits from the expanded gambling opportunities.

Profits and Taxes

This benefit is calculated by determining the casino profits and taxes minus the reduction in profits and taxes of other businesses caused by casinos. Although casino profits and taxes are highly visible, they are invalid measures of *social* benefits because they do not adjust for the entire economy for the lost profits and taxes of competing businesses. This point is not special to casinos. Any business—be it Wal-Mart or a drugstore chain, that attracts consumer sales, employs labor and other inputs, and displaces competing businesses—should be evaluated on the same basis.

Because many casinos do not have to report their profits or pay taxes (for example, casinos owned by American Indian tribes), there are no data on industry profits. However, we can estimate revenues from annually published information. We provide a brief overview of casino gambling in the US before estimating the benefits.

Table 1 reports total and per capita gambling revenue.[17] For comparison, we provide data on the tobacco industry.[18] Many studies estimate potential casino revenues using the amount of gambling per person in areas where casino gambling is a prominent activity. For example, the City of Chicago Gaming Commission funded a study (Deloitte and Touche, 1992) that reported that adults within 35 miles of Atlantic City lost $198 per adult annually to casinos. Adjusted for eight years of price changes, this figure is approximately $230. In its study, the Mirage Hotel (1993) estimated that annual per capita gambling revenues for persons residing within a 50-mile radius of its proposed Chicago suburb gambling facility would be $200.[19] In Iowa, in 1995, a Christiansen and Cummings Associates study for the state Racing and Gaming Commission found that the average adult lost $172 to the casinos (this figure is lower than $230 because casinos are still not in close proximity to all parts of Iowa). These data are comparable to revenue for other areas.

In addition to averages we are interested in the concentration of gambling among users. Many studies examined gambling markets in different locations and at different times. Taken together, they provide a general estimate of how frequently residents gamble. In a market with readily available gambling opportunities including casinos, approximately 30% of the population does not gamble, meaning that they will not have gambled in the past year.[20] Another 50–60% could be termed light bettors, who gamble less than once per week. This group includes those who enjoy a night out at the casino once in a while, but do not frequent casinos. About 5–15% could be termed heavy bettors who gamble twice per week or more. The last 2–5% of the population consists of problem and pathological (P&P) gamblers, who suffer from compulsive gambling disorders, which are expressed when the opportunity to gamble is present and sufficient time has elapsed for the problem to become evident. This group might be in the casino daily, for long periods of time, and at unusual hours. Two-thirds to 80% of gambling revenues come from the 10% of the population that gambles most heavily.[21] Expressed in reverse, 90% of the population may provide as little as 20% of casino revenues. Consequently, the great majority of adults are indifferent, or nearly indifferent, to the availability of casino gambling. Although the average American adult loses

Table 1. The Casino Market

	Casino gambling revenues per adult ($)	All gambling revenues per adult ($)	Total revenues ($)	All gambling revenues ($)
US 1998	153	282	29.5 billion	54.4 billion
'Saturated market'	≈230	359	44.4 billion	69.3 billion
Tobacco industry			39 billion	

approximately \$153 per year and might lose closer to \$230 per year were gambling more widespread, these revenues come from a few who gamble a lot, instead of many who gamble a little.

We now return to our original question—what is the social value of this amount of casino gambling? According to Equation (5) we need the profits and taxes attributable to casinos, minus the reduction in profits and taxes of other business due to casinos. To these we must add the consumer distance benefits of casinos (which we address in the next section). Because profits are a function of market structure and the presence of free entry and exit, if casinos were deregulated, market contestability and free entry of casinos would drive economic profits to zero. In that event, from the perspective of profits, a larger casino sector and smaller remainder of the economy would represent a net wash because economic profits in the economy would be no greater with casinos than without. The sole contribution of casinos to social welfare in that case would be the direct consumer benefits.

However, in the current legal environment, casinos in many locations are effectively regional monopolies sustained by government licensing restrictions.[22] We, therefore, make the following adjustment to allow for the higher monopoly profits of some casinos. In 1998, profits before taxes[23] of all non-financial corporate business in the United States were 13.8% of sales.[24] Assuming that casinos average 30% profit rates before taxes (more than *double* the normal business rate of profit) implies that social benefits in the form of profits and taxes from shifting \$153 of revenue from other businesses to casinos is (0.30–0.138) 153 = \$25 rounded up to the nearest dollar. In the next section, we add to this consumer distance benefits of casinos to produce an upper bound on total casino social benefits.

Consumer Distance Benefits

Equation (5) also idenifies $\int_{d_i^0}^{d_i^1} (\partial e/\partial d) dd_i$ as a direct social benefit of casinos, where d_i is consumer i's distance to the nearest casino. Distance benefits have been little studied, even though they constitute a primary direct benefit of casinos. To our knowledge, only Grinols (1999) estimated these benefits and compared them with the other components of (5). Assuming that utility depends on goods x, the number of casino visits V, the amount gambled (spent) per visit g, and the distance traveled to the casino, $u = u(g, V, I(g, d))$ where $I(g, d)$ is an enjoyment factor or visit 'intensity' factor that rises with g and falls with d and g is consumption of other non-casino, goods. The envelope theorem and consumer optimization conditions show that $\int_{d_i^0}^{d_i^1} (\partial e/\partial d) dd_i \leq \int_{d_i^0}^{d_i^1} V dg$. This inequality allows inferences about welfare to be made from data that relate to the number of visits and amount gambled per visit to the distance from the casino. Grinols (1999) estimated that the upper bound for direct conumer benefits of casinos was \$50 per adult (again, rounding up to the nearest round figure to produce an upper bound on casino benefits) when no allowance is made for the significant portion of revenues from problem and pathological gamblers. If the revenues of non-P&P gamblers only are used to calculate consumer distance benefits, then the benefit figure falls to under \$34.[25] This number can be interpreted as the answer to the question, 'How much would you be willing to pay each year to have the opportunity to gamble in a casino nearby compared with the alternative where casinos are 1000 miles away?'

Employment Benefits

Although the topic of employment benefits is one of the most studied issues about casino gambling,[26] it also contains a widespread and central misunderstanding—that the benefits of new businesses are measured by the jobs they create in a given location. While it may be legitimate to ask what effect a new business will have on employment, what taxes it will pay, and from where its revenues will come, these answers do not assess the social benefits and costs of the business. Increasing jobs in one location at the expense of lost jobs in another is not a social benefit. Business profitability is not social profitability. Social cost benefit is grounded on consumer utility and results in a list of relevant factors different from tracking income and employment effects.[27]

Total Social Benefits

Based on the previous sections, if casinos were fully deregulated and allowed to spread freely nationwide, economic profits would be driven to zero. The net increase in profits and taxes from

expanding the casino sector at the expense of the rest of the economy, therefore, would be zero. The consumer distance benefits of casinos would be less than $50 per adult, or if the revenues of P&P gamblers are subtracted, $34 per adult.

If casinos are regulated and granted regional monopoly status in some jurisdictions, the economic profits of casinos will remain positive, but the distance benefits will drop. Assuming average pre-tax profits equal to 30% of sales (more than double the rate for non-financial corporate business in the US) implies that the net profit and tax benefits of casinos are less than $25 per adult. However, if there is not free entry, distance benefits will average less than $50 per adult (less than $34 adjusting for P&P gamblers) because some areas will not have casinos close to consumers. We are, therefore, left with three upper bounds. The preferred number, $34 per adult, is the most correct upper bound because it represents the full social value of casinos under circumstances in which all of the benefits would be captured by consumers if the industry were deregulated to allow free entry. Fifty-nine dollars combines the full estimate of consumer distance benefits adjusted for P&P gamblers with a generous profit figure. It is too high because the consumer benefit is overstated, and in addition, because it fails to recognize that distance benefits would decline with regional monopolies present that do not put casinos close to all consumers. Finally, $75 per adult adds consumer benefits to profits without making any adjustments. We emphasize that these numbers are upper bounds on the estimated benefits.

COUNTING COSTS

Researchers estimate the social costs of casinos using two methods. The first is through the study of problem and pathological gamblers. The second is through statistical analyses of cost-creating activities such as crime, suicide, and bankruptcy. The former approach ties the cost activities to gamblers, but overlooks social costs that do not derive from problem and pathological gamblers. The latter approach, determining the effect of casinos on social costs such as crime by examining aggregate statistics, is direct and more inclusive because it looks at more than just the crimes committed by P&P gamblers.

The remainder of this section consists of two parts. The first derives a detailed taxonomy of cost classifications tied to the theoretical analysis in the second section. When discussing these classifications, we cite cost studies of both types listed above. The second part of this section is a more detailed review of all the studies that focused specifically on problem and pathological gamblers. We calculate costs per pathological and problem gamblers, and estimate the costs for the entire nation. These sections constitute the most comprehensive compilation of the social costs of gambling available to date.

Cost Taxonomy

The underlying principle, based on Equation (5), is that each social cost uses physical resources g in ways that do not directly enter utility or that reduce economic efficiency. We arrange social costs into nine disjoint groups and discuss each one briefly.

1. **Crime:** Of all the social costs, the link between casinos and crime has received the most attention.[28] Crime costs are real resources used for the apprehension, adjudication, incarceration, and rehabilitation of criminals, or the police costs that result from the need for increased police presence in areas of greater gambling activity. One significant problem that has plagued the majority of the casino-crime literature is analogous to the problem present in calculating the profit and tax benefits of casinos: To estimate social costs, one should not count new crime around the casino only, but also consider whether casinos reduced crime in other locales (for example, this could happen if casinos move crime from other locations). Counting only local crime as a cost is similar to counting only local profits as a benefit.

   The most comprehensive analysis of the casino-crime link is Grinols *et al.* (2000), which evaluated county-level data for seven offenses in every US county over 20 years, and controlled for about 50 variables. It concluded that on average, 8–10% of crime in casino counties in 1996 could be attributed to the presence of casino gambling in the county, resulting in costs of $63 per adult annually in these counties. Furthermore, counties that border casinos also experience increased crime rates, which suggests that casinos truly

increase crime, not merely shift it from one location to another. Estimates of the cost of non-Index crimes would add to total crime costs. For example, insurance fraud is not an FBI Index I crime. Estimates of the fraud committed by gamblers is $1.3 billion per year,[29] or $6.61 per adult annually.[30]

Studies of problem and pathological gamblers have found similar effects. Maryland Department of Health and Mental Hygiene (1990) reported that 62% of gamblers in treatment committed illegal acts as a result of their gambling, 80% committed civil offenses and 23% were charged with criminal offenses. Lesieur (1998b) surveyed nearly 400 members of Gamblers Anonymous, 57% of whom admitted stealing to finance their gambling. On average these 400 people stole $135000, and their total theft was over $30 million. Lesieur (1992) reported on illegal activities and civil fraud engaged in by pathological gamblers to gamble or to pay gambling debts in five samples from hospital inpatients, Veterans Administration and Gamblers Anonymous groups, male prisoners, female prisoners, and a female Gamblers Anonymous sample that includes the white-collar crime and other crimes listed in item 1.[31]

2. **Business and Employment Costs:** These costs include lost productivity on the job, lost time and unemployment: sick days off for gambling, extended lunch hours, leaving early to gamble, and returning late after gambling. Problem and pathological gamblers often impose costs on their employers (in addition to theft or embezzlement discussed in the section on abused dollars below) in the form of an unreliable presence on the job and reduced productivity when present. Between 21 and 36% of problem gamblers in treatment reported losing a job because of their gambling (Lesieur, 1998b). Firing an employee imposes costs on the worker in terms of lost output during the period of unemployment and on the employer in terms of additional costs of hiring and training new employees. These costs are higher the greater the firm-specific human capital.
3. **Bankruptcy:** Lawsuits and legal costs, and bill collection costs, bill collector harassment are among the consequences of bankruptcy. Pathological gamblers often follow a predictable path of exhausting personal resources, selling insurance policies, selling possessions, and 'borrowing' from family and friends. Their search for funds may lead them to acquire multiple credit cards that they use to the limit. Debts will be paid off, of course, when the individual wins big in his next gambling episode. Bankruptcy entails costs to creditors attempting to collect and costs to the legal system in court time and resources. SMR Research Corporation (1997, p. 118) indicated that these costs may be quite large, 'We set out this year to interview many of the leading US experts on gambling, gambling addiction, and the financial impacts of gambling. Their studies have suggested, fairly consistently, that more than 20% of compulsive gamblers has filed for bankruptcy as a result of their gambling losses'.
4. **Suicide:** Lesieur (1992) concluded that problem and pathological gamblers have higher suicide rates than the general public.[32] Dozens of stories have been reported of gamblers killing themselves after losing at the casino, sometimes on the premises.[33] Consistent with this, Phillips *et al.* (1997) found that deaths in Las Vegas were 2.5 times more likely to be a result of suicide than deaths in other comparably sized metropolitan areas. Visitors to Atlantic City and Reno were 1.75 and 1.5 times more likely to die in suicides than tourists to other non-gambling areas, and in Atlantic City the suicide rates did not become elevated until after casinos were introduced in 1978. McCleary *et al.* (1998), funded by the American Gaming Association, contested Phillips' findings. While we recognize the impact of casino gambling on suicide, the literature has not provided sufficiently reliable social cost estimates, and, therefore, we do not account for such costs in the table below.
5. **Illness:** Among the forms of sickness associated with gambling or affected by it are depression, stress-related illness, chronic or severe headaches, anxiety, moodiness, irritability, intestinal disorders, asthma, cognitive distortions, and cardio-vascular disorders. Many sickness costs are borne by the gambler, but they also appear as resource costs when the gambler seeks treatment. Gambler-borne costs, even when not absorbing resources, however, are tangible costs to the extent that the gambler would be willing to pay to eliminate the problem.

6. **Social Service Costs:** This category of costs includes therapy/treatment costs, unemployment and other social service costs (includes welfare and food stamps).
7. **Government Direct Regulatory Costs:** Social service and government direct regulatory costs are paid primarily through the government. The gambling industry has been regulated because it has historically been subject to fraud and abuse. Social service costs transfer resources from one segment of society to another, consuming resources in the process. If social costs include the financial burden placed on the non-gambling society that would not be present in the absence of gambling, then these costs should be included for a complete assessment of the effects of gambling. Regulatory costs differ by state and depend on the type of casinos (i.e. riverboat, Indian reservation, etc.), and extent of the responsibilities of the regulatory agencies.
8. **Family Costs:** Families of problem and pathological gamblers bear gambling-related costs of divorce, separation, spousal abuse, and child neglect. Although these costs are non-pecuniary, they are, nevertheless, tangible and real. They can be quantified in terms of the amount of money an individual would be willing to pay to remove the problem. In practice, such costs are rarely measured. When social services become necessary, as when gambling leads to divorce proceedings, they represent resources lost to other uses in society and can be measured by the cost of the services provided.
9. **Abused Dollars:** The final category represents lost gambling money acquired from family, friends, or employers under false pretenses. Two examples are stealing that is never reported because the thief is a relative, and money 'loaned' under duress that is never repaid. Abused dollars represent costs to the non-gambling population. To the extent that abused dollars represent purchases of gambling services that are inefficiently sub-optimal from the gambler's perspective or create market inefficiencies, a significant portion represents social costs to society as a whole even allowing for gains by the gambler or gambling sector.[34]

Social Cost Estimates Tied Directly to P&P Gamblers

Table 2 reports the results of all eight studies that contain original research that ties social costs directly to pathological gamblers.[35] The first two rows show the location studied and the author(s), respectively. The first column shows the category of costs, as outlined in the previous section. The studies are listed in order of date of publication. With the exception of the pathbreaking paper by Politzer *et al.* (1981), the studies were published between 1994 and 1999. The column totals range from a low of $1,195 (Gerstein *et al.*, 1999) to a high of $30,235 (Politzer *et al.*, 1981). The Executive Office of the Governor (1994) is the highest post-1994 estimate. Because all studies omit some of the costs, these totals will understate the actual totals.

A large share of the differences in the totals is explained by differences in the number of cost components the studies estimated. The Executive Office of the Governor (1994) estimated only crime costs in Florida, while Thompson and Quinn (1999) estimated ten components. The study with the lowest total cost (Gerstein *et al.*, 1999) estimated only four categories. No study estimated all the components.[36] By far, crime and abused dollars are the largest cost estimates. Gerstein *et al.* (1999) is the only study that completely omits crime costs, and only the Executive Office of the Governor (1994) and Gerstein *et al.* (1999) omit estimates of abused dollars. One important common characteristic of all but one of these studies is that they are not published in peer-reviewed journals. The Executive Office of the Governor (1994), Ryan *et al.* (1999), Thompson and Quinn (1999) and South Dakota Legislative Research Council (1998) were either published by or prepared for state agencies. Thompson *et al.* (1996) was published by the Wisconsin Policy Research Institute. Politzer *et al.* (1981) was presented at the Fifth National Conference on Gambling and Risk Taking, Gerstein *et al.* (1999) was presented to the NGISC. The paper by Thompson *et al.* (1998) was presented at the Twelfth National Conference on Problem Gambling, and later published in *Gaming Research and Review Journal.*

We used many strategies to ensure that the final estimates of costs per pathological gambler were

Table 2. Annual Social Costs per Pathological Gambler

	MD Politzer *et al.* (1981) ($)	FL Exec. Office of Gov (1994) ($)	WI Thompson *et al.* (1996) ($)	CT Thompson *et al.* (1998) ($)	SD SD Leg. Research Council 1998–1999 ($)	LA Ryan *et al.* (1999) ($)	US Gerstein *et al.* (1999) ($)	SC Thompson and Quinn (1999) ($)	Row averages for studies 1994–1999 ($)
Crime									
Apprehension and increased police costs			44	71	1000	53		116	257
Adjudication (criminal and civil justice costs)	1788		1234	994	27	649		476	676
Incarceration and supervision costs	2828	15 221	758	889	382	690		451	3065
Business and employment costs	11 265								
Lost productivity on job								1082	1082
Lost time and unemployment			2717	3436		5936	320	2156	2913
Bankruptcy			515					118	316
Suicide									
Illness							700		700
Social service costs									
Therapy/treatment costs			437	114	75	396	30	83	189
Unemployment and other soc. svc. (incl. welfare and food stamps)			606	971	549	60	145	318	442
Government direct regulatory costs									
Family costs									
Divorce, separation								111	111
Abused dollars	14 354		3802	9519	240	3175		2436	3834
									13 586

lower bounds.[37] First, in calculating the average annual cost per pathological gambler by category (shown in the last column of Table 2 on the right) we omitted Politzer *et al.* (1981).[38] This study had the highest cost estimates, but was conducted at a different time and in a different gambling environment from the other studies. Second, costs for suicide and government regulation are omitted, because none of these studies estimated them. Third, we did not price adjust the estimates, but rather took the values as given by the authors. Last, many studies combined their estimates for pathological and problem gamblers. We treated the numbers as if the costs we report apply *only* to pathological gamblers. Because costs due to pathological gamblers are higher than costs due to problem gamblers, the estimates further underestimate the costs connected to pathological gamblers.

Table 2 shows that the total average social cost of eight studies is $13,586 per pathological gambler per year. If 1.5% of 196.65 million US adults were pathological gamblers, this would imply annual social costs of $40.1 billion or $204 per adult. If pathological gamblers are 1% of the population, the estimate reduces to $136 per adult.

Table 3 replicates Table 2 for problem gamblers. Only Gerstein *et al.* (1999) and South Dakota Legislative Research Council (1998) estimated any separate costs per problem gambler. These studies estimated only three of the many cost categories. The average annual cost per problem gambler by cost category is shown in the last column. For the same reasons discussed in analyzing the results for pathological gamblers, the Table 3 total cost estimate of $912 due to problem gamblers understates the actual cost.

Table 4 applies the information in Tables 2 and 3 to produce annual national social costs per adult. To test the robustness of these cost estimates, we use the 95% confidence bounds on the numbers of problem and pathological gamblers set by Shaffer *et al.* (1997).[39] This confidence interval sets the fraction of pathological gamblers between 0.9 and 1.38% of the adult population, and the fraction of problem gamblers between 1.95 and 3.65% of the adult population. Based on these lower and upper bounds, annual national social costs from problem and

Table 3. Annual Social Costs per Problem Gambler

	US Gerstein *et al.* (1999) ($)	SD S. Dakota, 1998–1999 ($)	Row averages: studies 1994–1999 ($)
Crime			
Apprehension and increased police costs			
Adjudication (criminal and civil justice costs)			
Incarceration and supervision costs			
Business and employment costs			
Lost productivity on job			
Lost time and unemployment	200		200
Bankruptcy			
Suicide			
Illness			
Social service costs			
Therapy/treatment costs	360		360
Unemployment and other soc. svc. (incl. welfare and food stamps)	155	549	352
Government direct regulatory costs			
Family costs			
Divorce, separation			
Abused dollars			
			912

Table 4. National and per Adult Social Costs

NATIONAL COST : BILLIONS of DOLLARS

Problem Rate	Pathological Rate: Low	Pathological Rate: High
High	$30.6	$43.4
Low	$27.5	$40.4

PER ADULT COST

Problem Rate	Pathological Rate: Low	Pathological Rate: High
High	$156	$221
Low	$140	$205

Pathological 95% Confidence Bound: LOWER	0.9000%
Pathological 95% Confidence Bound: UPPER	1.3800%
Problem 95% Confidence Bound: LOWER	1.9500%
Problem 95% Confidence Bound: UPPER	3.6500%

pathological gambling range from 27.5 billion to over $43 billion. On a per adult basis, the numbers range from a low of $140 to a high of $221. Because Shaffer *et al.* (1997) estimated these confidence bounds based on samples of the nation before the time of publication including areas with different degrees of casino gambling they clearly understate the fractions of the entire US population that would be identified as pathological or problem gamblers if casinos were expanded fully. The costs of Table 4, therefore, also understate the associated costs of full gambling expansion.

IMPLICATIONS FOR FUTURE RESEARCH

This paper makes many contributions to the discussion of social costs and benefits of casino gaming, and has numerous implications for future research in this area. First, we provide the first theoretical justification of what should be included as costs and benefits. This justification is based on individual utility and distinguishes business and social profitability for industries with externalities. The lack of a clear theoretical basis has impaired the entire research agenda on this issue. Much research has examined relatively minor issues or issues that are not even part of a properly defined cost–benefit analysis. Conversely, there are relatively few estimates of some of the key components of social costs and benefits. Consequently, a well-grounded theoretical framework of costs and benefits will make future research more productive.

Second, using this theoretically grounded cost–benefit analysis we corrected several common conceptual mistakes prevalent in the casino and gambling literature. One example of a common error is the focus on local rather than total social costs or benefits. On the benefits side, increases in local profits and taxes are often weighted heavily while losses in profits and taxes from geographically distant areas are weighted less or not at all. Similarly, on the cost side, local crime is often weighted heavily while there is little discussion about whether crime was simply moved from other areas. Another error is the frequent use of the net export-multiplier modeling of jobs, an inappropriate method to determine social costs and benefits. Clearly, identifying these errors will reduce them in future research.

Third, we used the theory to construct a clear taxonomy of benefits and costs as applied to the casino industry. To estimate these costs and benefits we reviewed the available studies that do original research on this topic. This literature shows that the extreme upper bound on annual total social benefits is $75 per adult. The lower bound for social costs, based on the estimates of costs associated with prevalence of problem and pathological gamblers, was between $140–$221 per adult. Consequently, the available research indicates that when using the highest estimates of benefits and the lowest estimates of costs, casino gambling fails a cost–benefit test by a ratio of 1.9 to one or greater.[40] Standard Pigouvian corrective theory for an industry with externalities is that it should be taxed by an amount equal to the costs that it imposes on society. Relative to the

revenues for a representative casino of about $230 per adult each year from nearby residents, Pigouvian corrective taxes would represent between 61 and 96% of casino revenues.

Fourth, we showed that the available research indicates there is a lack of quality research on both the benefit and cost sides of the debate, and that there is an important need for better research. There is a need for more uniformity in the manner in which costs and benefits are treated. Peer-review-quality studies not funded by the casino industry or by pro- or anti-gambling groups are especially needed to refine and improve the cost–benefit numbers that are currently available. To further refine the cost–benefit analysis of casino gaming the following questions must be addressed.

What is the Effect of Casinos on the Number and Gambling Patterns of Problem and Pathological Gamblers?

Because the social costs of the casino industry are generated primarily by problem and pathological gamblers, it is essential to know how casinos affect problem and pathological gamblers. There is abundant evidence that increased gambling opportunities increase problem and pathological gambling. For example, the NGISC reported that the presence of a casino within 50 miles roughly doubled the prevalence of problem and pathological gambling.[41] Other indicators include the tremendous increase in the numbers of gamblers seeking help when casinos enter a market, the increase in gamblers anonymous groups when gambling enters a state, and the evidence from survey data on the number of problem and pathological gamblers before and after casino expansion.

Casinos may also affect the amount of gambling by problem and pathological gamblers. An average adult is expected to lose $200–300 each year in casinos if they are nearby, while a typical pathological gambler often loses 10–20 times this amount. Therefore, a small number of pathological gamblers accounts for a significant portion of casino revenues. A related issue is to determine the share of casino revenues that derive from problem and pathological gamblers. Does this share differ by type of gambling? For example, lotteries receive a smaller portion of their revenues from P&P gamblers because lottery play attracts a larger portion of the population.

How much does an Additional Active Problem or an Additional Active Pathological Gambler Cost Society?

This question is best addressed by studying problem and pathological gamblers directly. However, estimates derived from this sample may be biased because only a small fraction of P&P gamblers seek formal treatment. If those who seek help impose the greatest costs on society, our cost estimates of P&P gamblers would be overstated.

What is the Life Cycle of a Problem and Pathological Gambler?

For example, when casino gambling becomes available for the first time, what is the behavioral time profile for individuals who enter and leave the states of problem and pathological gambling? Do individuals begin with a period of increasing gambling dependence, move through a period of problem gambling, progress to pathological gambling, seek treatment (or withdraw unilaterally from the problem), and abstain thereafter? Or are there relapses and continued problems if treatment is not sought. This information could be used to predict how many currently active problem and pathological gamblers to expect for given population as a function of the availability of casino gambling.

What Effect do Different Types of Treatment have on Problem and Pathological Gamblers?

Such information would help people to know how to efficiently allocate funding resources for treatment interventions.

How can Casino Gambling be Offered to Minimize its Social Costs?

Quinn (2001) discusses many possible ways of offering casino gaming to reduce social costs. To evaluate the effectiveness of these interventions and their impact on casino benefits one would need to estimate the elasticity of both P&P and non-P&P gamblers to such actions.

What are the Net Profit and Tax Benefits of Increasing Casino Gambling?

Rather than estimating a true social benefit, many studies estimate only the gross increases in profits or only weight the increased benefits to local firms while ignoring lost profits to other firms.

What are the Distance Benefits of Increasing Casino Gambling?

To date only one study examines this important question. Testing the robustness of this result will provide more insight into this understudied area.

Focusing future research questions and methodologies on a clearly formulated theoretical foundation will allow us to make our estimates of both the costs and benefits of casino gaming more precise.

APPENDIX A

A Study of the Economic Impact of the Gaming Industry Through 2005, by The Evans Group: A Partial Critique

International Game Technology (♠ IGT), a manufacturer of computerized casino gaming products and video gaming machines, and operator of proprietary gaming systems, commissioned The Evans Group, an econometric consulting firm, to produce a study of the impact of the gambling industry in 1996. The 9 September 1996 press release for the resulting report entitled *A Study of the Economic Impact of the Gaming Industry through 2005* issued by ♠ IGT reported,

> States and localities that permit casino gaming have improved their overall economic performance ... The study ... reports that *wherever casino gaming has been implemented, employment has risen, unemployment fallen*, and additional tax revenues have been generated. (Emphasis added.)

The Evans study describes impacts for individual states. We will briefly examine the findings related to Illinois, a state with which the authors are familiar. On page 4-3 the report states:

> Based on these data, *it would appear that the opening of a casino reduced the unemployment rate* in that county in both the year it was opened and in the following year. The average employment in these eight counties...implies a total of 37 000 extra jobs. These multiplier figures are much higher than ordinarily obtained, and employment in these counties might have risen for other reasons as well. Nonetheless, *the figures do indicate that casino gaming has been a boon to these counties*, especially those that are more rural. (Emphasis added.)

Most casinos opened after 1991. The period 1991–1996 covered by the study, therefore, coincided with the nationwide economic expansion coming out of the recession of 1990–1991. Employment was rising and unemployment was falling in many counties, with or without the introduction of casinos. The authors, therefore, were right to feel uneasy. Their caution that 'employment in these counties might have risen for other reasons' shows they knew that simple before-and-after comparisons finding declining unemployment and increasing employment proved

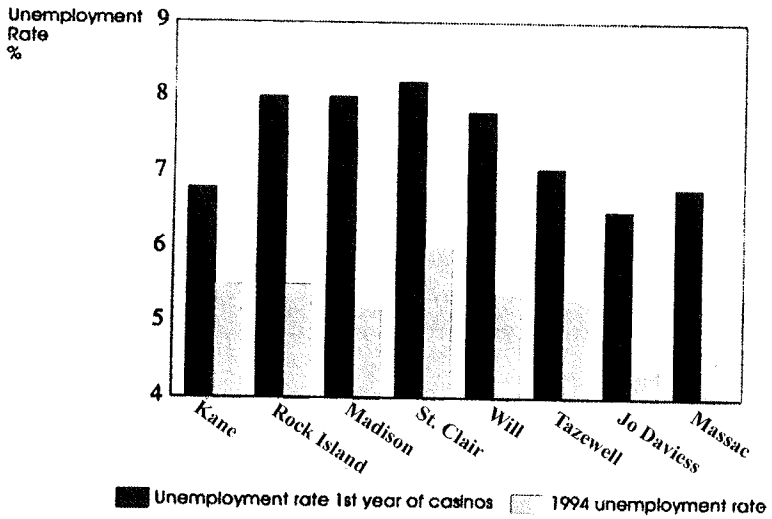


Figure 1. The Evans Group study, reproduced figure 4-1.

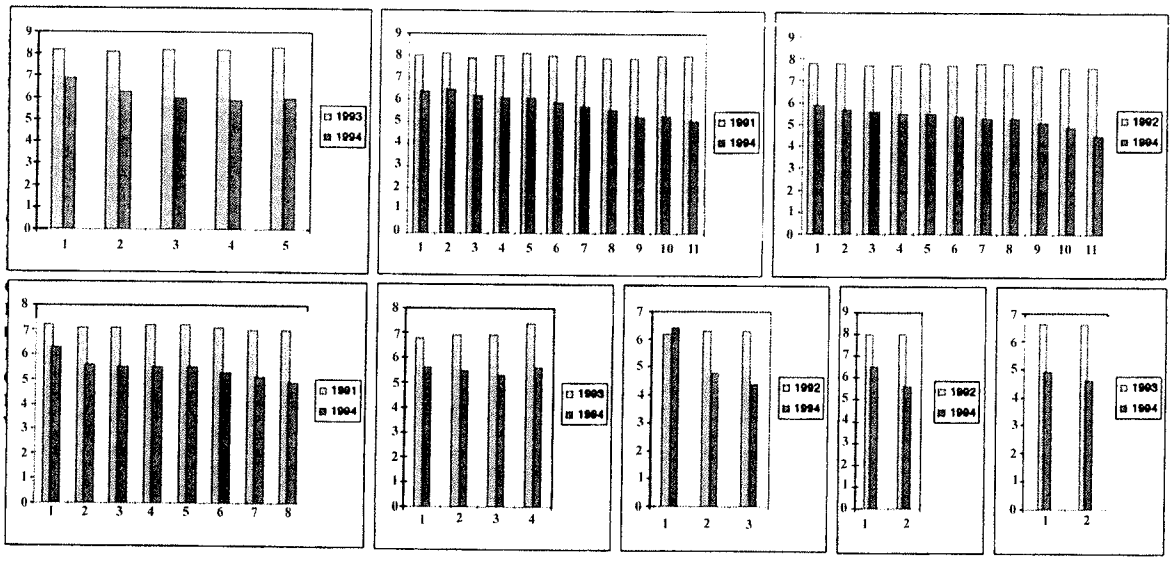


Figure 2. Casino counties are indistinguishable from non-casino counties.

nothing about the effects of casinos in a country recovering from recession. Figure 1 reproduces figure 4-1, provided in the original study. The authors explain that the observed drop in casino county unemployment rates exceeded the state average by 0.3 and 0.2 percentage points on average in the first and second year after introduction. The authors' conclusions are noted above. The rest of the story is provided below.

The study gives the impression that counties that opened casinos experienced better economic performance than those that did not. However, Illinois contains 102 counties. We can select other counties that had the same unemployment rate (within 0.1 percentage point) as the casino county in the inital period and compare their peformance directly. This is done in Figure 2. As shown there, the unemployment rate dropped in all counties with similar initial unemployment. Some counties did better than casino counties, some counties did worse. From left to right, bottom row first, the casino counties are numbers 6, 1, 3, 2, 2, 3, 7, 3. Nineteen counties performed better than their casino cousin, while 19 performed worse.

A statistical test confirms that the drop in unemployment of casino counties is statistically insignificantly different from the drop experienced by the comparable non-casino counties shown in Figure 2. Let ΔU denote the change in county unemployment rate minus the change in state unemployment rate for the same period, and let *Casino* identify counties that introduced casinos in the initial period (*Casino* = 1 if a county introduced a casino, 0 otherwise). Then running the following regression,

$$\Delta U = a + b\ Casino + \varepsilon$$

reveals that coefficient b is 2.75 (consistent with the 0.2 and 0.3 percentage point differences reported by The Evans Group), but with a standard error of 0.856 implying a p-value of 0.4. Coefficient b is, therefore, statistically indistinguishable from 0 at conventional levels.

NOTES

1. Gambling revenue is the net amount of money that the gambling operator extracts from patrons. It equals the 'handle' (gross amount wagered—which may reflect the same chips being bet many times before it is ultimately retained or lost) less payouts, prizes, or winnings returned to players. For example, if players wager $1 000 000 on outcomes of a roulette wheel over the course of an evening, and $880 000 is returned to them as winnings (some roulette slots are reserved for the house), then operator revenue is $120 000.
2. According to the Indian Gaming Regulatory Act of 1988, Class I gambling consists of 'social games solely for prizes of minimal value'. Included in Class I gambling are traditional Indian games identified with tribal ceremonies and celebrations. Class II gambling includes bingo and 'games similar to bingo'. Class III gambling includes 'all forms of

gaming that are not Class I gaming or Class II gaming', such as blackjack, slot machines, roulette, and other casino-style games.

3. Kindt (1994), Grinols (1996), Grinols and Omorov (1996) and Henriksson (1996) discussed a number of these.
4. Public Law 104-169 of the 104th Congress established the NGISC. For more information about its mission, composition and findings see http://www.ngisc.gov/.
5. We show below that both concepts are necessary to a proper cost–benefit assessment of casinos.
6. We will show below that it should be present.
7. We follow throughout the paper standard general equilibrium accounting conventions for describing inputs and outputs in consumption and production.
8. That is, \$100 of utility is defined to be the utility that can be achieved by optimally spending \$100 at prices p, with nearest casino d miles away.
9. For example, the returns to playing roulette, slot machines, or a blackjack game are approximately the same regardless where offered. The framework could be modified to allow for different qualities of gambling. In this case the model would deal with multiple, imperfectly substitutable goods.
10. The transfer of wealth in gambling is generally from relatively poor to relatively wealthy. Therefore, if a dollar generates more utility for rich than poor, our assumption understates the social benefits. If a dollar generates more utility for the poor than the rich, our assumption understates the social costs of casinos.
11. A positive element of y_j denotes output of a good or service, and a negative component denotes the use of an input.
12. Although it is not central to our objective in this paper, we include z to be consistent with the general framework we develop. Excluding z does not affect the central arguments of this paper. Components of z are economy excess demands for traded goods. A zero denotes a non-traded good, while a positive entry denotes imports.
13. Use the fact that $\Sigma_i \theta_{ij} = 1$.
14. In 1998, gambling revenues were approximately 0.5% of GDP and casino revenues were approximately 0.25%.
15. It is conceivable, of course, in certain circumstances that the introduction of casinos could change prices enough to matter to local residents. For example, if casinos increased employment and the local population, the demand for local housing would increase, thus raising housing prices and creating capital gains for residents. In such cases, however, the *reduction* in demand for residential property and capital *losses* in the areas from which the new residents came would have to be taken into account. Over time, if new housing responded to the increased demand, the prices of the existing stock of housing would decrease. Because gambling doesn't *create* new people, but only moves them from one place to another, a reasonable first approximation is that the net effect of gambling on capital gains and consumer surplus considerations would be small.
16. We presume that the jobs being compared in two locations are comparable. Blair *et al.* (1998) argued that 'employees in gaming industry occupations are less satisfied with their jobs than those in other industries'. If jobs are *different* in two locations, then the jobs would appear in the formula as different because workers would demand compensating wage differentials, and this would affect profitability. If compensating wage differentials do not arise, but workers face non-market constraints that cause them to work hours that are not optimal given the wages paid, these costs would appear in the unemployment terms of Equation (5).
17. For industry revenue data, see *International Gaming and Wagering Business* (1999, p. 24).
18. The value of tobacco grown each year is \$39 billion. *Encarta Encyclopedia*, http://encarta.msn.com/find/Concise.asp?ti = 02A43000 # s12.
19. The proposal was for West Dundee, Illinois. The study reported, 'Both Christiansen/Cummings and Mirage Resorts estimate local gaming demand by applying gaming win *per capita* factors to the population residing within concentric circles of a gaming venue. The factors decline as distance increases. The \$200 win *per capita* applicable to the 0–50 mile segment was developed jointly by representatives of Mirage Resorts and Dr Cummings to apply to the local population in the New Orleans environs in a 1992 evaluation of the New Orleans gaming market.'
20. See, for example, GLS Research (1994) Clark County (Las Vegas, Nevada) Residents Study 1993–1994. Even in Las Vegas, one-third of the population does not gamble.
21. For example, a study of wagers in Minnesota (Smith and Craig, 1992; Tice, 1995) found that 1% of gamblers accounted for 50% of wagers, and that 10% accounted for 80%. An Illinois study (Gazel R, Thompson WN. 1996. Casino gamblers in Illinois: who are they? Manuscript, 1–25 (plus data supplied by the authors)) found that 10% of bettors accounted for 66% of wagers. Heavy gambling is not the same as problem and pathological gambling even though the revenues of P&P gamblers figure disproportionately among the revenues of the highest-gambling segment of the population. When compared with the population at large, the amount gambled by P&P gamblers implies that the share of casino revenues from problem and pathological gamblers can be as much as 1/4 to 1/2 of casino revenues (see Grinols and Omorov, 1996). Lesieur (1998b) reported that 48.7% of casino revenues in Nova Scotia came from problem gamblers, and that 55% of revenues for casino cards and dice games came from problem gamblers in Washington. In other locations he found that percentages ranged between 26.7 and 41.4%. In Montana, 37% of the revenues of video gambling machines was estimated to come from problem and pathological gamblers (Polzin *et al.*, 1998). The Productivity

Commission (1999) reported that problem gamblers account for 2.1% of the adult population but one-third of all gambling revenues in Australia. Volberg *et al.* (2001) also examined the distribution of revenue from different types of gamblers.

22. This description applies in Illinois and many other midwestern states. In Minnesota, for example, only American Indians operate casinos. In locations such as Atlantic City or the Gulf Coast of Mississippi, regulations allow entry to all as long as certain operating requirements are met. In these locations competitition drives economic profits to zero.
23. Non-Indian casinos paid over $2 billion in taxes to the various states on gaming revenues in 1997. CT's two Indian casinos paid $236 million to the state that year. In comparison, states generated revenues of approximately $10 billion from net proceeds of lotteries in 1997, or $51.15 per adult.
24. See Economic Report of the President, 1999, Table B-15, column 8.
25. How should we treat demand derived from addiction? If addiction is not rational then its derived demand should be treated differently. We, therefore, report both figures above. In the lower figure, we assumed that 32% of casino revenues are from P&P gambling.
26. A survey of this literature and list of references can be found in Adam Rose and Associates (1998) and the NGISC (1999), appendix 5 on Economic Development.
27. Leven *et al.* (1998) provide an example of how the focus on job creation may mislead the unwary or untrained. They wrote,

> 'This study seeks to take an objective look at the economic impact of the gaming industry on the Missouri economy. Where do the gaming revenues come from? How are they redistributed in the economy? By how much do state and local governments benefit? What is the net bottom-line economic impact? . . . [Gaming] does add spending, income, and jobs to the Missouri economy. It should be addressed in this context.'

While the authors do not claim that the answers to their questions constitute a cost–benefit evaluation, their plea that gambling adds 'spending, income, and jobs to the Missouri economy' and that 'it should be addressed in this context' could easily be misinterpreted to mean that a calculation of income, jobs, and employment is synonymous with a cost–benefit evaluation. In their summary (p. 75) they wrote:

> 'The focus of this study has been the determination of whether net new output (and jobs and employment) have been created state-wide in Missouri as a consequence of casino gaming operations, and if so how much . . . The 'bottom line' is that significant additions to the Missouri economy have been achieved. As of 1997, almost 18 000 net new jobs, $500 million in added personal income, and over $750 million of added output have benefited the state's economy.'

Who would argue with such figures? Or be aware that regardless of their accuracy, casinos in Missouri might fail to pass a cost–benefit test and thus be harmful to state welfare?

28. See Grinols *et al.* (2000) for a complete review of this literature. Each of the following crimes has been alleged in the literature to be associated with gambling. Index I Violent Crime (Aggravated Assault, Robbery, Rape, Murder), Property Crime (Larceny, Burglary, Auto Theft), and non-Index I crime such as Embezzlement and Employee Theft, Loan Fraud, Insurance Fraud, Forgery (including check forgery), Tax Evasion, Tax Fraud, Con Games (Swindles, Hustling Cards, Dice or Other Games), Bookmaking, Working in an Illegal Game, Pimping, Prostitution, Selling Drugs, and Fencing Stolen Goods.
29. Lesieur (1992, p. 45) and Executive Office of the Governor (1994, p. 67).
30. National population data by age cohort are on the US Census Bureau website http://www.census.gov/population/estimates/nation/intfile2-1.txt. As of 25 August 2000, the US had a population of 275 130 000. Moreover, 196 649 000 were aged 20 or older.
31. See Table 2.
32. See also Frank *et al.* (1991).
33. Representative of such cases is the following account, 'A Florida man who lost about $50 000 while gambling here (Atlantic City) during the past two days died Tuesday after he jumped seven floors from a Trump Plaza Hotel and Casino roof onto Columbia Place, officials said'. Brian Hickey, Staff Writer, 18 August 1999, South Jersey Publishing Co.
34. The minimum social costs of this category are the value of the resources spent by those trying to steal and cover up their offenses and the value of the resources spent by potential victims to decrease their likelihood of being victimized. There may be another component of cost in addition, however. Social costs can be higher if the original owners of the property value it more than the offenders do. For example, if the owners valued their property at $1000 and the offenders who stole it sold it to someone who valued it at $300, there would be an additional social loss of $700. Furthermore, if the thief is a pathological gambler and spends the wrongly acquired $300 gambling, his expenditures may reflect addiction rather than rational choice. In that case there would be social cost equal to some or all of the $300 because of his sub-optimal allocation of resources to the gambling sector. Last, although there is some debate about whether to count stolen dollars as costs to all of society (which includes the thief) because 'the thief gets the money', it is clear that the non-gambling portion of society will be made worse off by such actions, and losses to the rest of society are important in the

policy debate because they suggest that all of the abused dollars represent social costs to the non-gambling sector.

35. Westphal *et al.* (1999) is not used in Table 2, but supplements Ryan *et al.* (1999). The South Dakota Research Council study was completed in 1998, but addenda were added in 1999. See also Finance and Administrative Cabinet, Commonwealth of Kentucky (1999), Florida Department of Law Enforcement (1994), Florida Sheriffs Association (1994), Iowa Racing and Gaming Commission (1995), Lesieur (1998a).
36. As an alternative way of showing that the differences in the totals are driven largely by the number of cost categories estimated, we compared the totals after 'filling the gaps' in each study using the average cost for a given category from those studies that did estimate those particular costs. When doing so, the variance in the totals decreased substantially. The lowest totals were for South Dakota Legislative Research Council (1998–1999) and Thompson and Quinn (1999), $7396 and $8047, respectively. The largest were $25 742 by the Executive Office of the Governor (1994) and $18 203 by Thompson *et al.* (1998).
37. In addition to our use of the numbers, some studies, such as Thompson *et al.* (1998) intentionally formed their original estimates conservatively to understate costs.
38. Including the nominal value of this study would increase the cost estimate for three of the four costs it estimates. Using the values adjusted for 19 years of price level changes would have significantly increased the estimates of all four costs.
39. See Table 5, p. 34.
40. Our highest estimate of benefits was $75; our lowest estimate of costs $140. Applying the per adult costs of $221 from Table 4 to the estimate of benefits adjusted for P&P gamblers of $34 implies that casino gambling fails a cost–benefit test by a ratio of 6.5:1.
41. NGISC (1999, p. 4-4).

REFERENCES

Adam Rose and Associates. 1998. *The regional economic impacts of casino gambling: Assessment of the literature and establishment of a reasearch agenda.* Report prepared for the National Gambling Impact Study Commission (August).

Blair BF, Schwer RK, Waddoups JC. 1998. Gambling as an economic development strategy: the neglected issue of job satisfaction and nonpecuniary income. *The Review of Regional Studies* **28**(1): 47–62.

Deloitte and Touche. 1992. Economic and other impacts of a proposed gaming, entertainment and hotel facility. Prepared for the City of Chicago Gaming Commission.

Eadington WR. 1999. The economics of casino gambling. *Journal of Economic Perspectives* **13**(3): 173–192.

The Evans Group. 1996. A study of the economic impact of the gambling industry through 2005. Study commissioned by International Game Technology, September, iii + 105.

Executive Office of the Governor. 1994. *Casinos in Florida.* Office of Planning and Budgeting: The Capitol, Tallahassee, FL.

Finance and Administrative Cabinet, Commonwealth of Kentucky. 1999. Assessment of the economic and social impact of expanded gaming in the commonwealth and neighboring region. December, iii + 182.

Florida Department of Law Enforcement. 1994. *The Question of Casinos in Florida: Increased Crime: Is it Worth the Gamble?* State of Florida: Tallahassee, FL.

Florida Sheriffs Association. 1994. Casinos and crime: is it worth the gamble? A summary report and position paper. Florida Sheriffs Association: Tallahassee, FL.

Frank ML, Lester D, Wexler A. 1991. Suicidal behavior among members of gamblers anonymous. *Journal of Gambling Studies* **7**: 249–254.

Gerstein D, Murphy S, Toce M, Volberg R, Harwood H, Tucker A, Christiansen E, Cummings W, Sinclair S. 1999. Gambling impact and behavior study: report to the National Gambling Impact Study Commission. National Gambling Impact Study Commission, (1 April).

GLS Research. 1994. *1993–1994 Clark County Residents Study.* Las Vegas Convention and Visitor's Authority: Las Vegas, NV.

Grinols EL. 1996. Incentives explain gambling's growth. *Forum for Applied Research and Public Policy* **11**(2): 119–124.

Grinols EL. 1999. Distance effects in consumption. *Review of Regional Studies* **29**(1): 63–76.

Grinols EL, Mustard DB, Dilley CH. 2000. *Casinos, Crime, and Community Costs.* University of Illinois: University of Georgia; 1–35.

Grinols EL, Omorov J. 1996. Development or dreamfield delusions?: assessing casino gambling's costs and benefits. *The Journal of Law and Commerce* **16**(1): 49–87.

Henriksson LE. 1996. Hardly a quick fix: casino gambling in Canada. *Canadian Public Policy* **XXII**(2): 116–128.

International Gaming and Wagering Business. 1999. August.

Iowa Racing and Gaming Commission. 1995. *Des Moines Register.* 13 October. Christiansen/Cummings Associates: Arlington, MA.

Kindt JW. 1994. Increased crime and legalized gambling operations: the impact on the socio-economics of business and government. *Criminal Law Bulletin.* **43**: 538–539.

Lesieur H. 1992. Compulsive gambling. *Society* **29**(4): 43–50.

Lesieur H. 1998a. Testimony before the National Gambling Impact Study Commission, Atlantic City, New Jersey, 22 January 1998, Institute of Problem Gambling.

Lesieur H. 1998b. Costs and treatment of pathological gambling. *The Annals of the American Academy of Political and Social Science* (Gambling: socioeco-

nomic impacts and public policy, Frey JH, special editor) **556**: 153–171.

Leven C, Phares D, Louishomme C. 1998. The economic impact of gaming in Missouri. Report to Civic Progress, St. Louis, April.

Maryland Department of Health and Mental Hygiene, Alcohol and Drug Abuse Administration. 1990. *Task Force on Gambling Addiction in Maryland.* Maryland Department of Health and Mental Hygiene, Alcohol and Drug Abuse Administration: Baltimore, MD.

McCleary R, Kenneth C, Feng W, Merrill V, Napolitano C, Moles M, Graffeo B. 1998. Suicide and gambling: An analysis of suicide rates in US counties and metropolitan areas. Report to the American Gambling Association. Manuscripts.

Mirage Hotel. 1993. Response of the developers of the proposed Fox River resort to the West Dundee riverboat project task force.

National Gambling Impact Study Commission. 1999. National Gambling Impact Study Commission Final Report www.ngisc.gov [accessed 18 June 1999].

Phillips DP, Welty WR, Smith MM. 1997. Elevated suicide levels associated with legalized gambling. *Suicide and Life-Threatening Behavior* **27**: 373–378.

Politzer RM, Morrow JS, Leavey SB. 1981. Report on the societal cost of pathological gambling and the cost–benefit/effectiveness of treatment. The Johns Hopkins Compulsive Gambling Counseling Center, Presented at Fifth National Conference on Gambling and Risk-Taking.

Polzin PE, Baldridge J, Doyle D, Sylvester JT, Volberg R, Moore WL. 1998. *Final Report. Presented to the Montana Gambling Study Commission*, 30 September 1998, Bureau of Business And Economic Research (University of Montana-Missoula).

Productivity Commission. 1999. *Australia's gambling industries.* Final Report, Summary (26 November, Report No. 10).

Quinn FL. 2001. First do no harm: What could be done by casinos to limit pathological gambling. *Managerial and Decision Economics* **22**: 133–142.

Ryan TP, Speyrer JF, with Beal ST, Burckel DV, Cunningham BR, Kurth MM, Scott LC, Wall JL, Westphal JR. 1999. Gambling in Louisiana: a benefit/cost analysis. Prepared for the Louisiana Gaming Control Board, Louisiana State University Medical Center (April).

SMR Research Corporation. 1997. *The Personal Bankruptcy Crisis, 1997: Demographics, Causes, Implications & Solutions.* SMR: Hackettstown, NJ.

Shaffer HJ, Hall MN, Vander Bilt J. 1997. *Estimating the Prevalence of Disordered Gambling Behavior in the United States and Canada: A Meta-Analysis.* Harvard Medical School: Boston.

Smith F, Craig WJ. 1992. Whos in for how much? CURA Reporter. *Center for Urban and Regional Affairs* **22**: 11–14, 16 (plus data supplied to the authors).

South Dakota Legislative Research Council. 1998. *Economic and fiscal impacts of the South Dakota gaming industry.* 1–146 + Attachment: Letter of 7 January 1999 to Mr. Terry Anderson, Director, South Dakota Legislative Research Council, Table South Dakota Total Estimated Incremental Social Costs.

Thompson WN, Gazel R, Rickman D. 1996. The social costs of gambling in Wisconsin. *Wisconsin Policy Research Institute Report* **9**(6): 1–44.

Thompson WN, Gazel R, Rickman D. 1998. Social costs of gambling: A comparative study of nutmeg and cheese state gamblers. Twelfth National Conference on Problem Gambling, NV 1998. *Gaming Research and Review Journal* **5**(1): 1–15.

Thompson WN, Quinn FL. 1999. An economic analysis of machine gambling in South Carolina. The Education Foundation of the South Carolina Policy Council, May 1999.

Tice DL. 1995. Why the press hates gaming. *Casino Executive* August: 57–58.

Volberg R, Gerstein DR, Christiansen EM. Baldridge J. 2001. Assessing self-reported expenditures on gambling. *Managerial and Decision Economics* **22**: 77–96.

Westphal JR, Johnson LJ, Stevens L. 1999. Estimating the social costs of gambling disorders in Louisiana for 1998. Study Performed Under Subcontract From University Of New Orleans, UNO # 313-204-124 (23 March).

Appendix #2

Grinols, Earl L., David B. Mustard, and Cynthia Hunt Dilley. Casinos, Crime, and Community Cost. June 2000. 20 June 2009 <http://www.uspaet.org/Grinols-Crime2004.pdf>.

CASINOS, CRIME, AND COMMUNITY COSTS

By Earl L. Grinols,*
David B. Mustard,**
Cynthia Hunt Dilley*

June 2000

Abstract

Casino gambling—providing negative expected return with positive variance—has puzzled economists with respect to a number of issues, including the extent to which casinos are tied to externalities. In the case of tobacco, the link between use and health-related externalities has led to state lawsuits to recover social costs. This paper studies the connection between casinos and crime using county-level data for every US county between 1977 and 1996, a period spanning the introduction of casinos to states other than Nevada. We find that casinos increased crime after a lag of 3 to 4 years. The data indicate that 8 percent of crime observed in casino counties in 1996 was attributable to casinos. The average annual cost of increased crime due to casinos was $65 per adult per year. Furthermore, by studying the crime rates in counties that border casino host counties we show that casinos create crime, not merely move it from one area to another. If anything, the neighbor data indicate that casino crime spills over into the border counties rather than is moved from them. Last, we explain why other studies have sometimes failed to identify a link between casinos and increased crime rates.

JEL Codes: K0, K2, H2
Key Words: Casinos, Index I Crime, Externalities, Social Costs, Pigouvian Taxes

---

* Department of Economics, University of Illinois, 1206 S. 6th Street, Champaign, Illinois 61820. E-mail: grinols@uiuc.edu

** Department of Economics, Terry College of Business, University of Georgia, 528 Brooks Hall, Athens, Georgia 30602. E-mail: mustard@terry.uga.edu. We thank workshop participants at the American Law and Economics Association and American Economics Association Annual Meetings and at the Universities of Buffalo, Georgia, Illinois and Rochester for their helpful comments.

CASINOS, CRIME, AND COMMUNITY COSTS

There is no consensus about the connection between casinos and crime. In spite of much public attention devoted to casinos and the many questions surrounding this dynamic sector, no authoritative analysis exists. Economists are virtually silent about the issue. Studies from other disciplines exhibit a number of fundamental weaknesses. For example, most used small samples, and focused on Las Vegas, Atlantic City or Reno. They rarely controlled for important variables that the law and economics literature has commonly identified as affecting crime. Time-series data were rarely used, and when they were, were not exploited to examine timing issues such as the pattern of effects over a number of years. The most commonly used methodology was to compare crime rates of different cities or regions in a given year. Last, many studies were agenda-driven, conducted or funded by either pro-gambling or law enforcement organizations. This paper re-examines the impact of casinos on crime to establish whether there is a connection to increased crime rates, and if so, to determine the likely magnitude of the social costs.

There are at least two reasons why determining whether there is a link between casinos and crime is socially important at this time. First, the casino industry has grown extremely rapidly in the last decade and has become one of the most controversial and influential industries. Commercial casino revenues increased 240 percent from $8.7 billion in 1990 to over $20.5 billion in 1997.[1] Including Class III American Indian casinos,[2] 1997 revenues totaled $26.3 billion, or $138 per adult aged 20 or over. Casino industry revenues are now 58 percent as large as the cigarette market, while all forms of gambling are 13 percent bigger.[3] From 1982 to 1997 GDP increased 150 percent, while casino revenues increased more than 530 percent. This rapid casino expansion generated extensive debate about the impact of casinos on many social, economic, and political issues.[4] The casino industry has also become a major lobbying presence. For example, between 1992 and 1997, $100 million was paid in lobbying fees and donations to state legislators.[5] These concerns were sufficiently pronounced that the U.S. Congress established the National Gambling Impact Study Commission in 1996 to exhaustively study casinos. Its final report called for additional research and a moratorium on further expansion.

[1]Gambling revenue is the net amount of money that the gambling operator extracts from patrons. It equals the "handle" (gross amount wagered—which may reflect the same chip being bet many times before it is ultimately retained or lost) less payouts, prizes, or winnings returned to players. For example, if players place wagers totaling $100,000 on outcomes of a roulette wheel over the course of an evening and $88,000 is returned to them as winnings (some roulette slots are reserved for the house), then operator revenue is $12,000.

[2]According to the Indian Gaming Regulatory Act of 1988, class I gambling consists of "social games solely for prizes of minimal value." Included in Class I gambling are traditional Indian games identified with tribal ceremonies and celebrations. Class II gambling includes bingo and "games similar to bingo." Class III gambling includes "all forms of gaming that are not Class I gaming or Class II gaming" such as blackjack, slot machines, roulette, and other casino-style games.

[3]Cigarette sales were $45 billion in 1997. Gambling revenues were $50.9 billion. See *The United States Gross Annual Wager: 1997.* Supplement to International Gaming and Wagering Business, August 1998, p. 3.

[4]Kindt (1994), Grinols (1996), Henriksson (1996), and Grinols and Omorov (1996) discussed a number of these.

[5]*The Wager*, 2, 39, 1997.

Second, in recent years there has been a growing campaign to litigate recovery of social costs generated by industries whose products are believed to generate harmful externalities. The lawsuits against the tobacco industry highlight the prior importance of data and understanding of the relevant issues. Application of Pigouvian taxes, for example, requires knowledge of the size of the externalities.

Available studies of casinos and crime have reached conflicting conclusions. Albanese (1985), who examined areas around Atlantic City, argued that New Jersey's Crime Casino Act (1977) minimized the increase in crime that would otherwise have occurred.[6] However, Friedman, Hakim and Weinblatt (1989), who studied 64 localities with populations over 1000 near Atlantic City, found that casinos increased violent crimes, burglary and auto theft. Buck, Hakim and Spiegel (1991) confirmed that Atlantic City gambling increased crime rates, while Hsing (1996), working from a cross-section of 48 states, identified higher illegal drug arrests in states that permit gambling. Chiricos (1994) showed that the cities with legalized gambling (Atlantic City, Las Vegas, and Reno) had lower visitor-adjusted crime rates than selected Florida tourist cities.

Nelson, Erickson and Langan (1996), Margolis (1997) and Albanese (1999) were funded by explicitly pro-gambling groups, and as expected, concluded that gambling had no impact on crime.[7] Margolis (1997) focused on Las Vegas, Atlantic City, Reno, and Deadwood, SD, and concluded that crime rates are not due to the presence or proximity of legalized gaming. Albanese (1999) studied the nine largest casino markets and concluded that casinos did not increase embezzlement, fraud and forgery crime rates. Although the paper made conclusions about crime rates, it only used data for arrest rates, and did not mention that one cannot use arrest rates to infer anything about definitive about crime rates. The Florida Department of Law Enforcement (1994) and Florida Sheriffs Association (1994), who both opposed casinos, concluded that crime and drunk driving increased in Atlantic City and Gulfport, Mississippi, as a result of casinos. Thompson, Gazel, and Rickman (1996a) studied county-level panel data from Wisconsin and found that casino gambling significantly increased crime rates in counties with casinos and in adjacent counties.

Because of their conflicting conclusions, different methodologies and samples, there is no clear picture of the effect of casinos on crime. Early studies of Atlantic City were hampered by the small number of years since the introduction of casinos. Non-scientific sampling and very small samples significantly limited comparisons across cities. None of the cited studies used all available data for the United States.[8]

[6]A special aspect of the crime-casino link is the role of organized crime. Lee and Chelius (1989) interviewed casino managers, union representatives and regulatory officials to evaluate the impact of New Jersey's 1977 law controlling the casino industry and its unions. They concluded that the Casino Control Commission kept casino ownership and management free from organized crime, but only by stringent and unpopular regulations, such as licensing requirements. In contrast, organized crime played a large role in the casino labor unions. According to Frey (1998) the federal government has generally been uninterested in regulating the gambling industry, except when organized crime was involved.

[7]See Wheeler (1999) for an interesting discussion of research funded by the gambling industry.

[8]The Government Accounting Office reported that "in general, existing data were not sufficient to quantify or define the relationship between gambling and crime. It [The National Gambling Impact Study Commission] reported that although numerous studies have explored the relationship between gambling and crime, the reliability of many of these studies is questionable." GAO, 2000, p. 35.

In contrast, we argue that the lack of clarity regarding casinos and crime is not the result of unclear connections between casinos and crime, but the result of limitations in the research used to find those connections. Our paper cuts through the debate about gambling externalities and crime by addressing the research limitations directly. First, we conduct the most exhaustive investigation to date, utilizing a comprehensive county-level crime data set that includes every U.S. county, thereby eliminating sampling concerns. Moreover, we analyze crime effects over time by exploiting the time-series nature of our data, which cover 1977 through 1996. Third, we do not focus on one or two crimes, but examine all seven FBI Index I Offenses (aggravated assault, rape, murder, robbery, larceny, burglary, and auto theft). The first four offenses are classified as violent crimes and the last three as property crimes. Fourth, we are the first to explicitly articulate a comprehensive theory about how casinos could increase and decrease crime. Last, we use the most exhaustive set of control variables, most of which are commonly excluded from other studies. If casinos are correlated with these excluded variables, then previous estimates will suffer omitted variable bias.

We conclude that casinos increase crime. The connection is evident in the raw data and in the econometric analysis. We provide evidence about the social costs of casino-related crime and suggest the magnitude of implied corrective taxation.

The outline of the paper is as follows. In section I we review the theoretical links between casinos and crime. Section II explains our data and Section III examines the casino-crime link with raw data. Section IV presents the basic empirical results. Section V extends the results to border counties. In section VI we use our findings to calculate social costs. Section VII concludes.

I. The Casino-Crime Link

Previous studies have focused on the empirical question of whether there is a connection between casinos and crime and have neglected precise discussions of how casinos affect crime. We present two reasons why crime could decrease and four reasons why crime could increase.

A. Theoretical Connections between Casinos and Crime

Casinos may reduce crime directly by improving legal earning opportunities or indirectly through other effects of economic development.

1. Wage Effects: Grogger (1997) argued that increases in wages reduce crime, and Gould, Mustard and Weinberg (1998) showed that increases in employment and wages of low-skilled individuals reduce crime. Therefore, if casinos provide greater labor market opportunities to low-skilled workers, they should lower crime.

2. Economic Development: Casinos may also reduce crime indirectly through economic development. In the Midwest, for example, legislation decriminalizing casino gambling cited economic development as its rationale. Decaying waterfronts and derelict sections of town that once harbored crime may be less amenable

to it when renovation occurs, streetlights appear, and resident presence increases. The streets near Las Vegas casinos, even at night, are often cited as some of the safest.

Conversely, casinos may increase crime through direct and indirect channels.

1. Economic Development: Casinos may raise crime by harming economic development, the opposite of the indirect effect discussed above. While some commend casinos for bringing development, others criticize them for draining the local economy, attracting unsavory clients, and for outgrowths like prostitution and illegal gambling-related activities.

2. Increased Payoff to Crime: Second, casinos may increase crime by lowering the information costs and increasing the potential benefits of illegal activity. Because casinos attract gamblers and money, there is an increased payoff to crime from a higher concentration of cash and potential victims. A 1996 Kansas City case is illustrative in which a local restaurant owner was followed home, robbed, and murdered in his garage after winning $3,000 at a casino.[9] Many similar stories could be produced in other locations with casinos.

3. Problem and Pathological Gambling: Crime may increase through problem and pathological gamblers. Pathological gambling is a recognized impulse control disorder of the Diagnostic and Statistical Manual (DSM-IV) of the American Psychiatric Association. Pathological gamblers (often referred to as "addicted" or "compulsive" gamblers) are identified by repeated failures to resist the urge to gamble, reliance on others to relieve the desperate financial situations caused by gambling, the commission of illegal acts to finance gambling, and the loss of control over their personal lives and employment. Problem gamblers have similar problems, but to a lesser degree. The latent propensity to pathology becomes overt when the opportunity to gamble is provided and sufficient time has elapsed for the problem to manifest. Lesieur (1998) estimated that pathological gamblers are one or two percent of the population and problem gamblers are another two to three percent. A well-cited Maryland study found that 62 percent of the Gamblers Anonymous group studied committed illegal acts as a result of their gambling.[10] 80 percent had committed civil offenses and 23 percent were charged with criminal offenses. A similar survey of nearly 400 members of Gambler's Anonymous showed that 57 percent admitted stealing to finance their gambling. On average they stole $135,000. Total stealing was over $30 million.[11]

4. Visitor Criminality: Crime may rise because casinos attract visitors who are both more prone to commit and be victims of crime. Although this basic effect may occur in other circumstances, such as when a theme park opens, the effect of casinos may be systematically different in important respects because a different clientele may go to casinos than to other tourist resorts. For example, casinos attract a different mix of visitors than many large tourist attractions such as Branson, Missouri (country and western music) whose clientele are disproportionately retired couples or a national park frequented by vacationing families.[12] Also,

[9]Reno, 1997.

[10]See Maryland Department of Health and Mental Hygiene (1990).

[11]Henry Lesieur from the Institute of Problem Gambling, in testimony before the National Gambling Impact Study Commission, Atlantic City, New Jersey (January 22, 1998).

[12]The three largest single tourist attractions in the Unites States in 1994 were the Mall of America (Bloomington, MN), Disney World (Orlando, Florida), and Branson, Missouri receiving 38 million, 34 million, and 5.6 million visitors, respectively. For comparison, Hawaii received approximately 6 million and Las Vegas received 30.3 million

more problem and pathological gamblers will visit casinos than other attractions. One anecdotal example of the different clientele casinos attract is the large increases in pawnshops that occur when casinos open. Other tourist areas do not experience similar increases.

These mechanisms should have different impacts across crimes. Improvements in the legal sector, for example, reduce property crime more than violent crime (Gould, Mustard and Weinberg, 1998). If casinos act as magnets for unsavory development then all types of crime may increase. Pathological gamblers will generally commit crime to generate monetary benefits to pay off debts or gamble.[13] Therefore, they would be more likely to commit crimes that generate revenue, like robbery, burglary, larceny and auto theft. Furthermore, if casinos increase criminal activity by problem and pathological gamblers, this increase could be compounded by spillover effects on others (Glaeser, Sacerdote, and Scheinkman (1996)).

The theory also predicts that the effects of casinos will change over time. Reduction of crime through improvements in labor market opportunities will be observed prior to the casino opening. Because casinos take time to build, and low-skilled people may be hired before casino openings, crime reductions could precede the openings. Both the positive and negative economic development theories imply that a casino will have an impact after opening. Over time, the development effects will grow, whether positive or negative. The nonresident effect should appear with the casino's opening, but may also expand with time as more nonresidents are attracted. Effects operating through problem and pathological gamblers will not be felt for the first few years. Enough time must elapse for a gambling habit to develop and the full extent of gambling pathology to be reached. Because crime data are reported annually and casinos could open in a given year as late as December, there may not be a discernible effect on crime rates until several years after they open.

B. Estimation

Casinos can affect crime rates directly through the resident local population and indirectly through the number and type of visitors. Therefore, the total impact requires that both direct and indirect effects be included, as explained in equations (1) and (2), where crime (C_{it}) in county i in year t is a function of the presence of a casino, the number of visitors (V) to the county, and other variables that affect crime (summarized in the term *Other*) where a, b, c, and d are unknown coefficients.

$$C_{it} = aCasino_{it} + bV_{it} + Other_{it} \quad (1)$$

$$V_{it} = cAttractions_i + dCasino_{it} \quad (2)$$

visitors in 1994. Visitors per resident were 1,345 for Branson, 436 for Bloomington, MN, 188 for Orlando, and 40 for Las Vegas. Combining visitors with residents, the crime rate per 100,000 visitors plus residents was 187.3 for Las Vegas, 64 for Orlando, 16.4 for Branson, and 11.9 for Bloomington. Thus Bloomington which recieved 7.7 million more visitors than Las Vegas had a crime rate per visitor plus resident less than $\frac{1}{15}$th of the rate for Las Vegas. See Grinols and Omorov, 1996, p. 56.

[13]Continued gambling is often perceived as a way to win back needed money. "Chasing" one's losses is a characteristic of pathological gamblers.

Visitors in equation (2) depend both on the intrinsic visitor attractiveness of the county (*Attractions*) and the presence of the casino. Coefficient a measures the direct effect of the casino on crime. The indirect effect via visitors is measured through coefficients b and d. Substituting from (2) into (1) gives

$$C_{it} = \beta_i + \delta Casino_{it} + Other_{it} \tag{3}$$

where $\delta = a + bd$, and $\beta_i = bc\,Attractions_i$. The total effect of the casino on crime, δ, in equation (3), includes the effects on both the local population and visitors. Estimating a in (1) would give only a partial effect because it would not take into account the effect of casinos on visitors.[14] The key to our being able to estimate the full effect is having time series data. Because many studies of the casino-crime relationship used cross-sectional data, they were limited to estimating only a partial effect.

A second analytical issue is whether to use diluted or undiluted crime rates. Should the number of crimes be divided by population—the conventional way to generate the crime rate (undiluted)—or be divided by population *plus* visitors (diluted)? There are four possibilities for research depending on whether one considers total or partial effects, and studies diluted or undiluted crime rates. Some have argued for one combination or another without realizing that the choice is not methodological, but depends on what questions the researcher wants to answer.[15] In this study we are interested in both the direct and indirect (visitor-induced) effects of casinos on crime. We also want to know the costs associated with a change in crime in the host county. We therfore estimate the full, undiluted effect of casinos on crime rates based on a version of equation (3) to be described after we explain the data.

[14]Ideally we would like to know both a and b to decompose the total effect into the portions generated by visitors and by locals. Because of data constraints, we estimate the total effect d but not a and b separately. Visitor data do not exist at the county level and do not distinguish visitors for different purposes. Both a and b might be estimated using other variables to proxy for the number of visitors, but there are no annual, time-series data at the county level. One possible proxy for future research is the number of hotels and hotel rooms, which exists at the MSA-level and is collected by Smith Travel Research. However, this still leaves the problem of distinguishing casino visitors from noncasino visitors.

[15]A frequently mentioned invalid claim is that to determine the change in probability that a resident would be the victim of a crime, the diluted crime rate should be used. However, knowing what happens to the diluted crime rate does not give the needed information and could even move in the wrong direction. Let s_1 be the share of the resident population P victimized by residents, and let s_2 be the share of the resident population victimized by visitors V. Similarly, let σ_1 be the share of visitors victimized by residents, and σ_2 the share of visitors victimized by visitors. Then the crime rate is $s_1 + s_2 + (\sigma_1 + \sigma_2)\frac{V}{P}$; the diluted crime rate is $(s_1 + s_2)w_P + (\sigma_1 + \sigma_2)w_V$, where w_P and w_V are the share of visitors plus residents made up by residents and visitors, respectively; and the probability of a resident being a crime victim is $s_1 + s_2$. For example, assume that residents do not victimize visitors ($\sigma_1 = 0$), $P = V$, and $(s_2 + \sigma_2)$ is smaller than s_1. Without visitors the probability of a resident being victimized is s_1. With visitors it rises to $s_1 + s_2$. The diluted crime rate without visitors is s_1. With visitors it falls to $(s_1 + s_2 + \sigma_2)/2$. Thus in this case the diluted crime rate *falls* while the probability of a resident being victimized *rises*.

II. Data

Between 1977 and 1996 the number of states with some form of casino gambling rose from one to 28.[16] The number of counties with casinos grew from 14 (in Nevada) to nearly 170. By the end of our sample period, twenty-one states permitted casinos on Indian reservations. The Indian Gaming Regulatory Act of 1988 increased the number of Indian casinos by mandating that states allow American Indian gambling on trust lands if the state sanctioned the same gambling elsewhere. The semi-sovereign status of Indian tribes and their management by the Federal Bureau of Indian Affairs gave them greater leverage in their dealings with the states.

A. Crime Statistics and Control Variables

Our sample covered 3,165 U.S. counties from 1977-96. The Federal Bureau of Investigation's Uniform Crime Report[17] provided the number of arrests and offenses for the 7 FBI Index I offenses.[18] With the exception of Alaska, the county jurisdictions usually remained unchanged over our sample period. We used U.S. Census Bureau data to control for demographic characteristics that might affect the crime rate. These controls include population density per square mile, total county population, and population distributions by race, age and sex. Income, unemployment, income maintenance transfers, and retirement data were obtained from the Regional Economic Information System, a component of the Bureau of Commerce. Appendix II provides more information about the data.

B. Casino Locations

The natural operating measure for casinos is gross revenue or profits. Unfortunately, such panel data do not exist—American Indian casinos are not required to report revenues. We therefore used the year a county first had an operating Class III gambling establishment, including riverboat casinos, American Indian casinos, land-based casinos, and in the case of Florida and Georgia, "boats to nowhere"—cruises that travel outside

[16]One must carefully distinguish the date casinos began operating from other dates. Nevada (1931) legalized commercial casino gambling prior to the start of our sample, but in other states there were sometimes lags between the legislation authorizing casinos and the opening of operations. Within a state, different counties acquired casinos at different times. Also, bingo halls operated by American Indians converted to Class III gambling during our sample. We use the date Class III gambling operations first began in the county. The following states began some form of casinos gaming during our sample: Arizona (1992), Connecticut (1993), Colorado (1991), Delaware (1995), Florida (1982), Georgia (1995), Idaho (1993), Illinois (1991), Indiana (1995), Iowa (1991), Kansas (1996), Louisiana (1993), Michigan (1993), Minnesota (1991), Mississippi (1992), Missouri (1994), Nebraska (1993), New Jersey (1978), New Mexico (1990), New York (1993), North Carolina (1995), North Dakota (1993), Oregon (1993), South Dakota (1989), Texas (1993), Washington (1992), Wisconsin (1991) and West Virginia (1994).

[17]U.S. Department of Justice, Federal Bureau of Investigation. *Uniform Crime Reports: County-level Detailed Arrest and Offenses Data, 1977-1996.* Washington, D.C.: U.S. Department of Justice, Federal Bureau of Investigation. Ann Arbor, MI: Inter-university Consortium for Political and Social Research (distributor).

[18]See Appendix I for the definitions of the crimes.

Table 1: Demographic and Crime Data: Casino vs Noncasino Counties

Variable	Mean	Standard Deviation	Sample Size	Mean	Standard Deviation	Sample Size
	CASINO COUNTIES			NONCASINO COUNTIES		
Population	148,319	293,792	3,313	73,310	252,150	59,273
Population Density	208	501	3,313	217	1,459	59,265
Area (Square Miles)	2,060	3,132	3,313	1,010	2,880	59,280
Personal Income	11,407	2,657	3,313	10,805	2,619	59,260
Unemployment Ins.	79	55	3,313	64	51	59,244
Retirement Compensation	10,787	6,545	3,313	9,833	6,244	59,248
Aggravated Assault	259	276	3,072	188	245	54,724
Rape	29	27	3,009	20	32	54,055
Murder	6	9	3,081	6	10	54,801
Larceny	2,537	1,428	3,081	1,741	1,939	54,795
Burglary	1,063	668	3,081	771	1,109	54,792
Robbery	82	135	3,081	44	143	54,796
Auto Theft	267	263	3,081	167	277	54,800

U.S. boundary waters to gamble, and that contain primarily U.S. participants. Not all forms of gambling qualify as a casino. For example, Montana has thousands of small gambling outlets that offer keno or video poker, many of which are in gas stations along the highway. Also, California has many card houses, some of which are illegal. These establishments are distinct from casinos in size and type of play.

We first contacted state gaming authorities. In cases like Washington, this was an expeditious way to ascertain the first year a casino opened. However, even the central gaming authorities and Indian affairs committees often lacked information on Indian casinos. In most states, therefore, we called each casino to obtain its opening date or first date of Class III gambling if it had previously been a bingo hall, etc. We also used lists from the Casino City website, www.casinocity.com, which lists casinos in every state. This list was verified against the annually-produced *Executive's Guide to North American Casinos*.

III. Assessing the Role of Casinos

With the exception of Nevada, U.S. casinos opened after 1977. We turn first to the raw crime data as they relate to casino and noncasino counties and then describe our research.

A. The Raw Data

Table 1 presents summary crime, income, and population statistics for casino and noncasino counties (counties with no casino in any year of the sample). Casino counties had higher population, land area and income. Crime rates are also higher for these larger counties, as one would expect.

Figure 1: Changes in Crime and Casino-Counties: 1977-1998

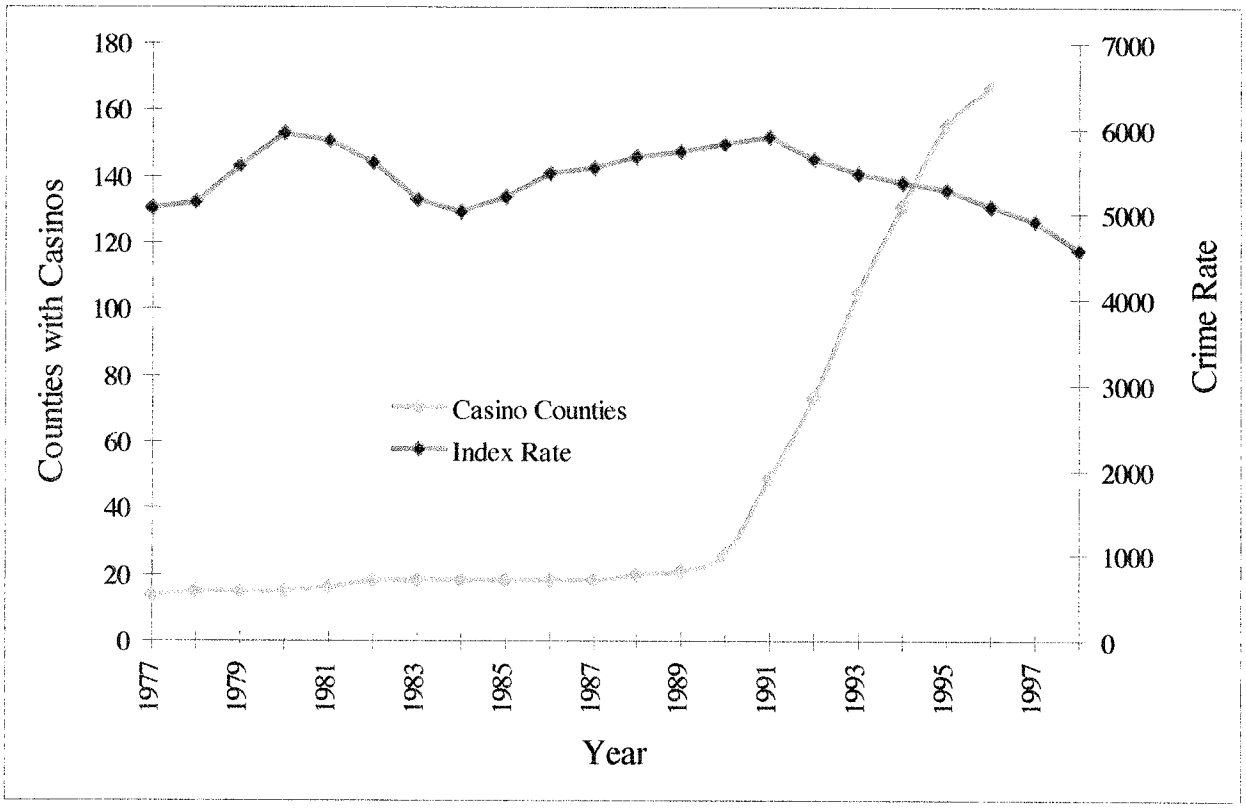
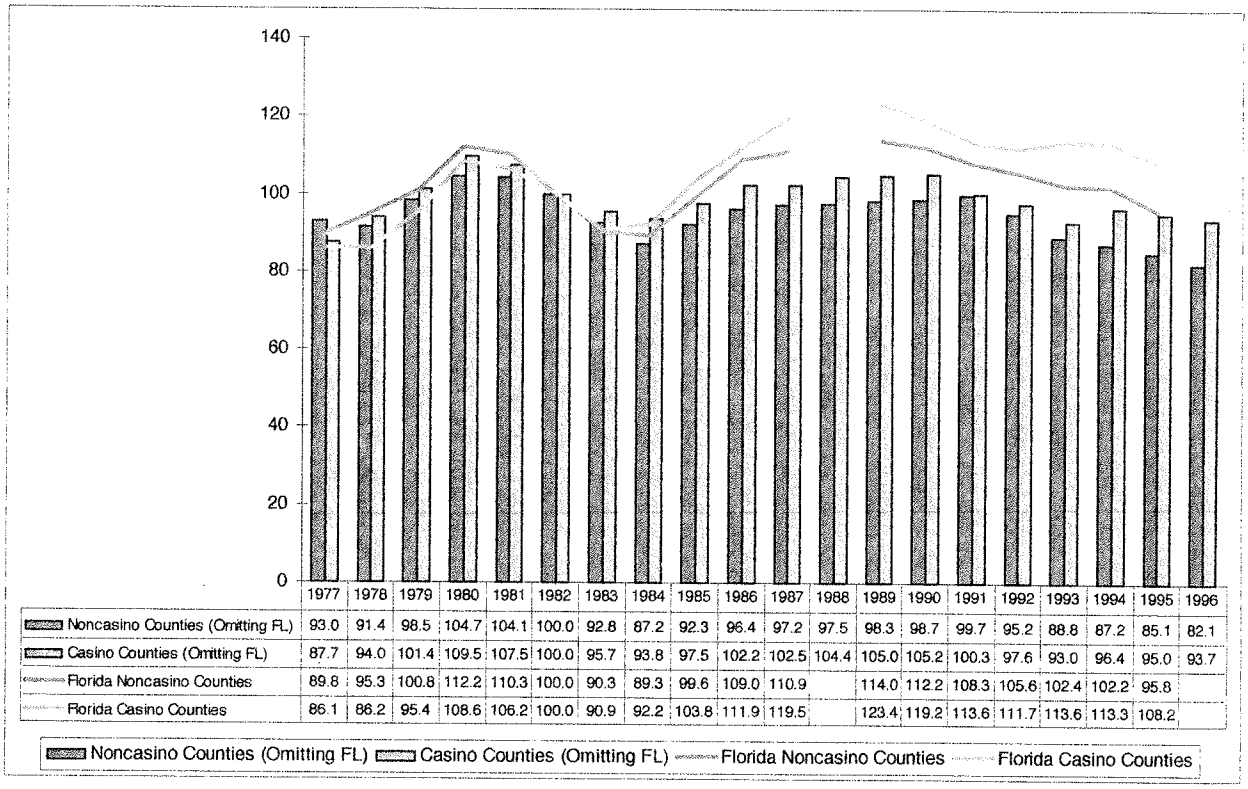


Figure 1 shows the aggregate relationship between the number of counties with casinos and the crime rate. From 1977 to 1990, when the number of casinos was relatively constant, the crime rate fluctuated. However, when counties with casinos increased rapidly from 26 to 167 between 1990 and 1996, the crime rate dropped substantially. This contemporaneous casino growth and crime reduction has been used by some to suggest that casinos reduced crime. For example, Margolis (1997) stated, "crime rates in Baton Rouge, LA have decreased every year since casino gaming was introduced." However, such conclusions are not justified because many regions in the country have experienced falling crime rates since 1991. Therefore, it is more appropriate to compare the magnitude of the decreases between casino and noncasino counties.

Figures 2 and 3 plot property and violent crime rates for casino and noncasino counties. The data are indexed so that 1982 = 100. Because data for Florida are missing in 1988 and 1996, Florida is shown

Figure 2: Property Crime Rates: 1977-96



	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Noncasino Counties (Omitting FL)	93.0	91.4	98.5	104.7	104.1	100.0	92.8	87.2	92.3	96.4	97.2	97.5	98.3	98.7	99.7	95.2	88.8	87.2	85.1	82.1
Casino Counties (Omitting FL)	87.7	94.0	101.4	109.5	107.5	100.0	95.7	93.8	97.5	102.2	102.5	104.4	105.0	105.2	100.3	97.6	93.0	96.4	95.0	93.7
Florida Noncasino Counties	89.8	95.3	100.8	112.2	110.3	100.0	90.3	89.3	99.6	109.0	110.9		114.0	112.2	108.3	105.6	102.4	102.2	95.8	
Florida Casino Counties	86.1	86.2	95.4	108.6	106.2	100.0	90.9	92.2	103.8	111.9	119.5		123.4	119.2	113.6	111.7	113.6	113.3	108.2	

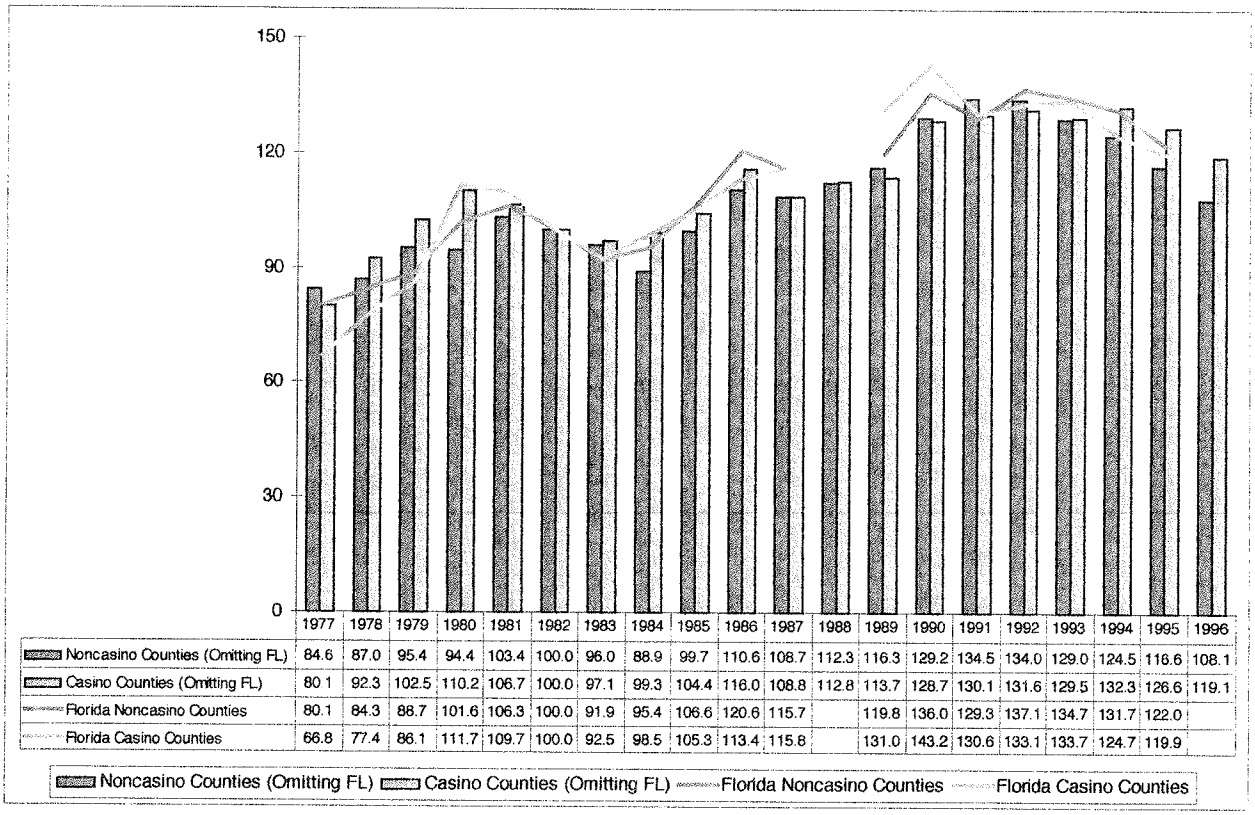
separately.[19] Florida is of separate interest because it was the first state after New Jersey to acquire casinos. In general the trends in crime rates between the two groups of counties are similar. Two features are worth noting, however. First, after 1991 casino- and noncasino-county property crime rates diverge, and crime falls more in noncasino counties than in casino counties. The 1991-96 period is when most casino counties acquired their casinos. Figure 3 shows a similar divergence for violent crime after 1993. Second, Florida casino counties show lower crime rates than the state's noncasino counties in the early years of the sample (before casinos were present) but higher crime rates at the end of the period.[20] Figure 4 highlights this cross-over. For example, total crime in 1977 was 6 percent lower in casino than noncasino counties. By 1995, however, it was 11 percent *higher*. For every crime except robbery, casino counties had lower crime rates in 1977, and higher crime rates in 1995. The robbery rate in casino counties in 1977 was 25 percent lower than in noncasino counties; by 1995 it was only 14 percent lower.

Many states have American Indian casinos governed by state compacts negotiated under the Indian Gaming Regulatory Act of 1988. Most compacts were signed, and Indian casinos opened, after 1992. In

[19]The state legislature changed the Florida crime reporting process from summary-based to incident-based on Jan 1, 1988. In 1995 Florida switched back to summary-based reporting. In the transition years, data are missing.

[20]Florida acquired its first "boat-to-nowhere" casino in 1982. Other counties acquired them in succeeding years.

Figure 3: Violent Crime Rates: 1977-96



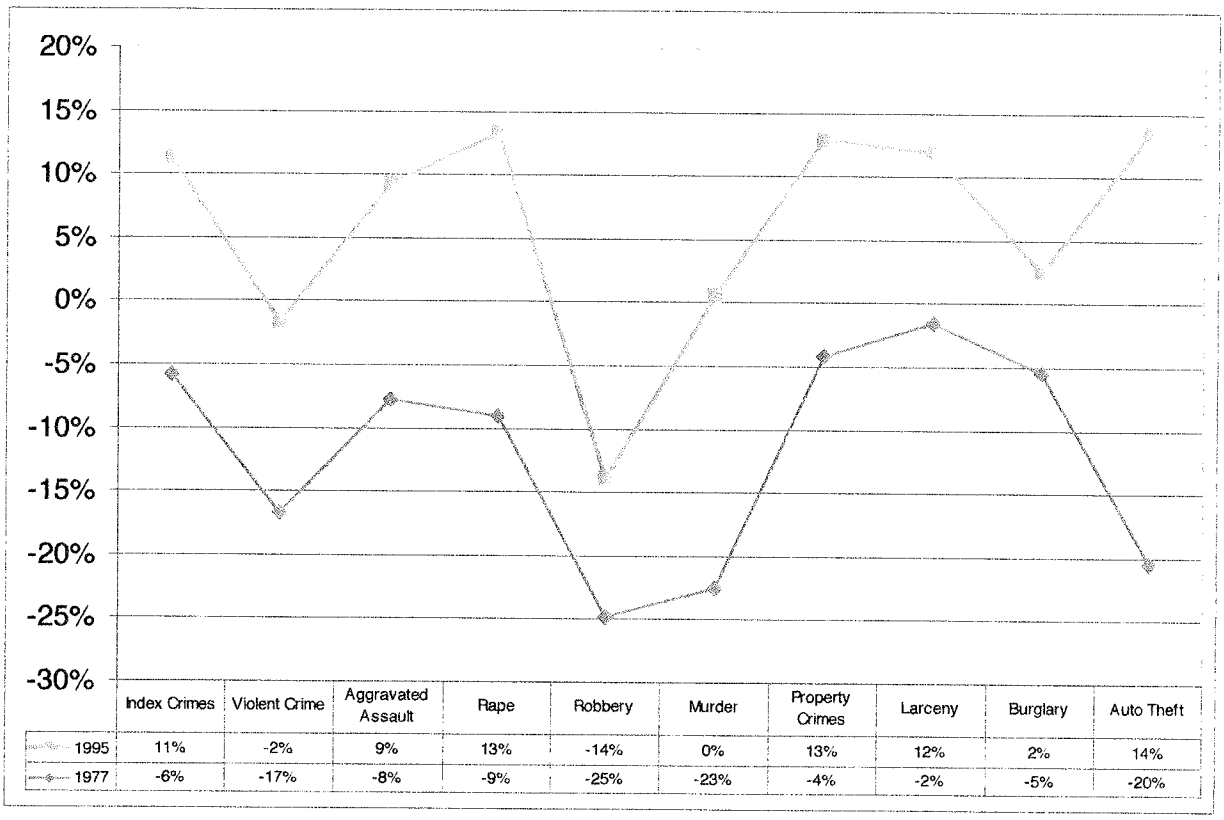
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Noncasino Counties (Omitting FL)	84.6	87.0	95.4	94.4	103.4	100.0	96.0	88.9	99.7	110.6	108.7	112.3	116.3	129.2	134.5	134.0	129.0	124.5	116.6	108.1
Casino Counties (Omitting FL)	80.1	92.3	102.5	110.2	106.7	100.0	97.1	99.3	104.4	116.0	108.8	112.8	113.7	128.7	130.1	131.6	129.5	132.3	126.6	119.1
Florida Noncasino Counties	80.1	84.3	88.7	101.6	106.3	100.0	91.9	95.4	106.6	120.6	115.7		119.8	136.0	129.3	137.1	134.7	131.7	122.0	
Florida Casino Counties	66.8	77.4	86.1	111.7	109.7	100.0	92.5	98.5	105.3	113.4	115.8		131.0	143.2	130.6	133.1	133.7	124.7	119.9	

some states (Connecticut, Minnesota, and Wisconsin are examples) Indian casinos are the sole type of casino. Figure 5 computes crime rates in Indian compact counties as a percent of the equivalent crime rate in noncompact counties for 1987 (the year before the Indian Gaming Regulatory Act was passed), in 1992 and 1996. Crime rates between 1987 and 1992 changed little relative to other counties, but between 1992 and 1996, the period of greatest increase in compact casinos, crime in compact counties rose noticeably in all categories.

Figure 6 presents the casino county data centered on the year of opening, where we set the average crime rate for the four years prior to casino opening to 100. Crime rates were very stable prior to opening, slightly lower in the year of casino introduction, returned to approximately average levels for the next three years and increased thereafter. By the fifth to seventh year after introduction, aggravated assaults were 50 to 95 percent higher, robbery was 71 to 119 percent higher, larceny was 9 to 41 percent higher, and auto theft and burglary also showed increases. Only rape was approximately unchanged at 7 percent lower to 12 percent higher.

When grouped around the year of opening the data suggest a connection between casinos and higher crime rates and the need to estimate lead and lag structures to correctly capture and identify the relevant

Figure 4: Casino County Crime Rates as Percent Deviation from Noncasino County Rates: Florida 1977 and 1995



	Index Crimes	Violent Crime	Aggravated Assault	Rape	Robbery	Murder	Property Crimes	Larceny	Burglary	Auto Theft
1995	11%	-2%	9%	13%	-14%	0%	13%	12%	2%	14%
1977	-6%	-17%	-8%	-9%	-25%	-23%	-4%	-2%	-5%	-20%

time dependencies. The lead structure will also show that crime rates in casino and non-casino counties were not different prior to the opening dates.

B. Separating Casino Effects from Other Effects, Identifying Timing

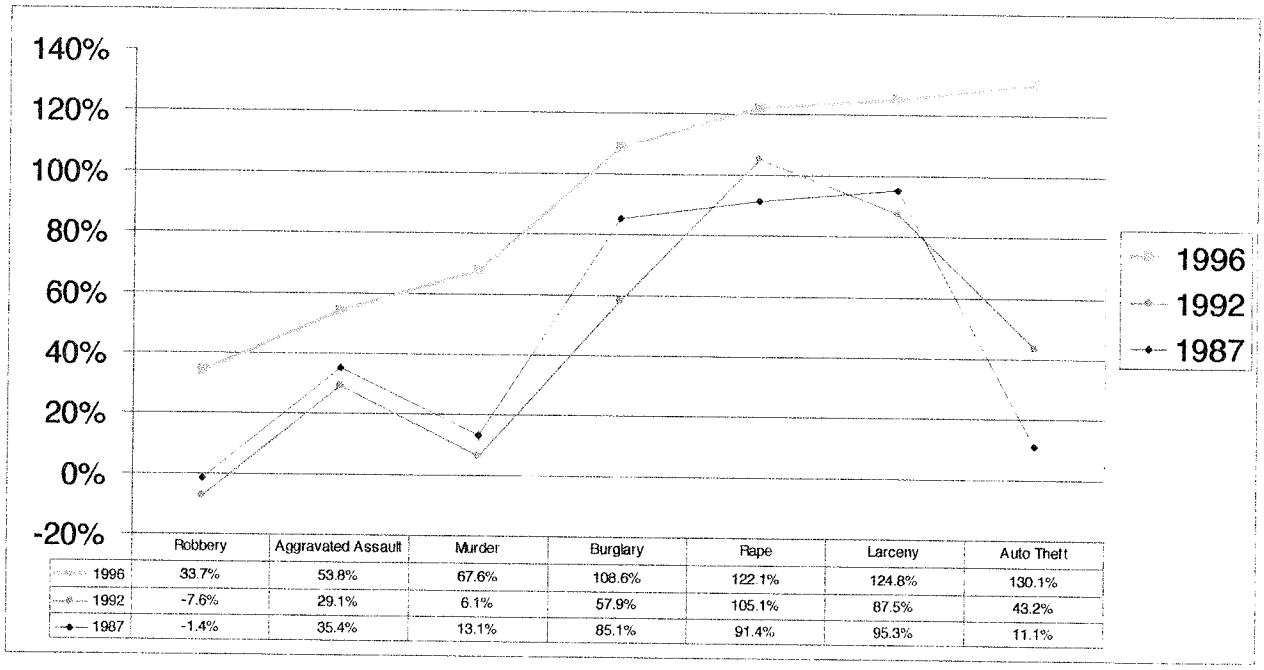
The crime model we estimated was

$$C_{it} = \alpha + \beta_i + \gamma_t + \delta L_{it} + \theta A_{it} + \varepsilon_{it} \tag{4}$$

where C_{it} is the crime rate (offenses per 100,000 people) of county i in year t. β_i is a county-level fixed effect that controls for unobserved characteristics across counties. The time fixed effect, γ_t, controls for national crime rate trends. L_{it} is a 12×1 vector of the casino opening dummy. It includes 4 leads and 7 lags of the opening variable, and captures the intertemporal effects outlined earlier.

A_{it} is a large vector of control variables and includes population density, the percent of the population that was male, percent that was black, percent that was white, and the percent between the ages of 10-19,

Figure 5: Indian Compact County Crime Rates as Percent Deviation from Noncompact County Rates



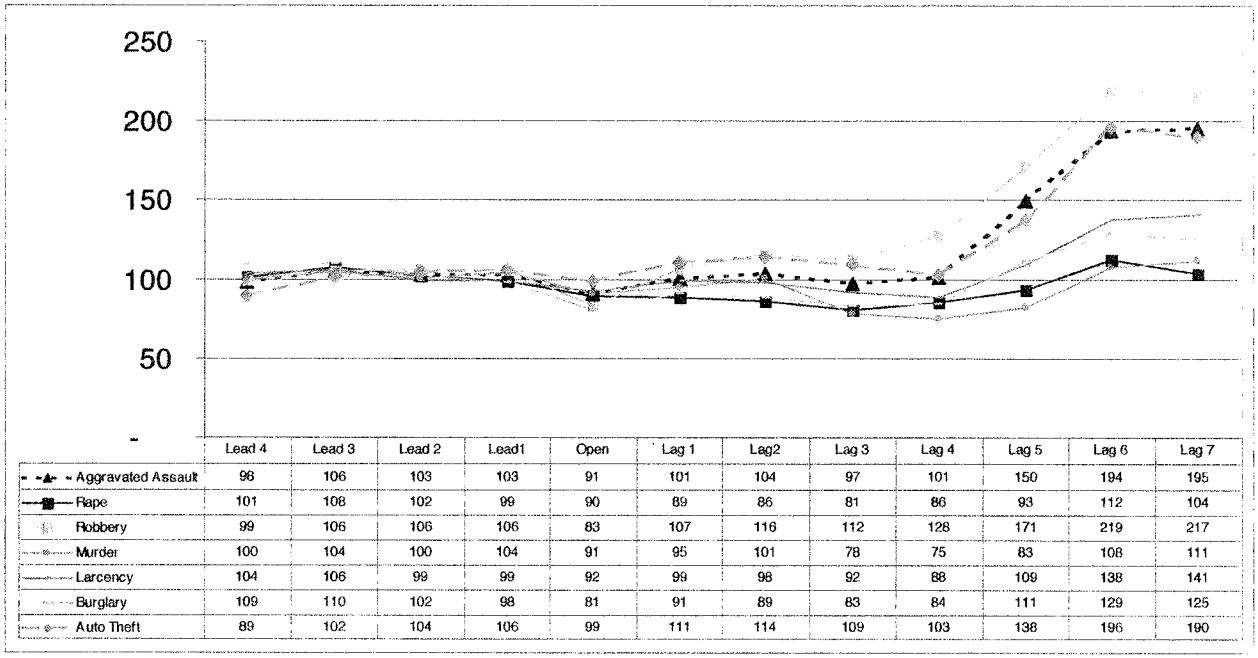
	Robbery	Aggravated Assault	Murder	Burglary	Rape	Larceny	Auto Theft
1996	33.7%	53.8%	67.6%	108.6%	122.1%	124.8%	130.1%
1992	-7.6%	29.1%	6.1%	57.9%	105.1%	87.5%	43.2%
1987	-1.4%	35.4%	13.1%	85.1%	91.4%	95.3%	11.1%

20-29, 30-39, 40-49, 50-64, and over 65.[21] Economic variables in A_{it} are real per capita personal income, real per capita unemployment insurance payments, real per capita retirement compensation per old person, and real per capita income maintenance payments. A_{it} also includes a dummy variable indicating whether the county honored a "shall issue" right giving citizens the authority to carry a concealed firearm upon request, and two years of leads and four years of lags on the shall issue dummy. A_{it} contains 22 explanatory variables. ε_{it} is the regression error. Including leads and lags, the regression has 54 explanatory variables. This was expanded to 66 when analyzing the border counties. Excluding observations with missing data reduced the sample size in most regressions from 63,300 ($3,165 \times 20$) to about 58,000.

The effect of a casino on crime depends on δ. A positive coefficient δ indicates that the introduction of casinos increased crime and a negative coefficient indicates that it reduced crime. We independently estimated each lead and lag of the casino opening year without cross restrictions to give separate estimates of the timing of changes. We weighted observations in the regression by county population.

[21]The remaining groups were Hispanics and those between 0 and 9 years.

Figure 6: Crime Rates Before and After Casino Opening - All Casino Counties Except Florida



	Lead 4	Lead 3	Lead 2	Lead1	Open	Lag 1	Lag2	Lag 3	Lag 4	Lag 5	Lag 6	Lag 7
Aggravated Assault	96	106	103	103	91	101	104	97	101	150	194	195
Rape	101	108	102	99	90	89	86	81	86	93	112	104
Robbery	99	106	106	106	83	107	116	112	128	171	219	217
Murder	100	104	100	104	91	95	101	78	75	83	108	111
Larcency	104	106	99	99	92	99	98	92	88	109	138	141
Burglary	109	110	102	98	81	91	89	83	84	111	129	125
Auto Theft	89	102	104	106	99	111	114	109	103	138	196	190

IV. Results

Table 2 reports the results for the coefficients of interest: four years of leads, the opening, and seven years of lags of the casino opening variable.[22] t-statistics are shown below the estimated coefficients. All coefficients refer to changes per 100,000 people. For example, the coefficient of Lag 4 in the column labeled "Aggravated Assault" is 50.29 and indicates that the aggravated assault rate was higher by 50.29 offenses per 100,000 population four years after a casino opened in the county. The number of observations for each regression varied from 57,029 to 57,847. R^2 was between .70 and .89.

The reported regressions exclude measures of law enforcement activity such as conviction rates, sentence lengths, arrest rates, annual police employment and law enforcement expenditures for two reasons. First, including them would have significantly limited the number of counties with available data. Conviction rates and sentence lengths are available for only four states (Mustard 2000), and annual police employment is unavailable at the county-level. The trade-off was one of reduced efficiency from loss of data versus omitted variable bias that would lead us to understate the true impact of casinos on crime.

Using the arrest rate is problematic because it is undefined when there are 0 offenses for a given crime

[22]The results for the 588 other coefficients and t-statistics are not included in the interest of space, and because they are used as controls and we are primarily interested in the casino-related variables. The full regression output is available from the authors on request.

type.[23] Many small counties in our sample record no offenses even for property crimes for a given year, and large counties frequently have no offenses for murder and rape. Therefore, including the arrest rate eliminated many observations, reducing our sample by over 30,000 observations for some offenses.

Table 2: Crime Rate Regressions - Casino Leads and Lags

	Aggravated Assault	Rape	Murder	Larceny	Burglary	Robbery	Auto Theft
Lead 4	5.44	0.42	0.87	243.89	36.68	9.91	26.40
	(0.758)	(0.5)	(3.225)	(6.113)	(1.399)	(1.672)	(2.222)
Lead 3	3.14	0.76	0.68	200.61	34.09	3.79	74.62
	(0.438)	(0.902)	(2.506)	(5.031)	(1.301)	(0.64)	(6.286)
Lead 2	−4.32	0.21	0.57	89.83	19.43	8.67	117.84
	(−0.602)	(0.251)	(2.098)	(2.25)	(0.741)	(1.462)	(9.916)
Lead 1	−8.02	−0.72	1.20	88.05	−0.54	10.51	137.59
	(−1.132)	(−0.865)	(4.513)	(2.236)	(−0.021)	(1.796)	(11.735)
Open	0.25	−0.46	1.38	172.08	−17.60	14.94	177.33
	(0.033)	(−0.529)	(4.901)	(4.138)	(−0.644)	(2.418)	(14.323)
Lag 1	3.75	1.06	1.36	235.81	40.84	34.96	210.29
	(0.505)	(1.24)	(4.876)	(5.719)	(1.508)	(5.706)	(17.131)
Lag 2	−7.86	0.29	1.34	67.04	−41.24	41.18	189.68
	(− 0.988)	(0.316)	(4.486)	(1.516)	(−1.42)	(6.266)	(14.407)
Lag 3	25.81	4.30	1.18	99.52	−31.12	74.06	242.09
	(2.758)	(4.044)	(3.362)	(1.914)	(−0.911)	(9.586)	(15.641)
Lag 4	50.29	7.61	0.59	289.82	83.67	54.65	198.85
	(3.881)	(5.179)	(1.216)	(4.03)	(1.771)	(5.113)	(9.287)
Lag 5	112.55	11.64	−0.54	771.74	356.68	68.07	331.08
	(7.132)	(6.47)	(−0.909)	(8.775)	(6.173)	(5.208)	(12.645)
Lag 6	88.28	11.26	−1.47	777.38	201.59	9.99	359.71
	(4.79)	(5.364)	(−2.117)	(7.568)	(2.988)	(0.655)	(11.763)
Lag 7	109.50	10.98	−0.98	1092.90	226.56	20.91	377.81
	(5.704)	(5.021)	(−1.351)	(10.214)	(3.223)	(1.315)	(11.861)
N	57761	57029	57847	57841	57838	57842	57846
F	364.9	121	83.01	138.34	352.27	132.76	327.45
Prob > F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R-squared	0.825	0.741	0.762	0.800	0.697	0.891	0.851

Second, and more important, by excluding these variables the reported regressions understate the true impact of casinos on crime. The Table 2 regressions with the arrest rate included displayed increased post-opening casino coefficients.[24] This is consistent with information from law enforcement officials who reported that enforcement expenditures increased substantially when casinos opened, and provides support for the evidence that omitting these variables understates the crime effect. Stephen Silvern (FBI in Atlantic City) documented that expenditures for the Atlantic City Police Department and Prosecutor's Office grew much more rapidly in the late 70s and early 80s than similar expenditures in the rest of the state and nation (Gaming Conference 1999). The Director of the Indiana Gambling Commission reported that Indiana hired an additional 120 state troopers when the casinos opened in 1995.[25] Allocations for police services also rose substantially in New Orleans upon introduction of casinos.[26] Law enforcement officials strongly

[23]See Lott and Mustard (1997) and Levitt (1998) for more detailed discussions of problems with arrest rates.

[24]We do not present the coefficients in a table because the results are qualitatively similar to the Table 2.

[25]John Thar, Director of the Indiana Gambling Commission, report at Gaming Conference 1999.

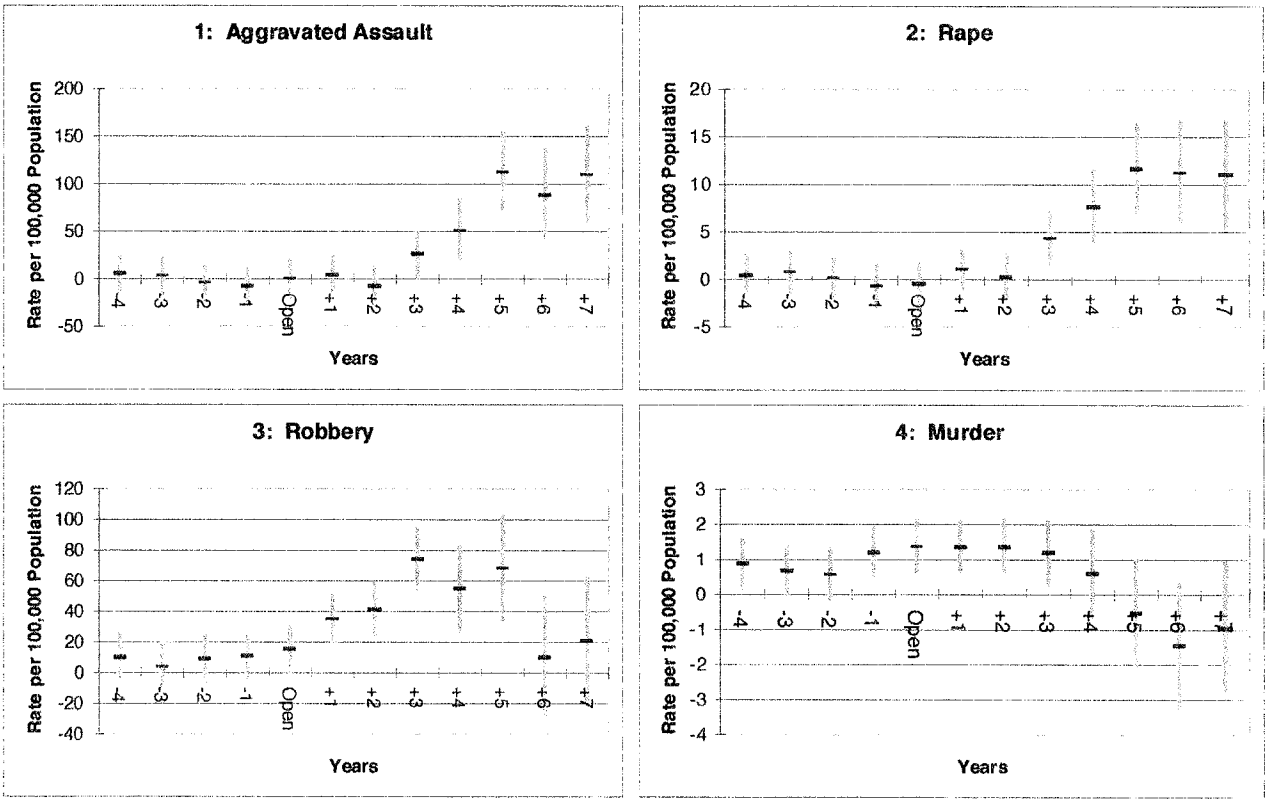
[26]Lt. Joseph P. Lopinto, Jr., Commander of the Gambling Section of the New Orleans Police Department reported

emphasize that to maintain public safety it is necessary to increase spending on enforcement resources when casinos open. Because we are unable to accurately measure these additional resources that reduce crime, the estimates without law enforcement variables understate the effect of casinos on crime and form a lower bound on the impact.

A. Violent Crime

Figure 7 displays the information for violent crime from Table 2. The horizontal axis plots the casino opening leads and lags and the vertical axis plots the coefficient estimates. Figure 7.1, for example, shows the effect of casino opening on aggravated assaults for the four years before and seven years after opening. The plotted vertical lines show the 99 percent confidence intervals, the range within which the regression indicates the true coefficient should lie with 99 percent probability.

Figure 7: Casino Effects - Violent Crime



For aggravated assault, the coefficients for all four years of leads, the year of opening, and the first two

that his department has been significantly resource constrained since the opening of New Orleans' casinos and the resulting increase in demand for police services. Gaming Conference 1999.

years after the casino opening are not significantly different from zero. However, coefficients for the third and subsequent year after opening are significantly above zero, and the trend rises. By the third and subsequent year casinos are a statistically significant contributor to increased assault rates. The estimated high occurs in the fifth year after opening, when the aggravated assault rate is 112 higher per year.[27]

Although the point estimates for years 3 through 7 after opening are each statistically significant at better than the 1 percent level, the number of counties with casinos open three to seven years is 91, 59, 35, 12, and 7, respectively. Because the number of counties whose casinos opened 6 and 7 years before is small, we treat the estimates for the sixth and seventh year lags cautiously.

Figure 7.2 for rape shows a similar pattern for aggravated assault. Coefficients are not significantly different from 0 prior to the opening. However, they are positive and significant in the third year after the casino opened, and rise thereafter. A county that introduces a casino might expect a negligible impact in the first two years after opening, but a higher rape rate by 8 to 12 incidents per 100,000 population in the fourth and fifth years after opening. The pattern for robbery (Figure 7.3) is similar to aggravated assault and rape with two exceptions. First, the increase in robbery began immediately. Second, the estimated coefficients for the sixth and seventh years after the casino opened cannot be distinguished from zero. One potential explanation is that the effect of casinos on robbery dies out in the sixth and seventh years after opening. Another is that the sample does not have enough observations with casinos opening six or seven years previously to distinguish an effect for this type of crime.

As expected, the impact of casinos on murder is the smallest of all offenses. Figure 7.4 shows there are significant coefficients only for the year before opening through the third year after opening, and implies about 1.3 additional murders for casino counties. However, casino counties have slightly higher murder rates (by about 0.7) before opening, and the change from before to after is not statistically significant. Gambling-related murders and deaths are frequently high profile cases. They include cases such as the disgruntled gambler who killed a casino teller when he tried to retrieve his gambling losses, a spouse who fought over the other's gambling losses and was murdered, a parent's gambling leading to the death of a child and similar tales.[28] However, such murders are not frequent and systematic enough to merit a strong assertion about the impact of casinos on murder. Because murder is the least frequently committed crime and most counties have zero murders, murder rates typically have high variance, which makes it difficult to conclusively identify effects.

[27]The estimated pattern of crime increase is unlike the typical pattern of visitor increases after casino opening. Grinols and Omorov (1996) showed the number of visitors to Illinois casinos typically rises immediately after opening and reaches equilibrium levels after six months or fewer.

[28]See Jeffry Bloomberg, Prepared Statement, Hearing Before the Committee on Small Business, House of Representatives, 103rd Congress, Second Session, 21 September 1994, Serial No. 103-104, Washington, D.C.: USGPO, p. 47. Accounts of the more spectacular gambling-related murders and deaths (most often suicides) often appear in the press. *USA Weekend*, February 10-12, 1995, p. 20, for example, describes a man killing his wife and beating up his daughter in a fight over his gambling away thousands of dollars. The Associated Press September 3, 1997, reported on the 10-day-old infant who died of dehydration after being left in a warm car for about seven hours while her mother played video poker in South Carolina.

B. Property Crime

Figure 8 displays the Table 2 coefficients for property crimes, which are committed far more frequently than violent crimes. Figure 8.1 displays a pattern similar to rape, robbery and aggravated assault (Figures 7.1, 7.2, and 7.3)—relatively little impact until the fourth year when crime rates increase consistently. The larceny coefficients increase from 67 in the second year after opening to over 1000 by the seventh year. This rising impact indicates that the negative effects of the casino-crime link outweigh positive impacts over time, and is consistent with the negative development argument that it takes a while for gamblers to exhaust personal resources before resorting to larcenous crime. An alternative explanation of the delayed impact is that casinos have an immediate impact on crime, but that impact is netted out by a large increase in police resources, which are typically significantly increased when casinos open, but do not maintain the same rate of growth over time. The slightly more immediate impact of casinos on violent crime observed in Figure 7 may be explained in terms of *imported* criminals. It may take less time to habituate to a new casino's location than for people to exhaust their resources.

Figure 8: Casino Effects - Property Crime

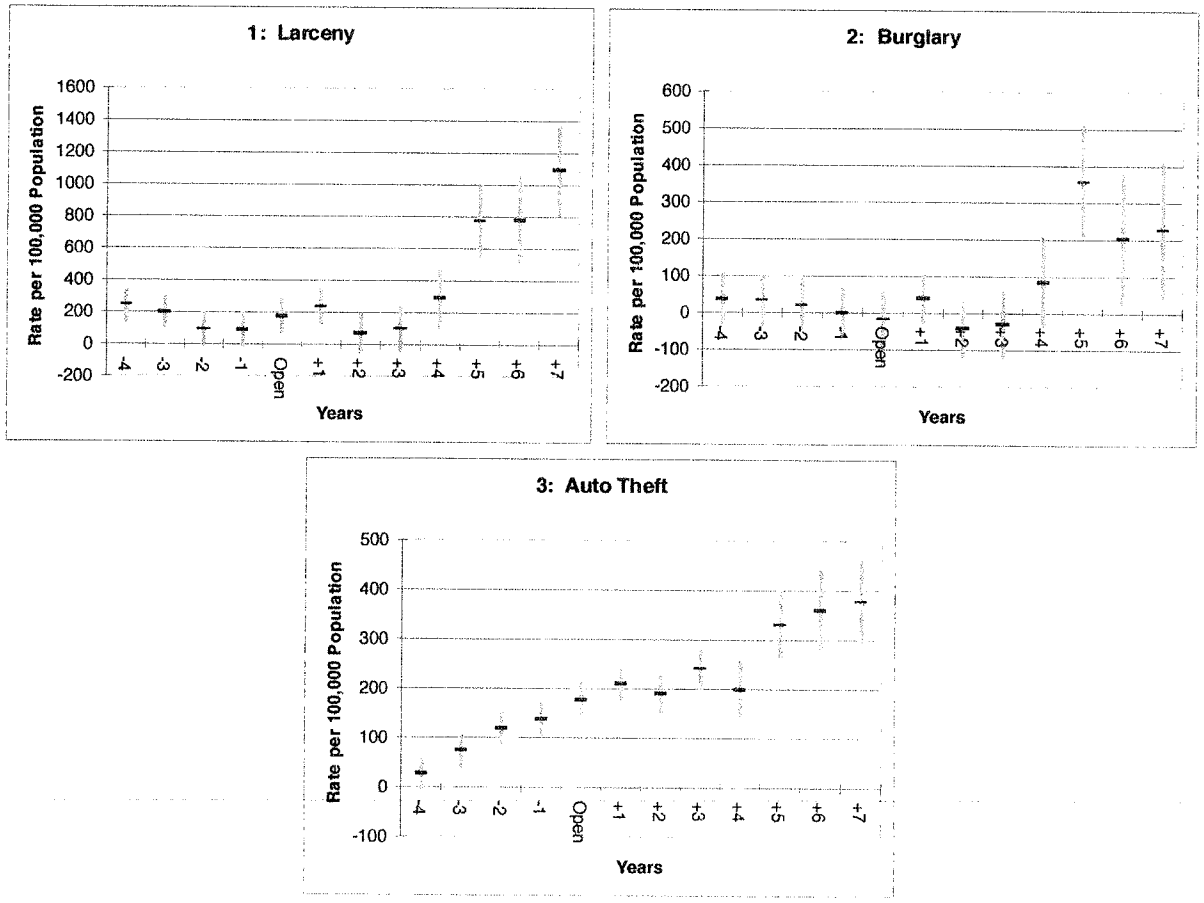
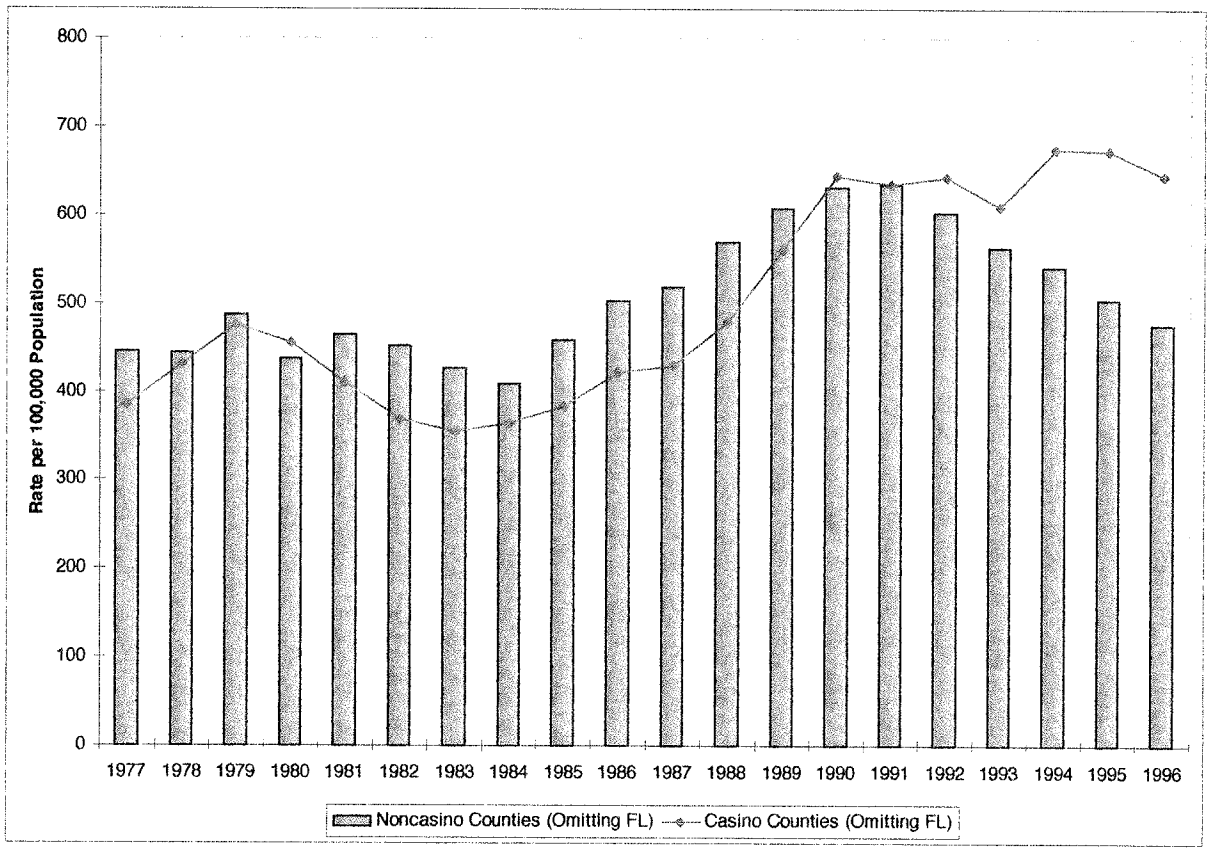


Figure 8.2 for burglary is very similar to larceny, robbery, assault and rape. Burglary shows no noticeable impact of casinos until the fourth year after casino opening. The five, six and seven year lag estimates are significant at between 200 and 400 additional offenses, again indicating that the negative effects of casinos dominate the positive effects over time.

Figure 8.3 for auto theft presents a different picture. It is the only crime that showed a rising trend before casino opening, which continued unabated through the seventh year after opening.[29] Figure 9 shows that casino counties did not experience the same decreases in auto thefts that noncasino counties experienced after 1991, when the number of casinos increased rapidly.[30] Thus, one reason for the auto theft results is that casinos play a role in causing auto thefts not to fall as fast as they did in noncasino counties.

Figure 9: Auto Theft Crime Rates: Casino vs. Noncasino Counties



[29]Again, we have only 12 observations of counties that had a casino open six years earlier and 7 observations of counties that had a casino open 7 years earlier. Robustness checks consisting of removing observations for the states making up these observations one state at a time did not materially affect the pattern shown.

[30]Note that a similar divergence in Florida started in 1984 and grew after that, consistent with Florida casino openings. The first Florida casinos opened in two counties in 1982, two more opened in 1988, and the rest opened between 1990 and 1995.

A second factor may be that we were unable to control for Lojack, an electronic tracking system that allows police to quickly locate and recover stolen autos. Ayres and Levitt (1998) showed that Lojack accounted for a significant reduction in auto thefts in the 1990s. Because cities that implemented Lojack generally do not have casinos, we may overstate the effect of casinos on auto theft.[31] It is also possible that Lojack's use is not yet sufficiently widespread to greatly affect our estimates.

To summarize our empirical results, the casino opening lead variables indicate that casino and noncasino counties have similar crime patterns prior to the opening of casinos. Casinos are not more likely to be placed in areas that have systematically different crime environments than other regions. After casinos open the crime trends differ: casino-county crime rates increase relative to the noncasino-county rates. The differences typically begin a few years after casino opening and increase over time. These characteristics are consistent with the predicted effects outlined in the theory. For example, crime is generated by problem and pathological gamblers who, according to clinical research, take about two or three years to exhaust alternative resources before they commit crime. Furthermore, the most significant effects are for offenses where obtaining resources is the primary motivation of the crime. Not unexpectedly, the only crime that shows no effect is murder, which has the least clear relationship to casino gambling.

Studies that did not have large data sets, a sufficient number of years of observations after casino opening, and that did not allow for the impact to change over time have missed these effects. The evidence presented thus far suggests that casinos increased crime, but provides no information about whether casinos created crime or redistributed it from one area to another. We address this question next.

V. Do Casinos Create Crime or Attract It from Elsewhere?

The previous section provided strong evidence that the introduction of casinos is associated with an increase in crime rates in the host county beginning approximately three years subsequent to introduction. Grouping crime into property and violent categories, the estimates suggest that after six years, 8 percent of property crime and 10 percent of violent crime in casino counties is due to casinos.[32]

Do casinos create crime, or merely move it from other locations? In this section, we address this important question by examining the crime rates of counties that border casino-counties. When casinos open crime rates in neighboring counties could either decrease, remain the same or increase. The first possibility supports the idea that casinos move crime from adjacent counties but do not create new crime. In the second case adjacent counties experience no change in crime, which indicates that total crime rises and that casinos create crime. The last possibility is that both host and neighbor counties experience increased crime rates, which indicates that casinos create crime that spills over into neighboring areas.

To implement a test strategy, we defined a set of neighbor lead, opening and lag variables, similar to the original set used in Table 2 for the host county. The "neighbor opening" variable took a value of 1 if

[31] Ayres and Levitt (1998) showed that Lojack had little effect on other offenses, so our results for the other crimes will not be affected.

[32] Section VI. explains the computation of these numbers.

Table 3: Crime Rate Regressions - Casino Neighbor Leads and Lags

	Aggravated Assault	Rape	Murder	Larceny	Burglary	Robbery	Auto Theft
Lead 4	12.59	1.29	-0.07	96.84	-0.66	17.04	1.20
	(3.171)	(2.544)	(-0.490)	(4.382)	(-0.045)	(5.191)	(0.183)
Lead 3	4.80	0.13	-0.05	20.81	-13.92	11.27	-18.73
	(1.217)	(0.256)	(-0.366)	(0.948)	(-0.965)	(3.457)	(-2.870)
Lead 2	19.73	1.00	0.60	71.44	25.63	36.97	8.75
	(5.007)	(2.059)	(4.079)	(3.257)	(1.777)	(11.349)	(1.341)
Lead 1	10.71	0.82	0.60	5.66	10.63	21.51	15.89
	(2.745)	(1.711)	(4.061)	(0.261)	(0.744)	(6.666)	(2.459)
Open	1.40	0.69	0.88	6.82	3.87	4.14	9.37
	(0.355)	(1.442)	(5.926)	(0.310)	(0.267)	(1.267)	(1.430)
Lag 1	4.27	-0.35	0.89	29.63	5.57	12.08	32.95
	(1.027)	(-0.719)	(5.658)	(1.280)	(0.366)	(3.513)	(4.785)
Lag 2	-20.48	-2.56	0.57	-173.26	-70.49	-4.90	-21.59
	(-4.467)	(-4.824)	(3.316)	(-6.790)	(-4.200)	(-1.292)	(-2.844)
Lag 3	13.40	1.08	0.67	-47.63	7.40	6.03	9.86
	(2.566)	(1.765)	(3.403)	(-1.638)	(0.387)	(1.397)	(1.141)
Lag 4	14.74	1.23	0.75	-44.91	42.04	14.42	31.14
	(2.424)	(1.761)	(3.269)	(-1.326)	(1.888)	(2.867)	(3.091)
Lag 5	19.79	5.02	0.37	271.67	140.78	32.73	132.77
	(2.418)	(5.382)	(1.203)	(5.963)	(4.698)	(4.837)	(9.796)
Lag 6	63.08	6.49	0.47	472.50	71.73	34.60	233.09
	(4.981)	(4.493)	(0.981)	(6.699)	(1.546)	(3.303)	(11.109)
Lag 7	41.44	0.57	-0.99	223.20	168.21	48.44	89.83
	(3.547)	(0.430)	(-2.262)	(3.430)	(3.931)	(5.012)	(4.641)
N	57761	57029	57847	57841	57838	57842	57846
F(65,*)	299.7	100.3	70.1	116.1	288.6	112.6	272.5
Prob > F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R-squared	0.826	0.742	0.763	0.801	0.697	0.892	0.852

a casino opened in an adjacent county in a given year. These twelve new variables increase the number of regressors to 66. The adjacent counties are the relevant unit of measurement for this purpose, because the vast majority of casino patrons come from the local region surrounding the casino. For example, in Illinois over 92 percent of casino customers come from within 75 miles.[33] Therefore, a substantial majority of the visitor movement will be accounted for with the adjacent county technique. A few casinos, most of which are in Nevada, draw their customers from outside their immediate area. However, our estimates do not rely on these casinos to identify the effects, because these casinos opened prior to 1977.

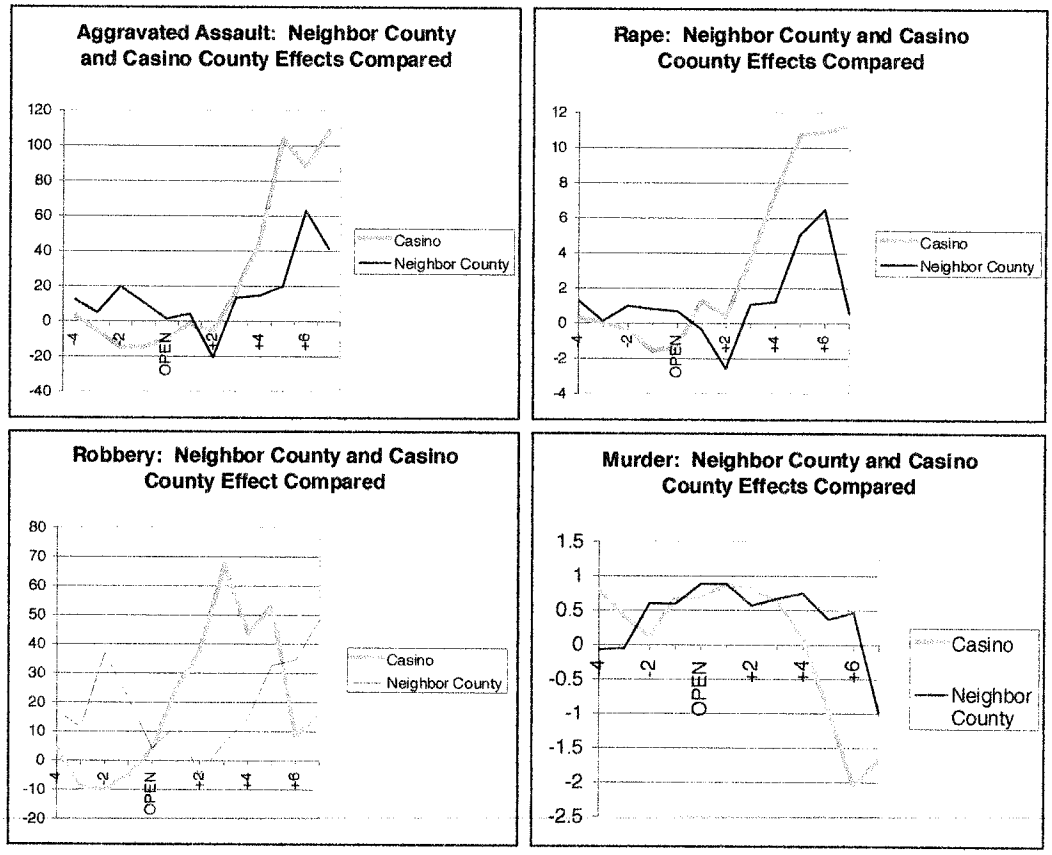
Table 3 shows the estimated effect of casinos on crime rates in neighboring counties. When the neighbor variables were included the host county crime coefficients were virtually unchanged, both in terms of point estimates and statistical significance. The correlation of the host county lead and lag coefficients of casino opening between the two regressions was higher than .99 for aggravated assault, rape, larceny, burglary, and auto theft, and was .985 for murder and .979 for robbery.

The pattern of crime increases in counties adjacent to casino counties showed no evidence of compensating

[33]Gazel and Thompson, 1996.

reductions in crime and therefore no evidence of crime shifting. For years before the opening of casinos, there is virtually no impact of the casino on crime rates in neighboring counties. Generally, the overal pattern of crime rate influences is similar to the pattern in the host county, with crime increases beginning after three years of casino introduction, but attenuated relative to the host county effect. For example, Figure 10 shows the coefficients for neighboring counties for aggravated assault (thin line) compared to the host county coefficients (heavy line). The crime rate for aggravated assaults in counties neighboring casino host counties is insignificantly different from zero for five out of the first seven years of the sample (four years before casino opening up to two years after opening), but thereafter all of the coefficients are statistically significant and positive. Comparison to the heavier line showing the host county coefficients reveals that in both the host county and neighboring counties there is little impact of the casino until approximately the third year after opening. From that point the crime rate begins to rise, with the crime rate in neighboring counties rising less than in the host county. The pattern in Figure 10 is consistent with a spillover effect for aggravated assault.

Figure 10: Neighbor County Effects: Violent Crime Rates on Vertical Axis

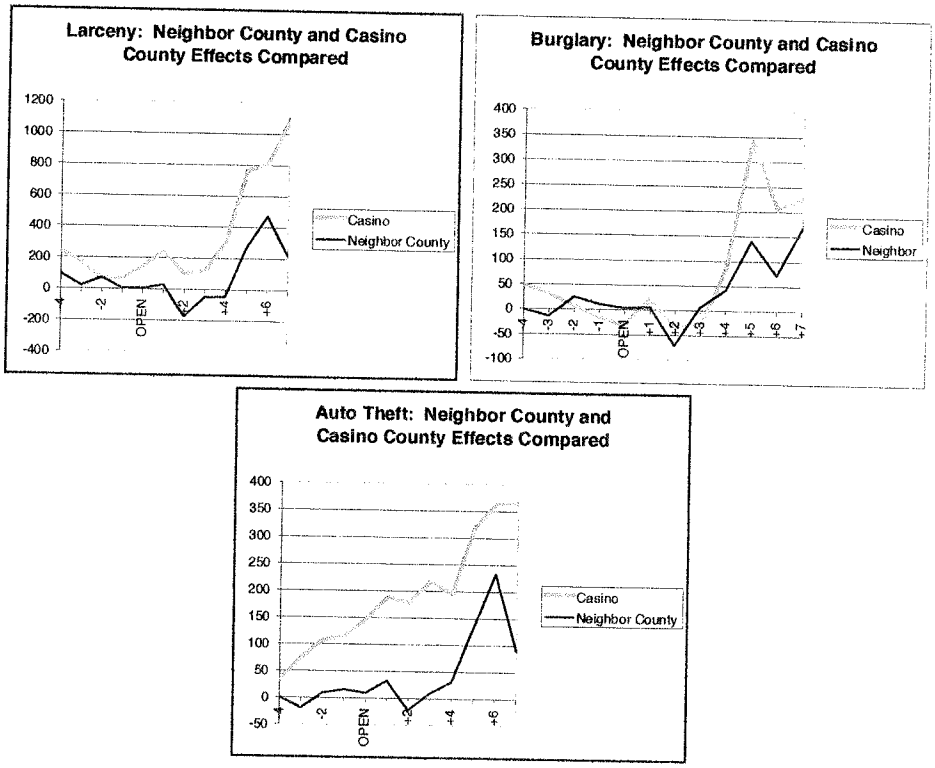


Rape exhibits a similar pattern. Robbery rates fell in neighboring counties before the opening of casinos.

However, starting in the second year after opening robbery rates increased substantially. The U-shaped pattern for the neighboring county crime rate with the base two years after casino opening is a strong indicator that casinos openings lead to robbery spillover effects in neighboring counties.

Murder rates in the neighboring county are not discernably different after the introduction of a casino. The lack of a pattern attributable to the opening of casinos agrees with the host county effects described in the previous section. Figure 11 plots the host county and neighbor county coefficients for property crime. The pattern of increased crime in neighboring counties beginning three or four years after introduction of casinos is apparent for larceny and burglary. As before, the effect in neighboring counties is smaller than in the host county.

Figure 11: Neighbor County Effects: Property Crime Rates



In our discussion of host county auto theft rates we speculated as to why the host county estimated coefficients presented a different pattern of continually growing crime. This pattern of host county coefficients did not appear to be closely related to the introduction of casinos. However, auto theft for neighbor counties displays the pattern of crime increases observed for other crimes. There is a discernably different crime rate three or more years after the opening of the neighboring casino, but not in the years before. The neighbor county effect suggests spillover of auto theft crimes due to the casino, even though host county effects are primarily driven by non-casino factors.

Taking all crimes into account, the data contain no evidence of compensating reductions in the crime rate of neighboring counties when crime rises in casino counties. The evidence more strongly supports spillover effects for all crimes but murder when casinos are introduced. The spillover effects are on the order of half the size of the casino host county effect. Therefore, we would conclude that casinos create crime, rather than attract it from elsewhere.

VI. Social and Legal Implications

The Table 2 coefficients allow us to estimate the fraction of observed crime due to casinos. In this section we combine these estimates with information about the cost of each crime to estimate social costs.

A. Share of Observed Crime Due to Casinos

Summing the estimated number of crimes attributable to casinos (for each county accounting for how many years the casino was in operation) and dividing by the casino counties' total population for each year measures the contribution of casinos to observed crime. Very little crime was due to casinos until the 1990s. Thereafter a growing percentage of observed crime was attributable to casinos. In 1996, the last year of our sample, casinos accounted for 10.3 percent of violent crime, and 7.7 percent of property crime in casino counties. Estimates of the share of crime attributable to casinos in the same year for individual crimes ranged between 3 and 30 percent. Auto theft was the highest, followed by robbery at 20 percent. The values for the rest of the offenses were between 3-10 percent.

B. Costs of Casino-Induced Crime

Recent studies have estimated the social costs of index crimes. We use total cost per victimization figures adjusted to 1998 dollars using the CPU-U to calculate the total cost of the crimes committed in casino counties that are attributable to the casino presence according to the coefficients in Table 2.[34] We also compute the crime cost for casino counties on a per adult basis. Both results are shown in Figure 12.

Figure 12 shows that total costs were relatively low over most of the 1980s, rising significantly only after 1988. By the end of the period, total costs for the 167 casino counties reached $1.3 billion per year in 1995 and 1996.[35] On a per adult per year basis, the costs were $1.10 or below until 1984, between $5 and $9 through 1988, $33 in 1990, $65 in 1995, and $63 in 1996, the last year of our sample.

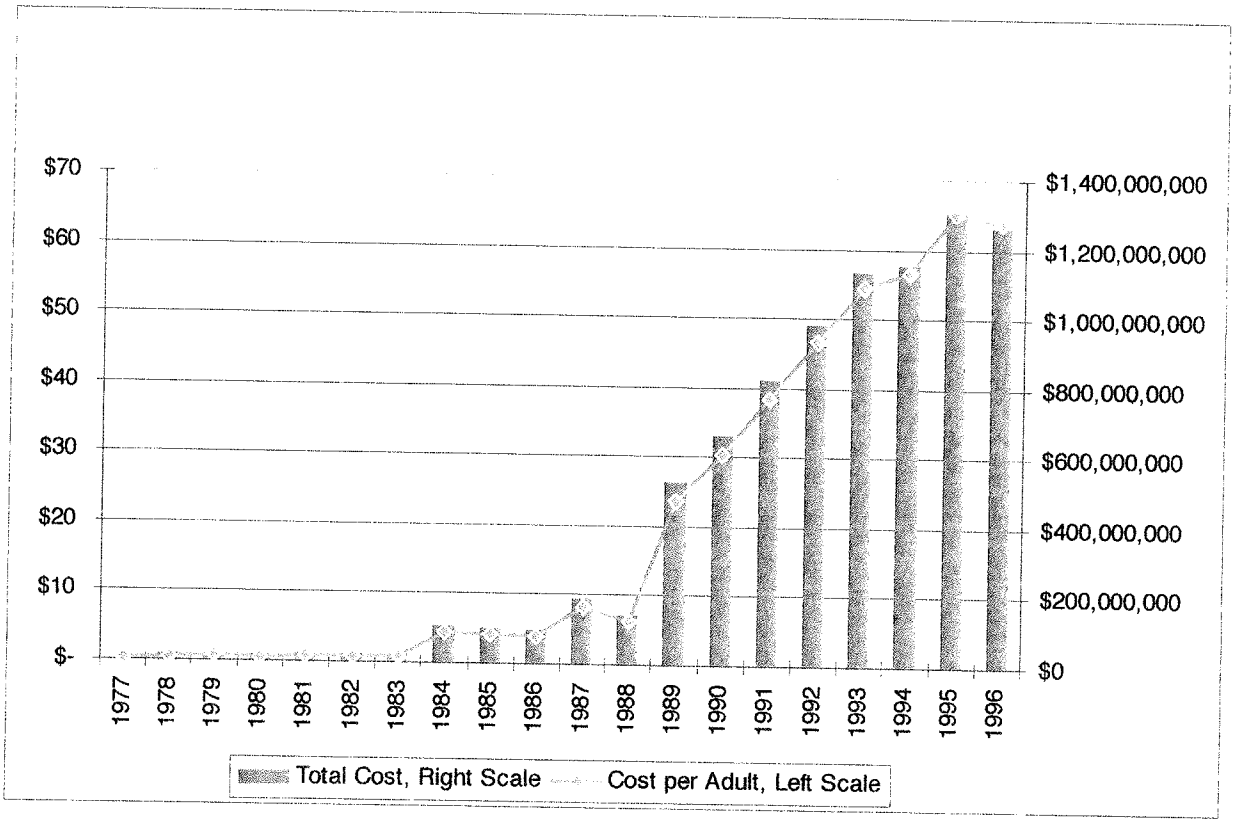
We can compare these cost estimates with others that relied on different methodology. Social costs of casinos have commonly been estimated in terms of the average cost imposed on society by a representative problem and pathological (P&P) gambler[36] multiplied by their number. In the most recent comprehensive

[34]See Miller, Cohen, and Wiersema, 1996, column 4 of Table 9, p. 24.

[35]The precise figures were $1.302 billion in 1995 and $1.275 billion in 1996.

[36]Some studies group problem and pathological gamblers, some treat them separately. Costs are computed by learning the behavior of P&Ps through direct questionnaires and surveys.

Figure 12: Casino Crime Costs: 1977-1996



study of this type of which we are aware, Thompson, Gazel, and Rickman (1996b) found that total social costs were $135 per adult in 1996 dollars, of which $57 (42 %) were due to police and judicial-related costs and thefts.[37] Thompson, *et al.* reported that they intentionally "projected numbers believed to be very conservative," and that the crime costs in their sample (Wisconsin) were probably lower than similar costs in other locations. For all of these reasons, and taking into account the different samples and methodology, their estimate is remarkably close to the direct costs estimated here for 1995-96 of $65 and $63. Applying the Thompson, *et al* proportions to our data, total social costs in those years would be $156 and $151 per adult.

[37]The social-cost impact of casino-related serious problem gamblers was $138,453,113. Dividing this by the number of adults over 20 in the counties with casinos gives the per adult figure in the text. The proportion of costs due to police, theft, and judicial-related costs is determined from their tables A-2 and A-5.

C. Pigouvian Taxes

What are the policy implications of casino-induced crime? Standard Pigouvian corrective theory for an industry with externalities is that it should be taxed by an amount equal to the costs that it imposes on society. By internalizing the externalities, corrective taxes would cause casinos to adjust their operations or go out of business. Only those that could pass a cost-benefit test by compensating society for the damage they cause would continue to operate. Relative to the revenues for a representative casino of about $230 per adult each year from nearby residents,[38] Pigouvian corrective taxes for the seven index I crimes would represent 25-30 percent of percent revenues. If other social costs are ultimately identified, required taxes would be higher.

An alternative to Pigouvian taxes depends on whether gambling can be offered in a manner that does not lead to externalities. Can gambling be provided in a manner that does not generate problem and pathological gamblers, and thereby lead to fewer crimes? If so, it may be less costly to society to implement than the response based on Pigouvian taxes.

VII. Summary

Our analysis of the relationship between casinos and crime is the most exhaustive ever done in terms of the number of regions examined, the years covered and the control variables used. Using data from every U.S. county from 1977 to 1996 and controlling for over 50 variables to examine the impact of casinos on the seven FBI Index I crimes (murder, rape, robbery, aggravated assault, burglary, larceny and auto theft), we concluded that casinos increased all crimes except murder, the crime with the least obvious connection to casinos. Most offenses showed that the impact of casinos on crime increased over time and began about three years after casino introduction. This pattern is consistent with the theories that problem and pathological gamblers commit crime as they deplete their resources, that nonresidents who visit casinos may both commit and be victims of crime, and that casinos lower information costs of crime and increase the potential benefits of illegal activity. These effects outweigh the potentially positive effects on crime that casinos may have through offering improved labor market opportunities.

According to our estimates, between 3 and 30 percent of the different crimes in casino counties can be attributed to casinos. This translates into a social crime cost associated with casinos of $65 per adult in 1995 and $63 per adult in 1996. These figures do not include other social costs related to casinos such as crime in neighboring counties, direct regulatory costs, costs related to employment and lost productivity, social service and welfare costs. Overall, 8 percent of property crime and 10 percent of violent crime in counties with casinos was due to the presence of the casino. Although robbery, the offense that exhibited the largest increase, is classified as violent crime, it is more appropriately classified as a property crime in that the motivation of its perpetrators is to obtain resources.

We also investigated whether the crime in casino counties is merely attracted (moved) from other regions

[38] See Grinols and Mustard, 2000.

or is created. Counties that neighbor casino counties generally experienced crime increases whose pattern matched the pattern in casino counties, but smaller. This indicates that crime spilled over from casino counties into neighbor counties, rather than shifting crime from one area to another.

In future research we hope to refine this study. Questions include whether different types of casinos have different impacts on crime. For example, do riverboat casinos affect crime in the same manner as land-based casinos or casinos based on Indian Reservations? Is there a difference based on geographic areas? Do casinos in rural areas affect crime in the same way as those in more highly populated areas? We will also try to decompose the total effect into the fraction due to local residents and visitors. We will also extend the data set as new data become available.

APPENDIX I

Definitions of FBI Part I Index Crimes[39]

The FBI Uniform Crime Report Part I offenses as follows:

I. Violent Crime–includes murder, rape, robbery and aggravated assault.

A. Murder and Non-negligent Homicide is the willful (non-negligent) killing of one human being by another and is based on police investigations, rather than the evaluations of a medical examiner or judicial body. Deaths caused by negligence, attempts to kill, assaults to kill, suicides, accidental deaths, and justifiable homicides are excluded from this category. Justifiable homicides are limited to the killing of a felon by a law enforcement officer in the line of duty and the killing of a felon by a private citizen.

B. Forcible Rape is the carnal knowledge of a female forcibly and against her will. Included are rapes by force and attempts or assaults to rape. Statutory offenses (where no force was used and the victim is under age of consent) are excluded.

C. Robbery is the stealing, taking or attempting to take anything of value from the care, custody or control of a person or persons by force, threat of force or violence and/or by putting the victim in fear. Robbery includes attempted robbery. Robbery is divided into seven subclassifications: street and highway (which accounted for 52 percent of all robberies in 1992), commercial house (11.9 percent), residence (10.1 percent), convenience store (5.3 percent), gas or service station (2.5 percent), bank (1.7 percent) and miscellaneous (13.1 percent).

D. Aggravated Assault is the unlawful attack by one person upon another for the purpose of inflicting severe or aggravated bodily injury. It includes assault with intent to kill. This type of assault is usually

[39]The definitions are taken from *Crime in the United States: 1993* (U.S. Department of Justice, Federal Bureau of Investigation), Appendix H, 380-381. The statistics quoted for 1992 are taken from *Crime in the United States: 1992, Section One.*

accompanied by the use of a weapon or by means likely to produce death or great bodily harm. Simple assaults are excluded.

II. Property Crime–includes burglary, larceny and auto theft.

A. Burglary is the unlawful entry of a structure to commit a felony or a theft. It includes attempted forcible entry, attempted burglary and burglary followed by larceny.

B. Larceny (except motor vehicle theft) is the unlawful taking, carrying, leading or riding away of property or articles of value from the possession or constructive possession of another. Larceny is not committed by force, violence or fraud. Attempted larcenies are included. Embezzlement, "con" games, forgery, worthless checks, etc., are excluded. Larceny is subdivided into a number of smaller classifications: items taken from motor vehicles (22.6 percent of all larcenies in 1992), shoplifting (15.8 percent), taking of motor vehicle accessories (14.0 percent), taking from buildings (14.0 percent), bicycle theft (5.9 percent), pocket picking (1.0 percent), purse snatching (0.9 percent), taking from coin operated vending machines (0.9 percent), and all others (24.8 percent).

C. Motor vehicle theft is the theft or attempted theft of a motor vehicle. A motor vehicle is self-propelled and runs on the surface and not on rails. Motor vehicle theft includes all cases where vehicles are driven away and abandoned, but excludes vehicles taken for temporary use and returned by the taker. Specifically excluded from this category are motorboats, construction equipment, airplanes and farming equipment.

APPENDIX II

Explanation of County level Data

The number of arrests and offenses for each crime in every U.S. county from 1977-1996 was obtained from the Federal Bureau of Investigation's Uniform Crime Report County-level Data. When the UCR data had an observation with a FIPS code that did not match any county listed in the codebooks, that observation was deleted.

One significant problem with the offense data has occurred since 1985. When ICPSR compiles the FBI data, it cannot distinguish between legitimate values of 0 and values of 0 that should have been coded missing.[40] If an individual offense or arrest category had a value of 0 and that county had non-zero values for other crime categories, we used the raw data. This rule was followed because the FBI and ICPSR indicated that law enforcement agencies normally report the data for all crimes and do not selectively send data for some types of crimes and not for others. If the number of offenses and arrests was 0 for all categories in a given county in a given year, then that county was assigned missing values for all offense and arrest rates.

State populations were taken from the Statistical Abstract of the United States. The county population, age, sex and race data for all years except 1990 and 1992 were obtained from the U.S. Department of Commerce, a division of the Bureau of the Census. All population measures estimate the July 1 population

[40]Ken Candell of the FBI and Chris Dunn of ICPSR have provided much assistance with these problems.

for the respective years.[41] The age distributions of large military installations, colleges, and institutions were estimated by a separate procedure. The counties for which special adjustments were made are listed in the report.[42] The 1990 and 1992 estimates were not available from the Census Bureau. The 1990 data were estimated by taking an average of the 1989 and 1991 data. The 1992 data were estimated by multiplying the 1991 populations by each county's 1990-1991 growth rate. The Bureau of the Census provided the data on land area in square miles.[43]

Data on income, unemployment, income maintenance and retirement were obtained from the Regional Economic Information System, a component of the Bureau of Commerce. Income maintenance includes Supplemental Security Insurance (SSI), Aid to Families with Dependent Children (AFDC), food stamps, and other income maintenance (which includes general assistance, emergency assistance, refugee assistance, foster home care payments, earned income tax credits, and energy assistance). Unemployment insurance benefits include state unemployment insurance compensation, Unemployment Compensation for Federal Civilian Employees (UCFE), Unemployment for Railroad Employees, and Unemployment for Veterans (UCX), and other unemployment compensation (which consists of trade readjustment allowance payments, Redwood Park benefit payments, public service employment benefit payments, and transitional benefit payments). Retirement payments included old age survivor and disability payments, railroad retirement and disability payments, federal civilian employee retirement payments, military retirement payments, state and local government employee retirement payments, federal and state workers' compensation payments, and other forms of government disability insurance and retirement pay.

---

[41]For further descriptions of the procedures for calculating intercensus estimates of population, see ICPSR (8384): "Intercensal Estimates of the Population of Counties by Age, Sex and Race (United States): 1970-1980." U.S. Department of Commerce, Bureau of the Census. Winter 1985. ICPSR, Ann Arbor, MI 48106. Also, see "Intercensal Estimates of the Population of Counties by Age, Sex and Race: 1970-1980 Tape Technical Documentation." U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 103, "Methodology for Experimental Estimates of the Population of Counties by Age and Sex: July 1, 1975." U.S. Bureau of the Census, Census of Population, 1980: "County Population by Age, Sex, Race and Spanish Origin" (Preliminary OMB-Consistent Modified Race).

[42]U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 103, "Methodology for Experimental Estimates of the Population of Counties by Age and Sex: July 1, 1975." U.S. Bureau of the Census, Census of Population, 1980: "County Population by Age, Sex, Race and Spanish Origin" (Preliminary OMB-Consistent Modified Race), pp. 19-23.

[43]Land area includes intermittent water and glaciers that appear on census maps and in the TIGER file as hydrographic features. It excludes all inland, coastal, Great Lakes and territorial water. Inland water consists of any lake, reservoir, pond or similar body of water that is recorded in the Census Bureau's geographic data base. It also includes any river, creek, canal, stream or similar feature that is recorded in the data base as a two-dimensional feature (rather than a straight line). Rivers and bays that empty into these bodies of water are treated as inland water from the point beyond which they are narrower than one nautical mile across. Coastal and territorial waters include portions of the oceans and related large embayments, such as the Chesapeake Bay and Puget Sound, the Gulf of Mexico and the Caribbean Sea, that belong to the United States and its possessions.

References

Albanese, Jay S. (1985) "The Effect of Casino Gambling on Crime," *Federal Probation*, 49, 2, June, 39-44.

Albanese, Jay S. (1999) "Casino Gambling and White Collar Crime: An Examination of the Empirical Evidence." Presented at the conference "Gambling and Gaming: Winners or Losers?" Omaha, NE (April).

Ayres, Ian and Steven D. Levitt (1998) "Measuring Positive Externalities from Unobservable Victim Precaution: An Empirical Analysis of Lojack," *Quarterly Journal of Economics*, 113 (February) 43-77.

Buck, Andrew J., Simon Hakim and Uriel Spiegel (1991) "Casinos, Crime and Real Estate Values: Do They Relate?" *Journal of Research in Crime and Delinquency*, 28, August, 288-303.

Chiricos, Ted (1994) "Casinos and Crime: An Assessment of the Evidence." University of Nevada, Las Vegas, Special Collections.

Florida Department of Law Enforcement (1994) "The Question of Casinos in Florida: Increased Crime: Is It Worth the Gamble?" Tallahassee, FL: State of Florida.

Florida Sheriffs Association (1994) "Casinos and Crime: Is It Worth the Gamble? A Summary Report and Position Paper," Tallahassee, FL: Florida Sheriffs Association.

Frey, James H. (1998) "Federal Involvement in U.S. Gaming Regulation," *Annals of the American Academy of Political and Social Science*, 556 (March) 136-152.

Friedman, Joseph, Simon Hakim and J. Weinblatt (1989) "Casino Gambling as a 'Growth Pole' Strategy and Its Effect on Crime," *Journal of Regional Science*, 29, November, 615-623.

"Gaming Conference" (1999) Sponsored by the Federal Bureau of Investigation, The United States Attorney's Office, the Kentucky Association of Chiefs of Police and the Kentucky Association of Commonwealth Attorneys, Louisville, KY (August 10).

Gazel, Ricardo and William Thompson (1996) "Casino Gamblers in Illinois: Who Are They?" Report for The Better Government Association of Chicago, June.

Glaeser, Edward L., Bruce Sacerdote and Jose A. Scheinkman (1996) "Crime and Social Interactions," *Quarterly Journal of Economics*, 111, May, 507-548.

Gould, Eric, David B. Mustard and Bruce Weinberg (1998) "Crime Rates and Local Labor Market Opportunities in the United States: 1977-1995." University of Georgia Working Paper.

Government Accounting Office (2000) "Impact of Gambling," GAO/GGD-00-78, April, 1-68.

Grinols, Earl (1996) "Incentives Explain Gambling's Growth," *Forum for Applied Research and Public Policy*, 11, 2, 119-124.

Grinols, Earl and David B. Mustard (2000) "Business Profitability vs. Social Profitability: Evaluating the Social Contribution of Industries with Externalities and the Case of the Casino Industry" *Managerial and Decision Economics* (forthcoming).

Grinols, Earl and J. D. Omorov (1996) "Development or Dreamfield Delusions?: Assessing Casino Gambling's Costs and Benefits," *Journal of Law and Commerce*, 16, 1, 49-88.

Grogger, Jeff (1997) "Market Wages and Youth Crime." NBER Working Paper #5983.

Henriksson, Lennart E. (1996) "Hardly a Quick Fix: Casino Gambling in Canada," *Canadian Public Policy*, 22, June, 116-128.

Hsing, Yu (1996) "An Analysis of Arrests Regarding Illegal Drugs: The Determinants and Policy Implications," *American Journal of Economics and Sociology*, 55, January, 53-60.

Kindt, John W. (1994) "Increased Crime and Legalized Gambling Operations: The Impact on the Socio-Economics of Business and Government," *Criminal Law Bulletin*, 43, 538-539.

Lee, Barbara A. and James Chelius (1989) "Government Regulation of Labor-Management Corruption: The Casino Industry Experience in New Jersey," *Industrial and Labor Relations Review*, 42, July, 536-548.

Lesieur, Henry R. (1998) "Pathological Gambling Is a Psychiatric Disorder," in *Legalized Gambling: For and Against.* R.L. Evans and M. Hance, eds. Chicago: Open Court Publishing, 37-63.

Levitt, Steven D. (1998) "Why Do Increased Arrest Rates Appear to Reduce Crime: Deterrence, Incapacitation, or Measurement Error?" Economic Inquiry, 36 (July): 353-72.

Lott, John R. and David B. Mustard (1997) "The Right-to-Carry Concealed Handguns and the Importance of Deterrence," *Journal of Legal Studies*, 26, 1: 1-68.

Margolis, Jeremy (1997) "Casinos and Crime, An Analysis of the Evidence," American Gaming Association, unpublished.

Maryland Department of Health and Mental Hygiene, Alcohol and Drug Abuse Administration (1990) *Final Report: Task Force on Gambling Addiction in Maryland*, Baltimore.

Miller, Ted R., Mark A. Cohen and Brian Wiersema (1996) *Victim Costs and Consequences: A New Look.* Washington, DC: National Institute of Justice.

Mustard, David B. (2000) "Reexamining Criminal Behavior: The Importance of Omitted Variable Bias." University of Georgia Working Paper.

Nelson, Dennis J., Howard L. Erickson, and Robert J. Langan (1996) "Indian Gaming and Its Impact on Law Enforcement in Wisconsin," API Consulting Services, October.

Reno, Ronald A. (1997) "False Hope," *Citizen*, 11, 6, June, 10-13.

Thompson, William N., Ricardo Gazel and Dan Rickman (1996a) "Casinos and Crime in Wisconsin: Is There a Connection?" Milwaukee: Wisconsin Policy Research Institute, 9, 8 (October).

Thompson, William N., Ricardo Gazel and Dan Rickman (1996b) "The Social Costs of Gambling in Wisconsin," Milwaukee: Wisconsin Policy Research Institute, 9,6, 1-44.

Wheeler, David L. (1999) "A Surge of Research on Gambling Is Financed in Part by the Industry Itself," *The Chronicle of Higher Education*, 60, 26, 17-18.

Appendix #3

Grinols, Earl L., and David B. Mustard. Measuring Industry Externalities: The Curious Case of Casinos and Crime. March 2001. 1-35. 20 June 2009 <http://casinofacts.org/casinodocs/Grinols-Mustard-Casinos_And_Crime.pdf>.

MEASURING INDUSTRY EXTERNALITIES: THE CURIOUS CASE OF CASINOS AND CRIME

Earl L. Grinols,* David B. Mustard**

March 2001

Abstract

The philosophy of externalities and corrective policy is much better developed theoretically than it is in application. It falters at the roadblock of inability to measure the size of externalities. This paper exploits the connection between casinos, an industry that did not exist outside Nevada prior to 1978, and crime using county-level data for the US between 1977 and 1996, a period spanning the introduction of casinos to states other than Nevada. We articulate reasons why casinos may both decrease and increase crime. We show that casinos increased crime after a lag of 3 to 4 years, consistent with the theoretical predictions of the role of problem and pathological gamblers. Furthermore, by studying the crime rates in counties that border casino host counties we show that the data suggest casinos create crime, and not merely move it from one area to another: Neighbor county data indicate that casino crime spills over into border areas rather than is moved from them. Last, we explain why other studies have failed to identify a strong link between casinos and increased crime rates. The data indicate that 8 percent of crime observed in casino counties in 1996 was attributable to casinos. The average annual cost of increased crime due to casinos was $65 per adult per year.

JEL Classification Numbers: K0, K2, H2

Key Words: Casinos, Index I Crime, Externalities, Social Costs, Pigouvian Taxes

---

* Department of Economics, University of Illinois, 1206 S. 6th Street, Champaign, Illinois 61820. E-mail: grinols@uiuc.edu

** Department of Economics, Terry College of Business, University of Georgia, 528 Brooks Hall, Athens, Georgia 30602. E-mail: mustard@terry.uga.edu. We thank workshop participants at the American Law and Economics Association and American Economics Association Annual Meetings and at the Universities of Buffalo, Georgia, Illinois and Rochester for their helpful comments.

MEASURING INDUSTRY EXTERNALITIES: THE CURIOUS CASE OF CASINOS AND CRIME

The theory of externalities and corrective policy developed in the last one third century contains an impressive array of tools and techniques for improving social welfare in the presence of activity spillovers. Progress in applications has been much less pervasive than the advances in theoretical understanding, however. While the Clean Air Act allows trading in pollution rights, there is ongoing discussion of the taxation of carbon fuels and greenhouse gases, and in recent years there has been a growing campaign surrounding the recovery of social costs generated by industries whose products are believed to generate harmful externalities exemplified by lawsuits against the tobacco industry, in many other cases the attempt to implement rational mechanisms has foundered on the shoals of the inability to quantify the externality to be controlled or moderated. Application of Pigouvian corrective taxes, for example, requires information on the size of the externalities. Inability to implement quantifiable objectives is tantamount to failure to understand the most critical feature of the corrective process.

Occasionally, however, social science encounters serendipitous events, or clouds with silver linings, in the form of social experiments ready for testing. The casino industry is a case in point. Prior to 1978, there were no casinos in the United States outside of Nevada. Mainly since 1990, casinos have expanded to the point where the vast majority of Americans are now within relatively easy access of one. But, casino gambling is not just another entertainment. On a national basis, research suggests that it generates externality costs greater than $37 billion annually, making casino gambling one of a handful of the most costly social problems. Crime is one of the biggest components of these social costs. Crime is of great interest to the average citizen and crime statistics are widely kept, hence the connection between casinos and crime is an ideal object of empirical study. Unlike alcohol or illegal drugs, whose effects are confounded with many other contributing factors, the absence of casinos in most of the country until the recent past means that statistical before and after comparisons can be made to measure the impact of casinos on crime.

There are two further reasons why determining whether there is a link between casinos and crime, and how big, is particularly valuable. First, the casino industry has grown extremely rapidly in just the last decade and in that time has become one of the most controversial and influential industries. Commercial casino revenues increased 186 percent from $8.7 billion in 1990 to $24.9 billion in 1998.[1] Including Class III American Indian casinos,[2] 1998 revenues totaled $31.8 billion, or $163 per adult aged 20 or over. Casino industry revenues are now 71 percent as large as the cigarette market, while all forms of gambling are 30

[1]Gambling revenue is the net amount of money that the gambling operator extracts from patrons. It equals the "handle" (gross amount wagered—which may reflect the same chip being bet many times before it is ultimately retained or lost) less payouts, prizes, or winnings returned to players. For example, if players place wagers totaling $100,000 on outcomes of a roulette wheel over the course of an evening and $88,000 is returned to them as winnings (some roulette slots are reserved for the house), then operator revenue is $12,000.

[2]According to the Indian Gaming Regulatory Act of 1988, class I gambling consists of "social games solely for prizes of minimal value." Included in Class I gambling are traditional Indian games identified with tribal ceremonies and celebrations. Class II gambling includes bingo and "games similar to bingo." Class III gambling includes "all

percent bigger.[3] From 1982 to 1999 GDP increased 185 percent, while casino revenues increased more than 660 percent. This rapid casino expansion generated extensive debate about the impact of casinos on many social, economic, and political issues.[4] The casino industry has also become a major lobbying presence. For example, between 1992 and 1997, $100 million was paid in lobbying fees and donations to state legislators.[5] These concerns were sufficiently pronounced that the U.S. Congress established the National Gambling Impact Study Commission in 1996 to exhaustively study casinos. Its final report called for additional research and a moratorium on further expansion.

Research on the connections between casinos and crime to date has been inconclusive for a number of reasons that are detailed in Section I of the paper. Using a more comprehensive data set than past studies, Section I reviews the raw data on crime in counties with and without casinos. The evidence seems to point to a divergence in crime rates that arise after the introduction of casinos. Before adjustment or statistical corrections, it suggests that 11.7 percent of observed crime in casino counties is due to the presence of casinos. Other evidence seems to point in the same direction. For example, counties with American Indian casinos show a rise in crime rates across a range of crimes that coincides with the period after casino introduction. For the same number of years before casinos there is no similar change. In Florida, casino counties began the sample period with lower crime rates that the rest of the state, but end it with higher. Perhaps the strongest evidence, however, is the behavior of crime rates for casino counties when the data is grouped on year of casino introduction. Crime indexes that were flat for four years prior to casino opening take a small dip during the year of opening, but begin to rise several years after. The rest of the paper deals with examining this evidence for other contributory factors and documenting the theoretical and empirical connections between casinos and crime. After describing the connection between casinos and crime in the raw data in section I we critique the casinos and crime research. In section II we elaborate the theoretical links between casinos and crime before explaining our estimation strategy in section III. Section IV discusses our basic empirical results and section V extends the results to border counties. We find that crime begins to rise in casino counties with a lag of three years. Crime in border counties follows a similar pattern but attenuated to approximately half the level. This suggests that casinos are not just shifting crime from neighboring regions, but are creating crime. In section VI we use the estimates to formally calculate the crime-related social costs in casino counties. Our estimates place these costs at approximately $63 dollars per adult per year. Section VII summarizes and evaluates our research and suggests several fruitful avenues for further research.

---

forms of gaming that are not Class I gaming or Class II gaming" such as blackjack, slot machines, roulette, and other casino-style games.

[3]Cigarette sales were $45 billion in 1997. Gambling revenues were $58.4 billion. See *International Gaming and Wagering Business*, August 2000, p. 15.

[4]Kindt (1994), Grinols (1996), Henriksson (1996), and Grinols and Omorov (1996) discussed a number of these.

[5]*The Wager*, 2, 39, 1997.

I. The Casino-Crime Context: What Do We Know?

Between 1977 and 1996, the years covered by our sample, the number of states with some form of casino gambling rose from one to 28.[6] The number of counties with casinos grew from 14 (all in Nevada) to nearly 170. At the end of the period, twenty-one states permitted casinos on Indian reservations. The Indian Gaming Regulatory Act of 1988 increased the number of Indian casinos by mandating that states allow American Indian gambling on trust lands if the state sanctioned the same gambling elsewhere. The semi-sovereign status of Indian tribes and their management by the Federal Bureau of Indian Affairs gave them greater leverage in their dealings with the states.

Table 1 presents summary crime, income, and population statistics for casino and noncasino counties (counties with no casino in any year of the sample). Casino counties had higher population, land area and income. Crime rates are also higher for these larger counties, as one would expect.

Figure 1 shows the aggregate relationship between the number of counties with casinos (left scale) and the crime rate (right scale). During the period 1977 to 1990, when the number of casinos was relatively constant, the crime rate fluctuated. However, we see that during the period between 1990 and 1996 when the number of counties with casinos increased rapidly, the crime rate dropped substantially. This contemporaneous casino growth and crime reduction is an important feature of the data. It has been used by some to suggest that casinos reduced crime. For example, Margolis (1997) stated, "crime rates in Baton Rouge, LA have decreased every year since casino gaming was introduced." However, such conclusions are not justified because many regions in the country experienced falling crime rates after 1991. Therefore, it is more appropriate to compare the magnitude of the decreases between casino and noncasino counties.

A. Evidence from National Data

1. Relative Crime Rates in the Post-Casino Period

Figure 2 contrasts the crime rate for casino and non-casino counties during the years 1991-96. The data are indexed so that 1991 = 100. Because data for Florida are missing in 1988 and 1996, Florida is not included.[7]

[6]One must carefully distinguish the date casinos began operating from other dates. Nevada (1931) legalized commercial casino gambling prior to the start of our sample, but in other states there were sometimes lags between the legislation authorizing casinos and the opening of operations. Within a state, different counties acquired casinos at different times. Also, bingo halls operated by American Indians converted to Class III gambling during our sample. We use the date Class III gambling operations first began in the county. The following states began some form of casinos gaming during our sample: Arizona (1992), Connecticut (1993), Colorado (1991), Delaware (1995), Florida (1982), Georgia (1995), Idaho (1993), Illinois (1991), Indiana (1995), Iowa (1991), Kansas (1996), Louisiana (1993), Michigan (1993), Minnesota (1991), Mississippi (1992), Missouri (1994), Nebraska (1993), New Jersey (1978), New Mexico (1990), New York (1993), North Carolina (1995), North Dakota (1993), Oregon (1993), South Dakota (1989), Texas (1993), Washington (1992), Wisconsin (1991) and West Virginia (1994).

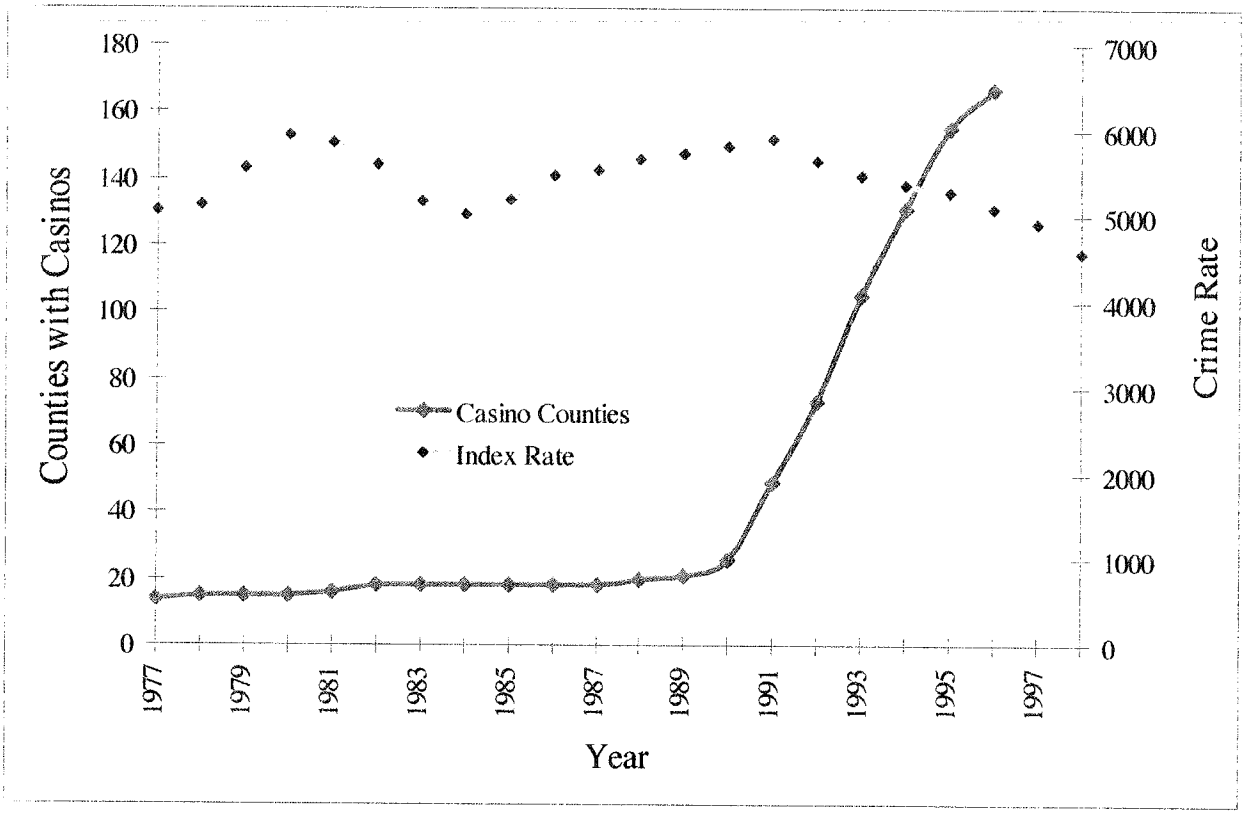
[7]The state legislature changed the Florida crime reporting process from summary-based to incident-based on Jan 1, 1988. In 1995 Florida switched back to summary-based reporting. In the transition years, data are missing.

Table 1: Demographic and Crime Data: Casino vs Noncasino Counties.

Variable	Mean	Std. Dev.	Sample Size	Mean	Std. Dev.	Sample Size
	CASINO COUNTIES			**NONCASINO COUNTIES**		
Population	148,319	293,792	3,313	73,310	252,150	59,273
Population Density (pop. per sq. mile)	208	501	3,313	217	1,459	59,265
Area (Square Miles)	2,060	3,132	3,313	1,010	2,880	59,280
Per capita Personal Income	$11,407	$2,657	3,313	$10,805	$2,619	59,260
Per capita Unemployment Ins.	$79	$55	3,313	$64	$51	59,244
Per capita Retirement Compensation	$10,787	$6,545	3,313	$9,833	$6,244	59,248
Aggravated Assault Rate	259	276	3,072	188	245	54,724
Rape Rate	29	27	3,009	20	32	54,055
Murder Rate	6	9	3,081	6	10	54,801
Larceny Rate	2,537	1,428	3,081	1,741	1,939	54,795
Burglary Rate	1,063	668	3,081	771	1,109	54,792
Robbery Rate	82	135	3,081	44	143	54,796
Auto Theft Rate	267	263	3,081	167	277	54,800

Note: Crime rates are annual number of incidents per 100,000 population.
Income figures are price-adjusted to 1982-84 $.

Figure 1: Index Crime Rate and Number of Counties with Casinos: U.S. 1977-1998

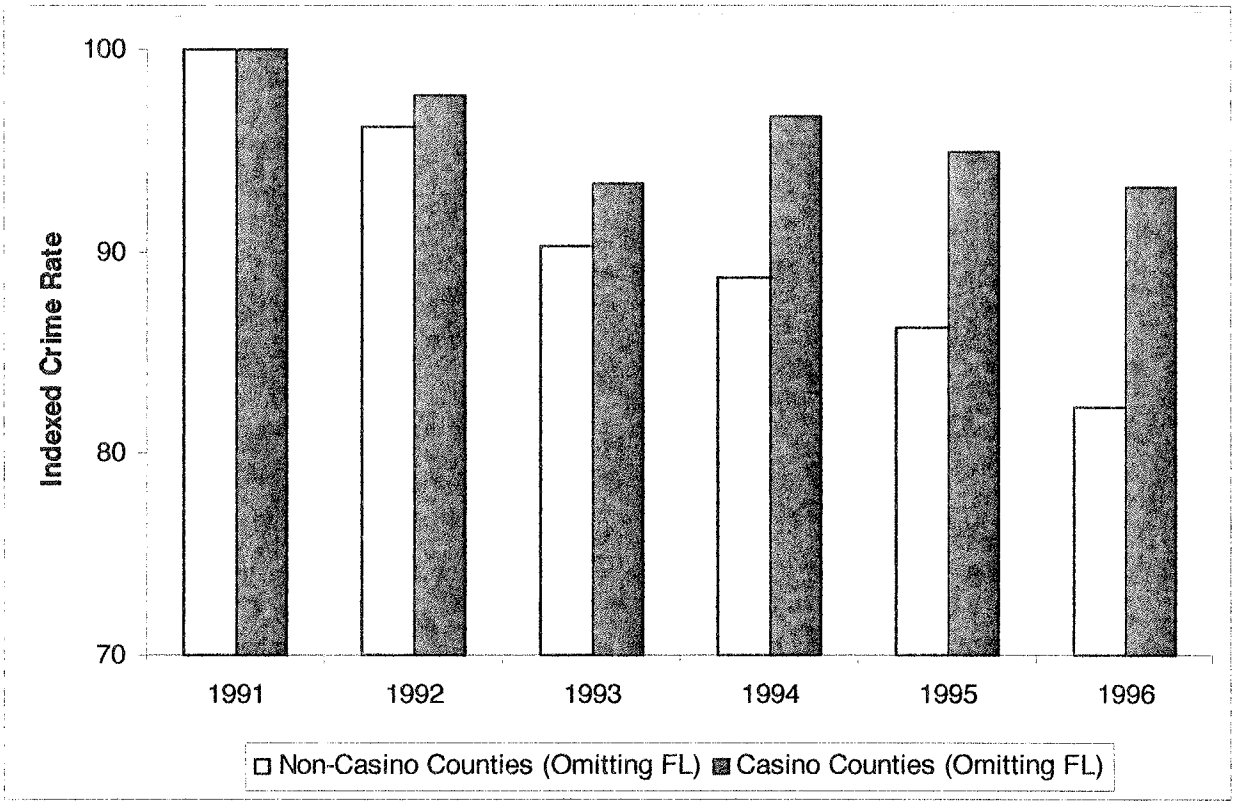


While crime dropped in both sets of counties, there was a widening divergence in the extent of the decline after 1991. If crime rates in casino counties had dropped in proportion to the drop in non-casino counties, crime in casino counties in 1996 would have been 11.7 percent lower. Far from suggesting that casinos lowered crime, falling crime rates in casino counties when compared to dropping crime rates everywhere, suggest that casinos may have been responsible for as much as 11.7 percent of the observed crime in such counties.

2. Florida

In addition to the need to consider Florida separately because of gaps in its data for two years of the sample, it is of interest in its own right because it is a large state and was the first state after New Jersey to acquire casinos. Florida's first "boat-to-nowhere" casino began operation in 1982. Other counties acquired casinos in 1988, and the early 1990s. Florida casino counties experienced greater rates of crime increase than the state's noncasino counties. Figure 3 highlights this differential for each of the crimes indexed so that 1982 = 100. The lower connected line forms a margin for 1977 showing the relative crime rate across all seven

Figure 2: Indexed Crimes: Casino County vs Noncasino County Crime Rates

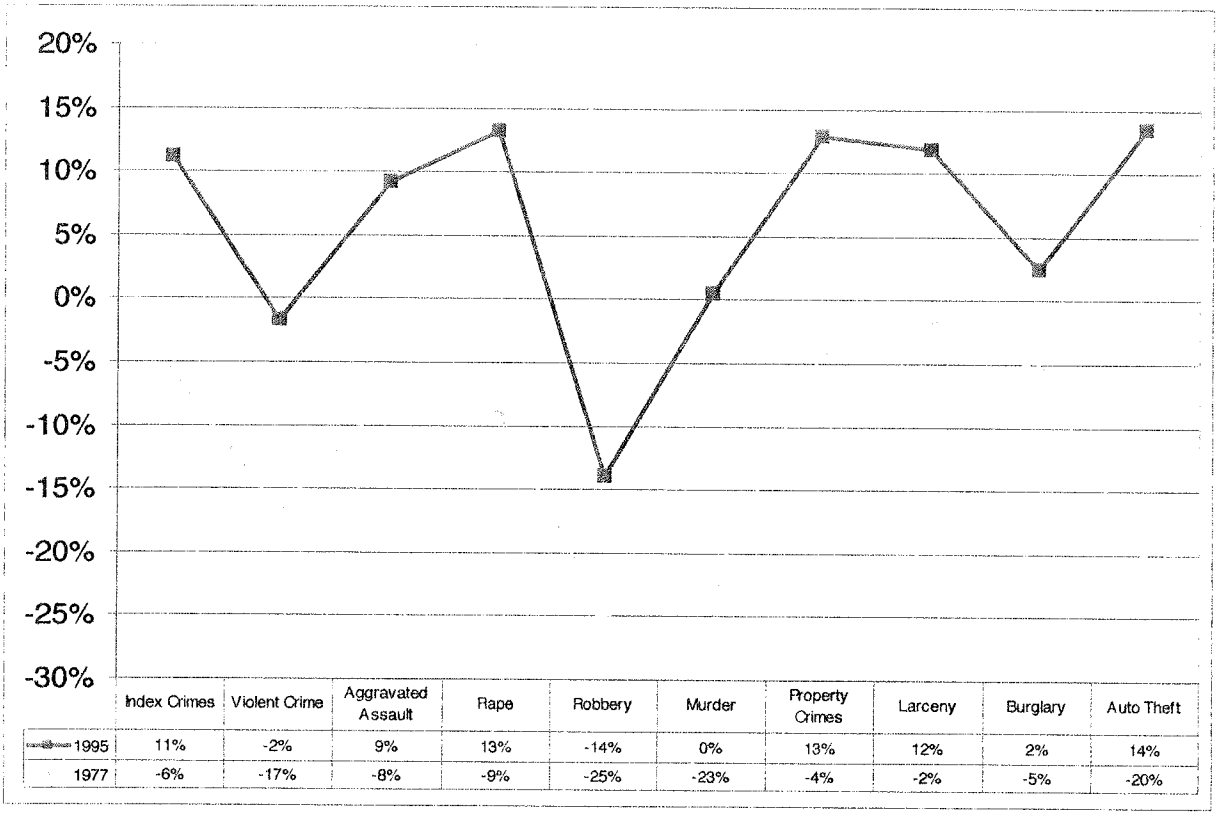


crime categories. The higher line shows that the 1995 margin rose. For example, the crime index in 1977 was 6 percent lower in casino than noncasino counties (this is the left-most Index Crime observation point on the lower margin). By 1995, however, it was 11 percent *higher* (the Index Crime observation on the higher margin). For every crime except robbery, casino counties had lower crime rates in 1977, and higher crime rates in 1995. The robbery rate in casino counties in 1977 was 25 percent lower than in noncasino counties; by 1995 it was only 14 percent lower.

3. American Indian Casinos

A similar pattern applies to American Indian casinos. Many states have American Indian casinos governed by state compacts negotiated under the Indian Gaming Regulatory Act of 1988. Most compacts were signed, and Indian casinos opened, after 1992. In some states (Connecticut, Minnesota, and Wisconsin are examples) Indian casinos are the sole type of casino. Figure 4 computes crime rates in Indian compact counties as a percent of the equivalent crime rate in noncompact counties for 1987 (the year before the Indian Gaming Regulatory Act was passed), in 1992 and 1996. Crime rates between 1987 and 1992, when casinos were just

Figure 3: Casino County Crime Rates as Percent Deviation from Noncasino County Rates: Florida 1977 and 1995.



	Index Crimes	Violent Crime	Aggravated Assault	Rape	Robbery	Murder	Property Crimes	Larceny	Burglary	Auto Theft
1995	11%	-2%	9%	13%	-14%	0%	13%	12%	2%	14%
1977	-6%	-17%	-8%	-9%	-25%	-23%	-4%	-2%	-5%	-20%

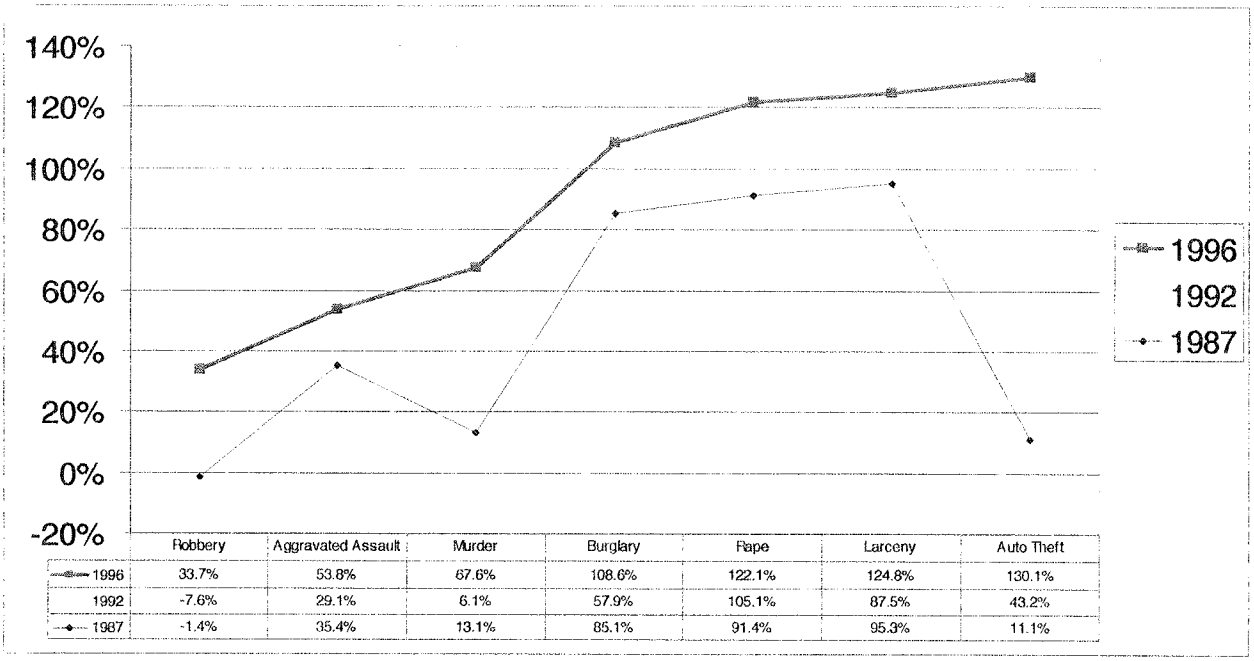
beginning or had not yet been introduced, changed little relative to other counties, but between 1992 and 1996, the period of greatest increase in compact casinos, crime in compact counties rose noticeably in all categories.

4. Evidence from Year of Opening

Figure 5 presents the casino county data centered on the year of opening, where we set the average crime rate for the four years prior to casino opening to 100. Crime rates were very stable prior to opening, slightly lower in the year of casino introduction, returned to approximately average levels for the next three years and increased thereafter. By the fifth to seventh year after introduction, aggravated assaults were 50 to 95 percent higher, robbery was 71 to 119 percent higher, larceny was 9 to 41 percent higher, and auto theft and burglary also showed increases. Only rape was approximately unchanged at 7 percent lower to 12 percent higher.

When grouped around the year of opening the data suggest a connection between casinos and higher

Figure 4: Indian Compact County Crime Rates as Percent Deviation from Noncompact County Rates.



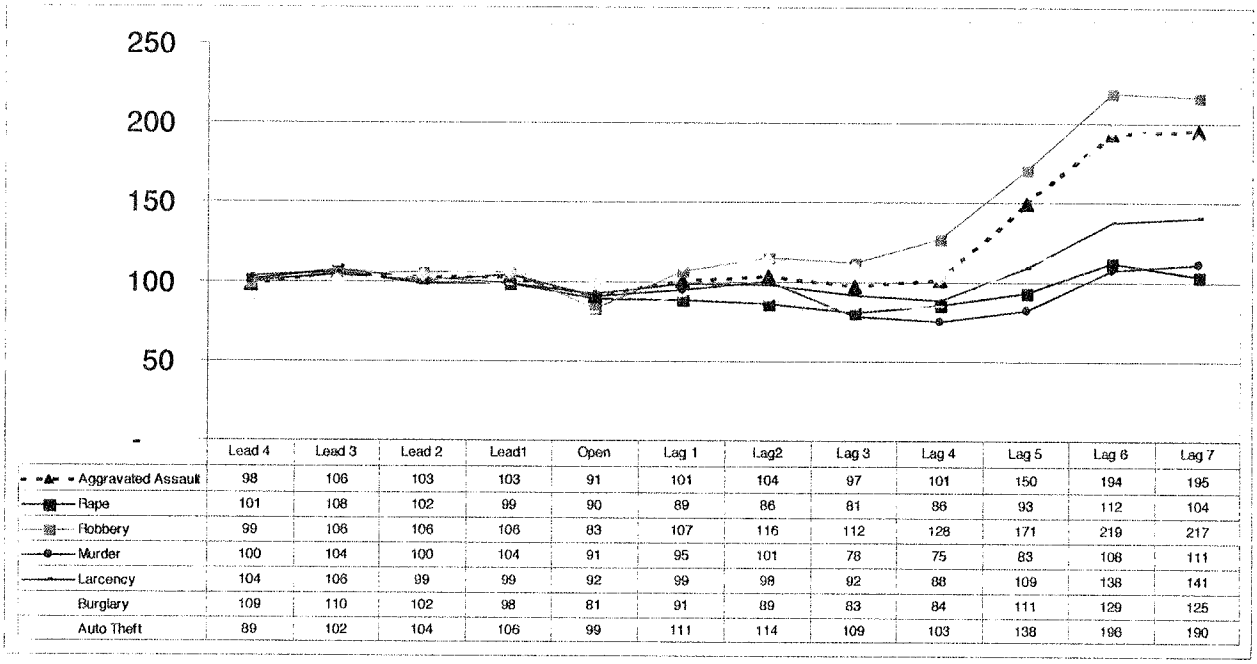
	Robbery	Aggravated Assault	Murder	Burglary	Rape	Larceny	Auto Theft
1996	33.7%	53.8%	67.6%	108.6%	122.1%	124.8%	130.1%
1992	-7.6%	29.1%	6.1%	57.9%	105.1%	87.5%	43.2%
1987	-1.4%	35.4%	13.1%	85.1%	91.4%	95.3%	11.1%

crime rates and the need to estimate lead and lag structures to correctly capture and identify the relevant time dependencies. The lead structure will show that crime rates in casino and non-casino counties were not different prior to the casino opening dates.

B. Existing Studies: A Critique

In spite of much public attention devoted to casinos and the many important questions surrounding this dynamic sector, there is a paucity of convincing research on the casino-crime link. Economists, virtually silent about the issue, are just beginning to research this new area. Studies from other disciplines, which typically compare crime rates of different cities or regions in a given year, exhibit many fundamental weaknesses. For example, no study examined the intertemporal effect of casinos on crime, which we argue is essential to understanding the relationship. In addition, nearly every study used small samples, most frequently focused on Las Vegas, Atlantic City or Reno. Many of these studies reach conflicting conclusions. Albanese (1985, 1999) examined areas around Atlantic City, arguing that New Jersey's Crime Casino Act (1977) minimized the increase in crime, and later studied only nine large casino markets. Lee and Chelius (1989) concluded that the New Jersey Casino Control Commission kept Atlantic City casino ownership and management free from organized crime. In contrast, organized crime played a large role in the casino labor unions. Friedman, Hakim and Weinblatt (1989) studied 64 localities near Atlantic City with populations over 1000. They found

Figure 5: Crime Rates Before and After Casino Opening - All Casino Counties Except Florida



	Lead 4	Lead 3	Lead 2	Lead1	Open	Lag 1	Lag2	Lag 3	Lag 4	Lag 5	Lag 6	Lag 7
Aggravated Assault	98	106	103	103	91	101	104	97	101	150	194	195
Rape	101	108	102	99	90	89	86	81	86	93	112	104
Robbery	99	106	106	106	83	107	116	112	128	171	219	217
Murder	100	104	100	104	91	95	101	78	75	83	106	111
Larcency	104	106	99	99	92	99	98	92	88	109	138	141
Burglary	109	110	102	98	81	91	89	83	84	111	129	125
Auto Theft	89	102	104	105	99	111	114	109	103	138	186	190

that casinos increased violent crimes, burglary and auto theft. Buck, Hakim and Spiegel (1991) also reported that Atlantic City gambling increased crime rates. Chiricos (1994), in contrast, reported that the cities with legalized gambling (Atlantic City, Las Vegas, and Reno) had lower crime rates than selected Florida tourist cities if one included visitors in the population base. Thompson, Gazel, and Rickman (1996a) studied statewide county-level panel data from Wisconsin and found that casino gambling significantly increased crime rates in counties with casinos and those with casinos in two adjacent counties.

Although some of the studies also made conclusions about crime rates, they examined arrests, and did not mention that one cannot use arrest rates to infer anything definitive about crime rates. Using arrest data, Albanese (1999) concluded that casinos did not increase embezzlement, fraud and forgery crime rates. Hsing (1996) used a cross-section of 48 states and identified higher illegal drug arrests in states that permit gambling.

A fourth criticism is that most studies are subject to substantial omitted variable bias because they rarely controlled for variables that affect crime. Margolis (1997), Florida Department of Law Enforcement (1994), and Florida Sheriffs Association (1994) included no control variables.

Last, many studies were agenda-driven, conducted or funded by either pro-gambling or law enforcement organizations. Nelson, Erickson and Langan (1996), Margolis (1997) and Albanese (1999) were funded by explicitly pro-gambling groups. Not unexpectedly, they concluded that gambling had no impact on crime.[8]

[8]See Wheeler (1999) for an interesting discussion of research funded by the gambling industry.

Margolis (1997) focused on Las Vegas, Atlantic City, Reno, and Deadwood, SD. The Florida Department of Law Enforcement (1994) and Florida Sheriffs Association (1994), who both opposed casinos, concluded that crime and drunk driving increased in Atlantic City and Gulfport, Mississippi, as a result of casinos.

In summarizing the existing body of literature, the GAO and National Gambling Impact Study Commission (NGISC) concluded that no definitive conclusions can yet be made about the casino-crime link because of the absence of quality research. According to the GAO, "In general, existing data were not sufficient to quantify or define the relationship between gambling and crime... although numerous studies have explored the relationship between gambling and crime, the reliability of many of these studies is questionable." (GAO, 2000, p. 35.)

II. Theory

Previous studies focused on the empirical question of whether there is a connection between casinos and crime but neglected precise discussions of how casinos theoretically could affect crime. We present two reasons why crime could decrease and four reasons why crime could increase. We then discuss their different impacts over time, an essential, but previously ignored issue.

A. Theoretical Connections between Casinos and Crime

Casinos may reduce crime directly by improving legal earning opportunities or indirectly through economic development effects.

1. Wage Effects: Grogger (1997) argued that increases in wages reduce crime, and Gould, Mustard and Weinberg (1998) showed that increases in employment and wages of low-skilled individuals reduce crime. Therefore, if casinos provide greater labor market opportunities to low-skilled workers, they should lower crime.

2. Economic Development: Casinos may also reduce crime indirectly through economic development. In the Midwest, for example, legislation decriminalizing casino gambling cited economic development as its rationale. Decaying waterfronts and derelict sections of town that once harbored crime may be less amenable to it when renovation occurs, streetlights appear, and resident presence increases. The streets near Las Vegas casinos, even at night, are often cited as some of the safest.

Conversely, casinos may increase crime through direct and indirect channels.

1. Economic Development: Casinos may raise crime by harming economic development, the opposite of the indirect effect discussed above. While some commend casinos for bringing development, others criticize them for draining the local economy, attracting unsavory clients, and for outgrowths like prostitution and illegal gambling-related activities.

2. Increased Payoff to Crime: Second, casinos may increase crime by lowering the information costs and increasing the potential benefits of illegal activity. Because casinos attract gamblers and money, there is an increased payoff to crime from a higher concentration of cash and potential victims. A 1996 Kansas

City case is illustrative in which a local restaurant owner was followed home, robbed, and murdered in his garage after winning $3,000 at a casino.[9] Similar stories exist in other locations with casinos.

3. Problem and Pathological Gambling: Crime may increase through problem and pathological gamblers. Pathological gambling is a recognized impulse control disorder of the Diagnostic and Statistical Manual (DSM-IV) of the American Psychiatric Association. Pathological gamblers (often referred to as "addicted" or "compulsive" gamblers) are identified by repeated failures to resist the urge to gamble, reliance on others to relieve the desperate financial situations caused by gambling, the commission of illegal acts to finance gambling, and the loss of control over their personal lives and employment. Problem gamblers have similar problems, but to a lesser degree. The latent propensity to pathology becomes overt when the opportunity to gamble is provided and sufficient time has elapsed for the problem to manifest. Lesieur (1998) estimated that pathological gamblers are one or two percent of the population and problem gamblers are another two to three percent. A well-cited Maryland study found that 62 percent of the Gamblers Anonymous group studied committed illegal acts as a result of their gambling.[10] 80 percent had committed civil offenses and 23 percent were charged with criminal offenses. A similar survey of nearly 400 members of Gambler's Anonymous showed that 57 percent admitted stealing to finance their gambling. On average they stole $135,000, for a total of over $30 million.[11]

4. Visitor Criminality: Crime may rise because casinos attract visitors who are both more prone to commit and be victims of crime. For example, Chesney-Lind and Lind (1986) suggest that one of the reasons tourist areas often haver more crime is that tourists themselves are the targets of crime. However, visitors *per se* do not necessarily increase crime. In the following section we show that visitors to national parks do not increase crime. Therefore, if casino visitors induce crime, it is because they are systematically different than national park visitors or visitors to other attractions.[12] Also, more problem and pathological gamblers will visit casinos than other attractions. One anecdotal example of the different clientele casinos attract is the large increases in pawnshops that occur when casinos open. Other tourist areas do not experience similar increases.

These mechanisms should have different impacts across crimes. Improvements in the legal sector, for example, reduce property crime more than violent crime (Gould, Mustard and Weinberg, 1998). If casinos

[9]Reno, 1997.

[10]See Maryland Department of Health and Mental Hygiene (1990).

[11]Henry Lesieur from the Institute of Problem Gambling, in testimony before the National Gambling Impact Study Commission, Atlantic City, New Jersey (January 22, 1998).

[12]The three largest single tourist attractions in the Unites States in 1994 were the Mall of America (Bloomington, MN), Disney World (Orlando, Florida), and Branson, Missouri (country and western music) receiving 38 million, 34 million, and 5.6 million visitors, respectively. For comparison, Hawaii received approximately 6 million and Las Vegas received 30.3 million visitors in 1994. Visitors per resident were 1,345 for Branson, 436 for Bloomington, MN, 188 for Orlando, and 40 for Las Vegas. Even combining visitors with residents to calculate diluted crime rates, the crime rate per 100,000 visitors plus residents was 187.3 for Las Vegas, 64 for Orlando, 16.4 for Branson, and 11.9 for Bloomington. Thus Bloomington which recieved 7.7 million more visitors than Las Vegas had a crime rate per visitor plus resident less than $\frac{1}{15}$th of the rate for Las Vegas.

act as magnets for unsavory development then all types of crime may increase. Pathological gamblers will generally commit crime to generate money to pay off debts or gamble.[13] Therefore, they would be more likely to commit crimes that generate revenue, like robbery, burglary, larceny and auto theft. Furthermore, if casinos increase criminal activity by problem and pathological gamblers, this increase could be compounded by spillover effects on others (Glaeser, Sacerdote, and Scheinkman, 1996).

The theory also predicts that the effects of casinos will change over time. Reduction of crime through improvements in labor market opportunities will be observed prior to the casino opening. Because casinos take time to build, and low-skilled people may be hired before casino openings, crime reductions could precede the openings. Both the positive and negative economic development theories imply that a casino will have an impact after opening. Over time, the development effects will grow, whether positive or negative. The nonresident effect should appear with the casino's opening, but may also expand with time as more nonresidents are attracted. Effects operating through problem and pathological gamblers will not be felt for the first few years. Enough time must elapse for a gambling habit to develop and the full extent of gambling pathology to be reached. Because crime data are reported annually and casinos could open in a given year as late as December, there may not be a discernible effect on crime rates until several years after they open.

III. Estimation Strategy

Our strategy is to address the identified research gap by rectifying a number of research limitations. First, we conduct the most exhaustive investigation to date, utilizing a comprehensive county-level crime data set that includes every U.S. county. This eliminates sampling concerns. Second, we analyze crime effects over time by exploiting the time-series nature of our data, which cover 1977 through 1996. Third, we do not focus on one or two crimes, but examine all seven FBI Index I Offenses (aggravated assault, rape, murder, robbery, larceny, burglary, and auto theft). The first four offenses are classified as violent crimes and the last three as property crimes. Fourth, we are the first to explicitly articulate a comprehensive theory about how casinos could increase and decrease crime.[14] Last, we use the most exhaustive set of control variables, most of which are commonly excluded from other studies. If casinos are correlated with these excluded variables, then previous estimates will suffer omitted variable bias. We conclude that casinos increase crime in their host counties and that crime spills over into neighboring counties to increase crime in border areas.

A. Direct and Indirect Effects

Casinos can affect crime rates directly through effects on the resident local population and indirectly by increasing the number of casino visitors. The total impact includes both direct and indirect effects, as explained in equations (1) and (2), where crime (C_{it}) in county i in year t is a function of the presence of a

[13]Continued gambling is often perceived as a way to win back needed money. "Chasing" one's losses is a characteristic of pathological gamblers.

[14]Miller and Schwartz (1998) explained in detail how the literature has generally neglected discussing the theoretical links between casinos and crime.

casino, the number of casino visitors (V) to the county, and other variables that affect crime (summarized in the term *Other*) where a, b, c, and d are unknown coefficients.

$$C_{it} = aCasino_{it} + bV_{it} + Other_{it} \quad (1)$$

$$V_{it} = cAttractions_i + dCasino_{it} \quad (2)$$

Casino visitors in equation (2) depend both on the visitor attractiveness of the county (*Attractions*) and the presence of the casino. Coefficient a measures the direct effect of the casino on crime. The indirect effect via casino visitors is measured through coefficients b and d. Substituting from (2) into (1) gives

$$C_{it} = \beta_i + \delta Casino_{it} + Other_{it} \quad (3)$$

where $\delta = a + bd$, and $\beta_i = bc\,Attractions_i$. The total effect of the casino on crime, δ, in equation (3), includes the effects on both the local population and casino visitors. Estimating a in (1) would give only a partial effect because it would not take into account the visitor effect.[15] The key to our being able to estimate the full effect is having time series data. Because many studies of the casino-crime relationship used cross-sectional data, they were limited to estimating only a partial effect.

B. Visitors

Estimating direct and indirect effects is important. At the same time, it is also important to avoid a related misperception. The observation is sometimes made, "X is associated with crime increases because X increases tourism and tourists cause crime." From there the inferential leap is made that any attraction that attracts the same number of visitors will have the same crime effects. This perception is false. Apart from begging the empirical question of whether it is uniformly true that tourists cause crime, this conclusion comes perilously close to ignoring the equally important fact that visitors are not generic. Systematically different types of visitors may have systematically different effects on crime even if the impact for all types of visitors is positive. The presence of a casino in (3) proxies for direct effects on crime that may exist and for an increased number of casino visitors. It does not necessarily follow that the same number of visitors for another purpose would lead to the same crime outcomes. Visitors for other purposes appear in the variable $Other_{it}$, which we now address.

Time series visitor data do not exist at the county level and certainly do not distinguish visitors for different purposes. Running regression (3) without such information, therefore, risks a potential omitted variable bias. In defense, no other crime studies have been run with these data either, but more importantly, in the case of casinos, the omitted variables are almost certainly uncorrelated with the entry of a casino.

[15] Ideally we would like to know both a and b to decompose the total effect into the portions generated by visitors and by locals. Because of data constraints, we estimate the total effect d but not a and b separately. Casino visitor data do not exist at the county level. Both a and b might be estimated using other variables to proxy for the number of casino visitors, but there are no annual, time-series data at the county level.

Fortunately, there is at least one type of tourist for which data *are* available that we can use to test the hypothesis of being uncorrelated and having an effect on crime different from the effect that casinos have. For this we obtained National Park Service time series data from 1978 to 1998 on all visitors to national parks, monuments, historic sites, recreation areas and so on. Scores of these parks and attractions, scattered all across the country, receive millions of visitors annually—some as many as 14 million. They are in counties both with sparse population and in counties with large cities. If vacationing families cause crime to the same extent as other visitors, then these counties should have crime rates to match. In the majority of cases the correlation between park visitors and the casino variables used in the study were well below 1 percent and in no case was the correlation above 1.7 percent. This is consistent with the view that omitted variable bias is likely to be small or zero. Although it always preferable to include such variables when possible, we are confident that in the case of casinos the procedure employed by (3) of, in effect, treating data on other visitors as part of the constant term and the error term is not a problem for the coefficients of interest.[16]

A second analytical issue is whether to use "diluted" or "undiluted" crime rates. That is, should the number of crimes be divided by population—the conventional way to generate the crime rate (undiluted)—or be divided by population *plus* visitors (diluted)? There are four possibilities for research depending on whether one considers total or partial effects, and studies diluted or undiluted crime rates. Some have argued for one combination or another without realizing that the choice is not methodological, but depends on what questions the researcher wants to answer. A frequently mentioned invalid claim is that to determine the change in probability that a resident would be the victim of a crime, the diluted crime rate should be used. However, knowing what happens to the diluted crime rate does not give the needed information and could even move in the wrong direction. Let s_1 be the share of the resident population P victimized by residents, and let s_2 be the share of the resident population victimized by visitors V. Similarly, let σ_1 be the share of visitors victimized by residents, and σ_2 the share of visitors victimized by visitors. Then the crime rate is $s_1 + s_2 + (\sigma_1 + \sigma_2)\frac{V}{P}$; the diluted crime rate is $(s_1 + s_2)w_P + (\sigma_1 + \sigma_2)w_V$ where w_P and w_V are the share of visitors plus residents made up by residents and visitors, respectively; and the probability of a resident being a crime victim is $s_1 + s_2$. For example, assume that residents do not victimize visitors ($\sigma_1 = 0$), $P = V$, and $(s_2 + \sigma_2)$ is smaller than s_1. Without visitors the probability of a resident being victimized is s_1. With visitors it rises to $s_1 + s_2$. The diluted crime rate without visitors is s_1. With visitors it falls

[16]When visitors to National Park Service sites were included, the regressions (3) showed that an additional one million park visitors annually were associated with 1.4, 0.34, 14.8, 0.64, 5.5, and 1.73 fewer crime incidents per 100,000 population for aggravated assault, rape, robbery, murder, burglary, and auto theft, respectively. The coefficients for rape and murder were significant at the 5 percent level and the coefficient for robbery was significant at the 1 percent level. The estimated effect of an additional million visitors was 13 additional larcenies per 100,000 population, but this coefficient was statistically insignificant. Since we do not have casino visitor data to estimate coefficient b in (1) we cannot directly compare casino visitors' and park visitors' effects on crime rates. However, the size of the effect found for park visitors was many times smaller than the total crime effect found for casinos (coefficient δ) and reported in section IV. Depending on the crime, the effect of a casino on crime rates five years after entering a county was 7 to 170 times larger except for the crime of murder. Neither casinos nor park visitors appear to have an important effect on murder rates. Their coefficients were of comparable magnitude.

to $(s_1 + s_2 + \sigma_2)/2$. Thus in this case the diluted crime rate *falls* while the probability of a resident being victimized *rises*.

In this study we are interested in the costs in the host county associated with a change in crime from whatever source. We are therefore interested in the total effect of casinos on crime using the undiluted crime rate based on equation (3).

C. Separating Casino Effects from Other Effects and Timing

The version of equation (3) we estimated was

$$C_{it} = \alpha + \beta_i + \gamma_t + \delta L_{it} + \theta A_{it} + \varepsilon_{it} \tag{4}$$

where C_{it} is the crime rate (offenses per 100,000 people) of county i in year t, α is a constant, and β_i is the county-level fixed effect that controls for unobserved characteristics across counties. The time fixed effect, γ_t, controls for national crime rate trends. L_{it} is a 12×1 vector of the casino opening dummy. It includies 4 leads and 7 lags of the opening variable, and captures the intertemporal effects outlined earlier.

A_{it} is a vector of control variables. It includes population density, the percent of the population that was male, percent that was black, percent that was white, and the percent between the ages of 10-19, 20-29, 30-39, 40-49, 50-64, and over 65.[17] Economic variables in A_{it} are real per capita personal income,[18] real per capita unemployment insurance payments, real per capita retirement compensation per old person, and real per capita income maintenance payments. A_{it} also includes a dummy variable indicating whether the county honored a "shall issue" right giving citizens the authority to carry a concealed firearm upon request, and two years of leads and four years of lags on the shall issue dummy. A_{it} contains 22 explanatory variables. ε_{it} is the regression error. Including leads and lags, the regression has 54 explanatory variables. This was expanded to 66 when analyzing the effects of casinos on adjacent counties. Excluding observations with missing data reduced the sample size in most regressions from 63,300 $(3,165 \times 20)$ to about 58,000, leaving more than adequate degrees of freedom for estimation.

The effect of a casino on crime depends on δ. A positive coefficient δ indicates that the introduction of casinos increased crime and a negative coefficient indicates that it reduced crime. We independently estimated each lead and lag of the casino opening year without cross restrictions to give separate estimates of the timing of changes. We weighted observations in the regression by county population.

[17] The remaining groups were Hispanics and those between 0 and 9 years.

[18] This and all other income figures were adjusted to 1982-84 $ base.

D. Data Preparation

1. Crime Statistics and Control Variables

The sample covered 3,165 U.S. counties from 1977-96. The Federal Bureau of Investigation's Uniform Crime Report[19] provided the number of arrests and offenses for the 7 FBI Index I offenses.[20] With the exception of Alaska, the county jurisdictions usually remained unchanged over our sample period. We used U.S. Census Bureau data for the demographic characteristics that might affect the crime rate. These controls include population density per square mile, total county population, and population distributions by race, age and sex. Income, unemployment, income maintenance transfers, and retirement data were obtained from the Regional Economic Information System, a component of the Bureau of Commerce. Appendix II provides more information about the data.

2. Casino Locations

The natural operating measure for casinos is gross revenue or profits. Unfortunately, such panel data do not exist—American Indian casinos are not required to report revenues. We therefore used the year a county first had an operating Class III gambling establishment, including riverboat casinos, American Indian casinos, land-based casinos, and in the case of Florida and Georgia, "boats to nowhere"—cruises that travel outside U.S. boundary waters to gamble, and that contain primarily U.S. participants. Not all forms of gambling qualify as a casino. For example, Montana has thousands of small gambling outlets that offer keno or video poker, many of which are in gas stations along the highway. Also, California has many card houses, some of which are illegal. These establishments are distinct from casinos in size and type of play.

We first contacted state gaming authorities. In cases like Washington, this was an expeditious way to ascertain the first year a casino opened. However, even the central gaming authorities and Indian affairs committees often lacked information on Indian casinos. In most states, therefore, we called each casino to obtain its opening date or first date of Class III gambling if it had previously been a bingo hall, etc. We also used lists from the Casino City website, www.casinocity.com, which lists casinos in every state. This list was verified against the annually-produced *Executive's Guide to North American Casinos.*

IV. Results

Table 2 reports the results for the coefficients of interest: four years of leads, the opening, and seven years of lags of the casino opening variable.[21] t-statistics are shown below the estimated coefficients. All coefficients

[19]U.S. Department of Justice, Federal Bureau of Investigation. *Uniform Crime Reports: County-level Detailed Arrest and Offenses Data, 1977-1996.* Washington, D.C.: U.S. Department of Justice, Federal Bureau of Investigation. Ann Arbor, MI: Inter-university Consortium for Political and Social Research (distributor).

[20]See Appendix I for the definitions of the crimes.

[21]The results for the 588 other coefficients and t-statistics for the seven crime regressions are not included in the interest of space, and because they are used as controls and we are primarily interested in the casino-related variables.

refer to changes per 100,000 people. For example, the coefficient of Lag 4 in the column labeled "Aggravated Assault" is 50.29 and indicates that the aggravated assault rate was higher by 50.29 offenses per 100,000 population four years after a casino opened in the county. The number of observations for each regression varied from 57,029 to 57,847. R^2 was between .70 and .89.

The reported regressions exclude measures of law enforcement activity such as conviction rates, sentence lengths, arrest rates, annual police employment and law enforcement expenditures for two reasons. First, including them would have significantly limited the number of counties with available data. Conviction rates and sentence lengths are available for only four states (Mustard 2000), and annual police employment is unavailable at the county-level. The trade-off was one of reduced efficiency from loss of data versus omitted variable bias that would lead us to understate the true impact of casinos on crime.

Using the arrest rate is problematic because it is undefined when there are 0 offenses for a given crime type.[22] Many small counties in our sample record no offenses even for property crimes for a given year, and large counties frequently have no offenses for murder and rape. Therefore, including the arrest rate eliminated many observations, reducing our sample by over 30,000 observations for some offenses.

Second, and more important, by excluding these variables the reported regressions understate the true impact of casinos on crime. The Table 2 regressions with the arrest rate included displayed increased post-opening casino coefficients.[23] This is consistent with information from law enforcement officials who reported that enforcement expenditures increased substantially when casinos opened, and provides support for the evidence that omitting these variables understates the crime effect. Stephen Silvern (FBI in Atlantic City) documented that expenditures for the Atlantic City Police Department and Prosecutor's Office grew much more rapidly in the late 70s and early 80s than similar expenditures in the rest of the state and nation (Gaming Conference 1999). The Director of the Indiana Gambling Commission reported that Indiana hired an additional 120 state troopers when the casinos opened in 1995.[24] Allocations for police services also rose substantially in New Orleans upon introduction of casinos.[25] Law enforcement officials strongly emphasize that to maintain public safety it is necessary to increase spending on enforcement resources when casinos open. Because we are unable to accurately measure these additional resources that reduce crime, the estimates without law enforcement variables understate the effect of casinos on crime and form a lower bound on the impact.

The full regression output is available from the authors on request.

[22]See Lott and Mustard (1997) and Levitt (1998) for more detailed discussions of problems with arrest rates.

[23]We do not present the coefficients in a table because the results are qualitatively similar to the Table 2.

[24]John Thar, Director of the Indiana Gambling Commission, report at Gaming Conference 1999.

[25]Lt. Joseph P. Lopinto, Jr., Commander of the Gambling Section of the New Orleans Police Department reported that his department has been significantly resource constrained since the opening of New Orleans' casinos and the resulting increase in demand for police services. Gaming Conference 1999.

Table 2: Crime Rate Regressions - Casino Leads and Lags.
(Coefficient units are additional crime incidents annually per 100,000 population.)

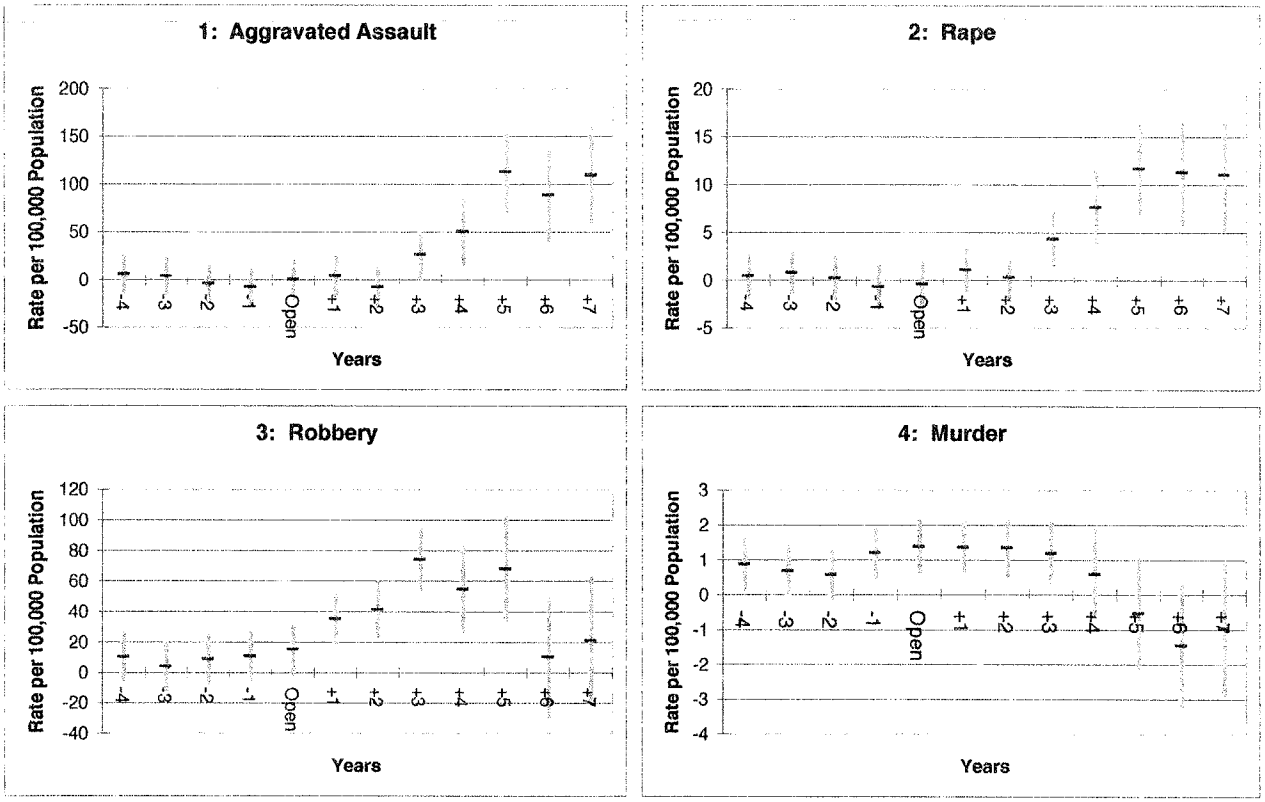
	Aggravated Assault	Rape	Murder	Larceny	Burglary	Robbery	Auto Theft
Lead 4	5.44	0.42	0.87	243.89	36.68	9.91	26.40
	(0.758)	(0.500)	(3.225)	(6.113)	(1.399)	(1.672)	(2.222)
Lead 3	3.14	0.76	0.68	200.61	34.09	3.79	74.62
	(0.438)	(0.902)	(2.506)	(5.031)	(1.301)	(0.640)	(6.286)
Lead 2	−4.32	0.21	0.57	89.83	19.43	8.67	117.84
	(−0.602)	(0.251)	(2.098)	(2.250)	(0.741)	(1.462)	(9.916)
Lead 1	−8.02	−0.72	1.20	88.05	−0.54	10.51	137.59
	(−1.132)	(−0.865)	(4.513)	(2.236)	(−0.021)	(1.796)	(11.735)
Open	0.25	−0.46	1.38	172.08	−17.60	14.94	177.33
	(0.033)	(−0.529)	(4.901)	(4.138)	(−0.644)	(2.418)	(14.323)
Lag 1	3.75	1.06	1.36	235.81	40.84	34.96	210.29
	(0.505)	(1.240)	(4.876)	(5.719)	(1.508)	(5.706)	(17.131)
Lag 2	−7.86	0.29	1.34	67.04	−41.24	41.18	189.68
	(− 0.988)	(0.316)	(4.486)	(1.516)	(−1.42)	(6.266)	(14.407)
Lag 3	25.81	4.30	1.18	99.52	−31.12	74.06	242.09
	(2.758)	(4.044)	(3.362)	(1.914)	(−0.911)	(9.586)	(15.641)
Lag 4	50.29	7.61	0.59	289.82	83.67	54.65	198.85
	(3.881)	(5.179)	(1.216)	(4.030)	(1.771)	(5.113)	(9.287)
Lag 5	112.55	11.64	−0.54	771.74	356.68	68.07	331.08
	(7.132)	(6.470)	(−0.909)	(8.775)	(6.173)	(5.208)	(12.645)
Lag 6	88.28	11.26	−1.47	777.38	201.59	9.99	359.71
	(4.790)	(5.364)	(−2.117)	(7.568)	(2.988)	(0.655)	(11.763)
Lag 7	109.50	10.98	−0.98	1092.90	226.56	20.91	377.81
	(5.704)	(5.021)	(−1.351)	(10.214)	(3.223)	(1.315)	(11.861)
N	57761	57029	57847	57841	57838	57842	57846
F	364.9	121	83.01	138.34	352.27	132.76	327.45
Prob > F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R-squared	0.825	0.741	0.762	0.800	0.697	0.891	0.851

A. Violent Crime

Figure 6 displays the information for violent crime from Table 2. The horizontal axis plots the casino opening leads and lags and the vertical axis plots the coefficient estimates. Figure 6.1, for example, shows the effect of casino opening on aggravated assaults for the four years before and seven years after opening. The plotted vertical lines show the 99 percent confidence intervals, the range within which the regression indicates the true coefficient should lie with 99 percent probability.

For aggravated assault, the coefficients for all four years of leads, the year of opening, and the first two years after the casino opening are not significantly different from zero. However, coefficients for the third and subsequent year after opening are significantly above zero, and the trend rises. By the third and subsequent year casinos are a statistically significant contributor to increased assault rates. The estimated high occurs

Figure 6: Casino Effects - Violent Crime



in the fifth year after opening, when the aggravated assault rate is 112 assaults higher per year.[26]

Although the point estimates for years 3 through 7 after opening are each statistically significant at better than the 1 percent level, the number of counties with casinos open three to seven years is 91, 59, 35, 12, and 7, respectively. Because the number of counties whose casinos opened 6 and 7 years before is small, we treat the estimates for the sixth and seventh year lags cautiously.

The problem of small number of observations should not be confused with the problem of poor observations from which we do not think the sample suffers for several reasons. First, counties that introduced casinos during the sample period and that remained open 7 or more years is geographically diverse, including Florida, Nevada, New Jersey, and South Dakota. Second, the dates of openings are temporally diverse, the earliest occurring in 1978, and others ranging up to eleven years later. During this time, national crime rates both rose and fell (see Figure 1). Third, there is no pattern to the crime rates in the diverse sampling of counties: 4 counties had a declining crime rate before casino introduction, 3 had rising, and the crime rates

[26]The estimated pattern of crime increase is unlike the typical pattern of visitor increases after casino opening. Grinols and Omorov (1996) showed the number of visitors to Illinois casinos typically rises immediately after opening and reaches equilibrium levels after six months or fewer.

after the introduction of casinos—covering as they did different regions and different eras of time—did not fit any pattern. Fourth, the pattern observed in Figure 6 was robust to removing the observations of each state. Fifth, the regression itself controlled for a large number of demographic, income, and other variables that varied across the different counties and different time periods.

Figure 6.2 for rape shows a pattern similar to aggravated assault. Coefficients are not significantly different from 0 prior to the opening. However, they are positive and significant in the third year after the casino opened, and rise thereafter. A county that introduces a casino might expect a negligible impact in the first two years after opening, but a higher rape rate by 8 to 12 incidents per 100,000 population in the fourth and fifth years after opening. The pattern for robbery (Figure 6.3) is similar to aggravated assault and rape with two exceptions. First, the increase in robbery began immediately. Second, the estimated coefficients for the sixth and seventh years after the casino opened cannot be distinguished from zero. One potential explanation is that the effect of casinos on robbery dies out in the sixth and seventh years after opening. Another is that the sample does not have enough observations with casinos opening six or seven years previously to distinguish an effect for this type of crime.

As expected, the impact of casinos on murder is the smallest of all offenses. Figure 6.4 shows there are significant coefficients only for the year before opening through the third year after opening, and implies about 1.3 additional murders for casino counties. However, casino counties have slightly higher murder rates (by about 0.7) before opening, and the change from before to after is not statistically significant. Gambling-related murders and deaths are frequently high profile cases. They include cases such as the disgruntled gambler who killed a casino teller when he tried to retrieve his gambling losses, a spouse who fought over the other's gambling losses and was murdered, a parent's gambling leading to the death of a child and similar tales.[27] However, such murders are not frequent and systematic enough to merit a strong assertion about the impact of casinos on murder. Because murder is the least frequently committed crime and most counties have zero murders, murder rates typically have high variance, which makes it difficult to conclusively identify effects.

B. Property Crime

Figure 7 displays the Table 2 coefficients for property crimes, which are committed far more frequently than violent crimes. Figure 7.1 displays a pattern similar to rape, robbery and aggravated assault (Figures 6.1, 6.2, and 6.3)—relatively little impact until the fourth year when crime rates increase consistently. The larceny coefficients increase from 67 in the second year after opening to over 1000 by the seventh year. This

[27]See Jeffry Bloomberg, Prepared Statement, Hearing Before the Committee on Small Business, House of Representatives, 103rd Congress, Second Session, 21 September 1994, Serial No. 103-104, Washington, D.C.: USGPO, p. 47. Accounts of the more spectacular gambling-related murders and deaths (most often suicides) often appear in the press. *USA Weekend*, February 10-12, 1995, p. 20, for example, describes a man killing his wife and beating up his daughter in a fight over his gambling away thousands of dollars. The Associated Press September 3, 1997, reported on the 10-day-old infant who died of dehydration after being left in a warm car for about seven hours while her mother played video poker in South Carolina.

rising impact indicates that the negative effects of the casino-crime link outweigh positive impacts over time, and is consistent with the negative development argument that it takes a while for gamblers to exhaust personal resources before resorting to larcenous crime. An alternative explanation of the delayed impact is that casinos have an immediate impact on crime, but that impact is netted out by a large increase in police resources, which are typically significantly increased when casinos open, but do not maintain the same rate of growth over time. The slightly more immediate impact of casinos on violent crime observed in Figure 6 may be explained in terms of *imported* criminals. It may take less time to habituate to a new casino's location than for people to exhaust their resources.

Figure 7: Casino Effects - Property Crime

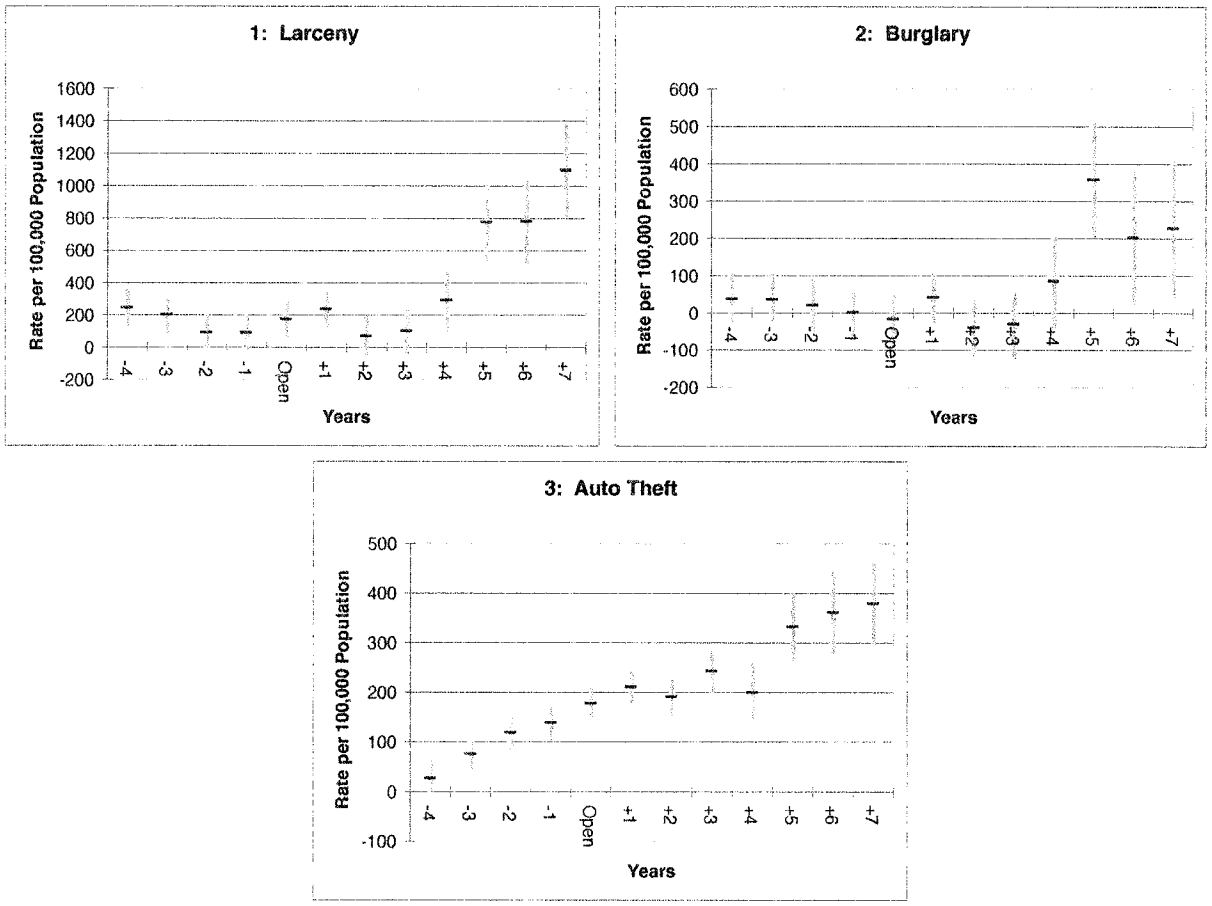
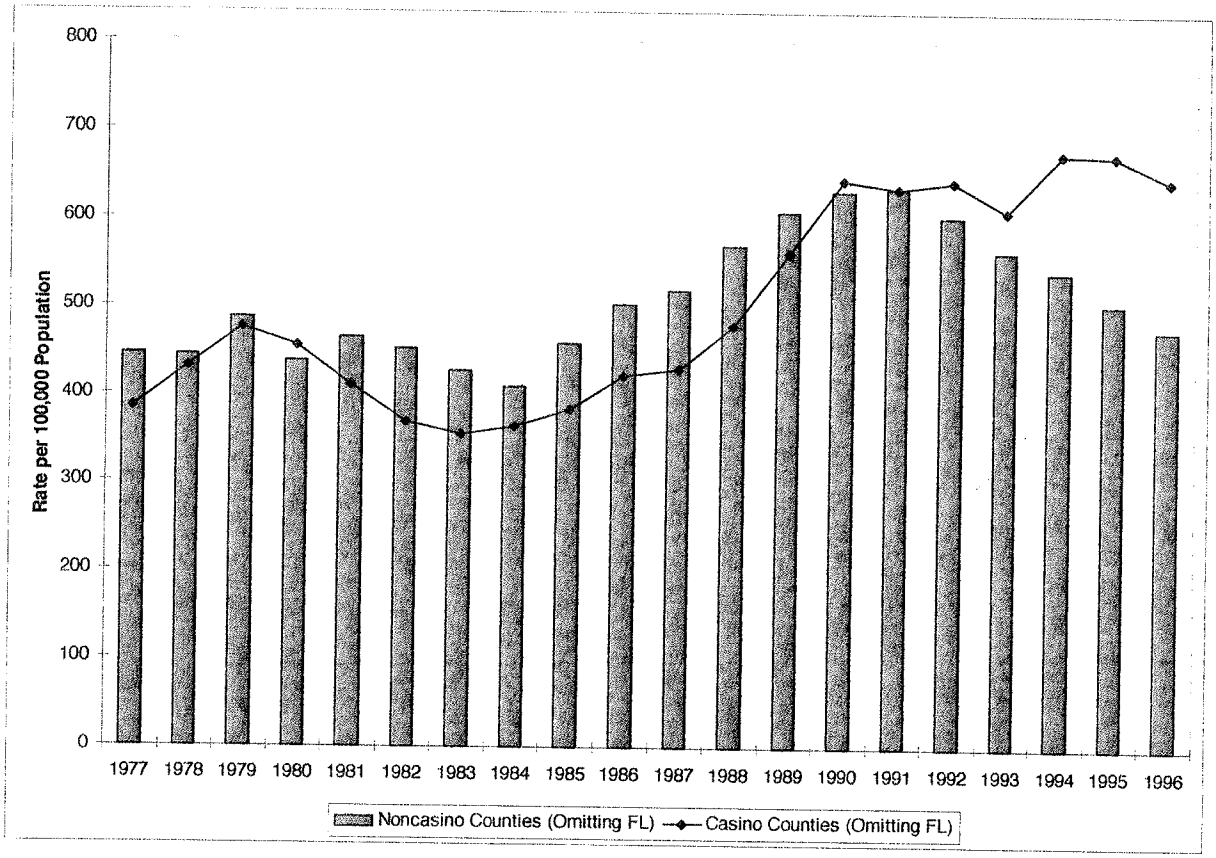


Figure 7.2 for burglary is very similar to larceny, robbery, assault and rape. Burglary shows no noticeable impact of casinos until the fourth year after casino opening. The five, six and seven year lag estimates are significant at between 200 and 400 additional offenses, again indicating that the negative effects of casinos dominate the positive effects over time.

Figure 7.3 for auto theft presents a different picture. It is the only crime that showed a rising trend before casino opening, which continued unabated through the seventh year after opening. Figure 8 shows that casino counties did not experience the same decreases in auto thefts that noncasino counties experienced after 1991, when the number of casinos increased rapidly.[28] Thus, one reason for the auto theft results is that casinos play a role in causing auto thefts not to fall as fast as they did in noncasino counties.

Figure 8: Auto Theft Crime Rates: Casino vs. Noncasino Counties



A second factor may be that we were unable to control for Lojack, an electronic tracking system that allows police to quickly locate and recover stolen autos. Ayres and Levitt (1998) found that Lojack accounted for a significant reduction in auto thefts in the 1990s. Because cities that implemented Lojack generally do not have casinos, we may overstate the effect of casinos on auto theft.[29] It is also possible that Lojack's use

[28]Note that a similar divergence in Florida started in 1984 and grew after that, consistent with Florida casino openings. The first Florida casinos opened in two counties in 1982, two more opened in 1988, and the rest opened between 1990 and 1995.

[29]Ayres and Levitt (1998) showed that Lojack had little effect on other offenses, so our results for the other crimes will not be affected.

is not yet sufficiently widespread to greatly affect our estimates.

To summarize our empirical results, the casino opening lead variables indicate that casino and noncasino counties have similar crime patterns prior to the opening of casinos. Casinos are not more likely to be placed in areas that have systematically different crime environments than other regions. After casinos open the crime trends differ: casino-county crime rates increase relative to the noncasino-county rates. The differences typically begin a few years after casino opening and increase over time. These characteristics are consistent with the predicted effects outlined in the theory. For example, we know that problem and pathological gamblers generate crime and, according to clinical research, take about two or three years to exhaust alternative resources before they commit crime. Furthermore, the most significant effects are for offenses where obtaining financial resources is the primary motivation of the crime. Not unexpectedly, the only crime that shows no effect is murder, which has the least clear relationship to casino gambling. Studies that did not have large data sets, a sufficient number of years of observations after casino opening, and that did not allow for the impact to change over time have missed these effects.

The evidence presented thus far suggests that casinos increased crime, but provides no information about whether casinos created crime or redistributed it from one area to another. We address this question next.

V. Do Casinos Create Crime or Attract It from Elsewhere?

The previous section provided strong evidence that the introduction of casinos is associated with an increase in crime rates in the host county beginning approximately three years subsequent to introduction. Grouping crime into property and violent categories, the estimates suggest that after six years, 8 percent of property crime and 10 percent of violent crime in casino counties is due to casinos.[30]

But do casinos create crime, or merely move it from other locations? In this section, we address this question by examining the crime rates of counties that border casino-counties. When casinos open, crime rates in neighboring counties could either decrease, remain the same, or increase. The first possibility supports the idea that casinos move crime from adjacent counties but do not create new crime. In the second case adjacent counties experience no change in crime, which indicates that total crime rises and that casinos create crime. The last possibility is that both host and neighbor counties experience increased crime rates, which indicates that casinos create crime that spills over into neighboring areas.

To implement a test strategy, we defined a set of neighbor lead, opening and lag variables, similar to the original set used in Table 2 for the host county. The "neighbor opening" variable took a value of 1 if a casino opened in an adjacent county in a given year. These twelve new variables increase the number of regressors to 66. The adjacent counties are the relevant unit of measurement for this purpose, because the vast majority of casino patrons come from the local region surrounding the casino. For example, in Illinois over 92 percent of casino customers come from within 75 miles.[31] Therefore, a substantial majority of the visitor movement will be accounted for with the adjacent county technique. A few casinos, most of which

[30]Section VI. explains the computation of these numbers.

[31]Gazel and Thompson, 1996.

Table 3: Crime Rate Regressions - Casino Neighbor Leads and Lags

	Aggravated Assault	Rape	Murder	Larceny	Burglary	Robbery	Auto Theft
Lead 4	12.59	1.29	-0.07	96.84	-0.66	17.04	1.20
	(3.171)	(2.544)	(-0.490)	(4.382)	(-0.045)	(5.191)	(0.183)
Lead 3	4.80	0.13	-0.05	20.81	-13.92	11.27	-18.73
	(1.217)	(0.256)	(-0.366)	(0.948)	(-0.965)	(3.457)	(-2.870)
Lead 2	19.73	1.00	0.60	71.44	25.63	36.97	8.75
	(5.007)	(2.059)	(4.079)	(3.257)	(1.777)	(11.349)	(1.341)
Lead 1	10.71	0.82	0.60	5.66	10.63	21.51	15.89
	(2.745)	(1.711)	(4.061)	(0.261)	(0.744)	(6.666)	(2.459)
Open	1.40	0.69	0.88	6.82	3.87	4.14	9.37
	(0.355)	(1.442)	(5.926)	(0.310)	(0.267)	(1.267)	(1.430)
Lag 1	4.27	-0.35	0.89	29.63	5.57	12.08	32.95
	(1.027)	(-0.719)	(5.658)	(1.280)	(0.366)	(3.513)	(4.785)
Lag 2	-20.48	-2.56	0.57	-173.26	-70.49	-4.90	-21.59
	(-4.467)	(-4.824)	(3.316)	(-6.790)	(-4.200)	(-1.292)	(-2.844)
Lag 3	13.40	1.08	0.67	-47.63	7.40	6.03	9.86
	(2.566)	(1.765)	(3.403)	(-1.638)	(0.387)	(1.397)	(1.141)
Lag 4	14.74	1.23	0.75	-44.91	42.04	14.42	31.14
	(2.424)	(1.761)	(3.269)	(-1.326)	(1.888)	(2.867)	(3.091)
Lag 5	19.79	5.02	0.37	271.67	140.78	32.73	132.77
	(2.418)	(5.382)	(1.203)	(5.963)	(4.698)	(4.837)	(9.796)
Lag 6	63.08	6.49	0.47	472.50	71.73	34.60	233.09
	(4.981)	(4.493)	(0.981)	(6.699)	(1.546)	(3.303)	(11.109)
Lag 7	41.44	0.57	-0.99	223.20	168.21	48.44	89.83
	(3.547)	(0.430)	(-2.262)	(3.430)	(3.931)	(5.012)	(4.641)
N	57761	57029	57847	57841	57838	57842	57846
F(65,*)	299.7	100.3	70.1	116.1	288.6	112.6	272.5
Prob > F	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R-squared	0.826	0.742	0.763	0.801	0.697	0.892	0.852

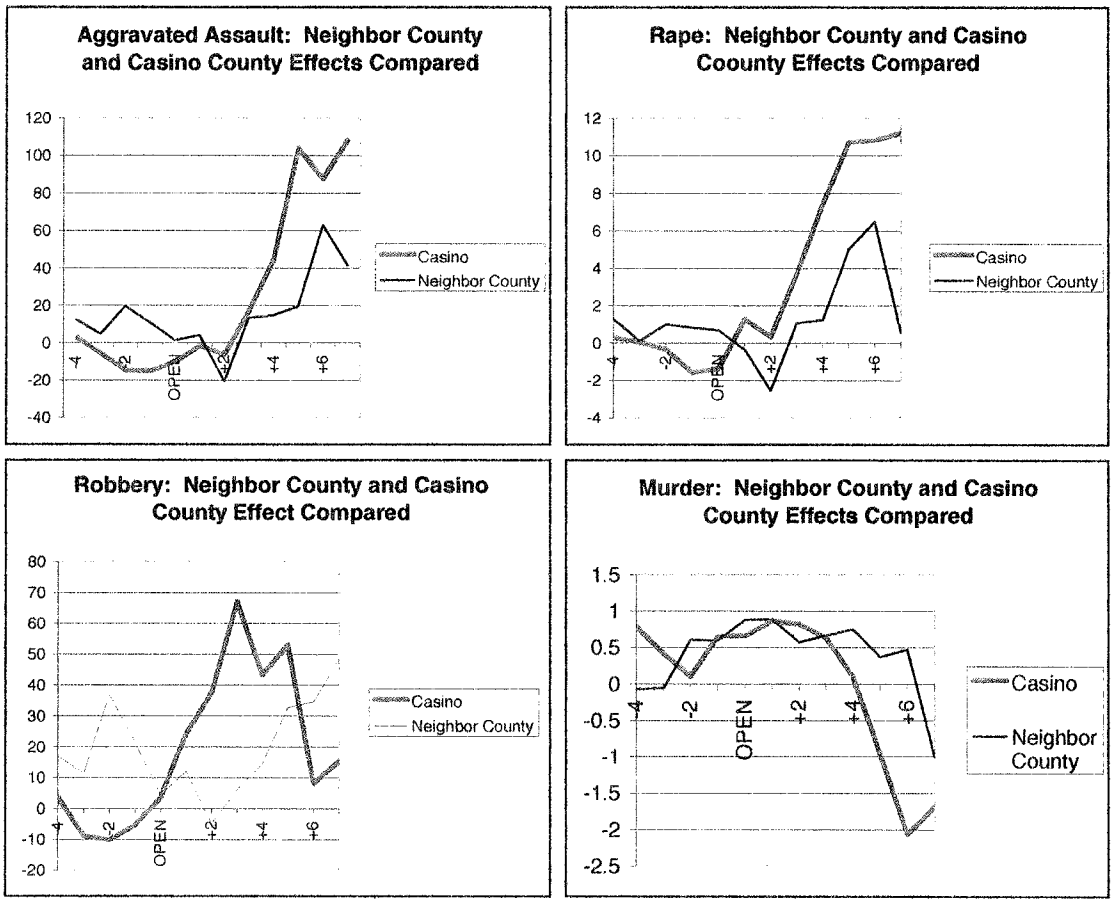
are in Nevada, draw their customers from outside their immediate area. However, our estimates do not rely on these casinos to identify the effects, because these casinos opened prior to 1977.

Table 3 shows the estimated effect of casinos on crime rates in neighboring counties. When the neighbor variables were included the host county crime coefficients were virtually unchanged, both in terms of point estimates and statistical significance. The correlation of the host county lead and lag coefficients of casino opening between the two regressions was higher than .99 for aggravated assault, rape, larceny, burglary, and auto theft, and was .985 for murder and .979 for robbery.

The pattern of crime increases in counties adjacent to casino counties showed no evidence of compensating reductions in crime and therefore no evidence of crime shifting. For years before the opening of casinos, there is virtually no impact of the casino on crime rates in neighboring counties. Generally, the overal pattern of crime rate influences is similar to the pattern in the host county, with crime increases beginning after three years of casino introduction, but attenuated relative to the host county effect. For example, Figure 9 shows the coefficients for neighboring counties for aggravated assault (thin line) compared to the host county coefficients (heavy line). The crime rate for aggravated assaults in counties neighboring casino host

counties is insignificantly different from zero for five out of the first seven years of the sample (four years before casino opening up to two years after opening), but thereafter all of the coefficients are statistically significant and positive. Comparison to the heavier line showing the host county coefficients reveals that in both the host county and neighboring counties there is little impact of the casino until approximately the third year after opening. From that point the crime rate begins to rise, with the crime rate in neighboring counties rising less than in the host county. The pattern in Figure 9 is consistent with a spillover effect for aggravated assault.

Figure 9: Neighbor County Effects: Violent Crime Rates on Vertical Axis

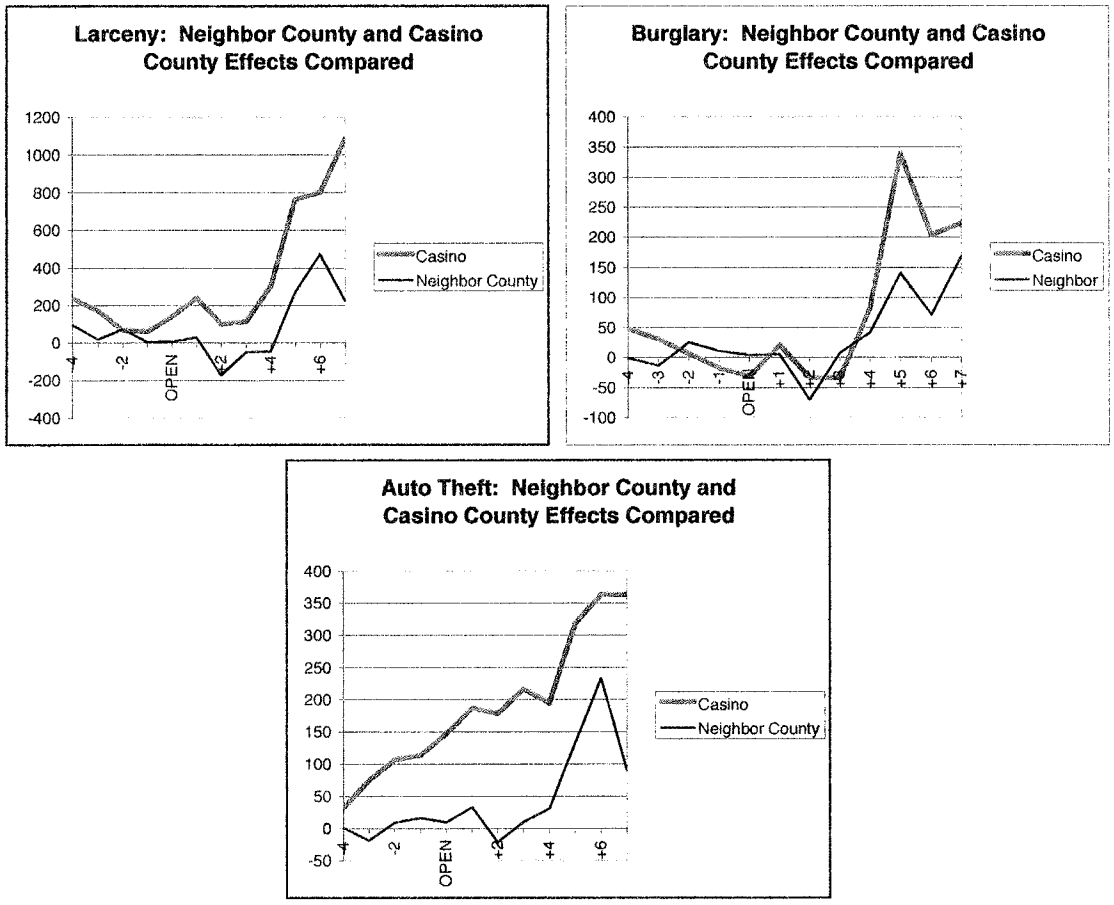


Rape exhibits a similar pattern. Robbery rates fell in neighboring counties before the opening of casinos. However, starting in the second year after opening robbery rates increased substantially. The U-shaped pattern for the neighboring county crime rate with the base two years after casino opening is a strong indicator that casinos openings lead to robbery spillover effects in neighboring counties.

Murder rates in the neighboring county are not discernably different after the introduction of a casino.

The lack of a pattern attributable to the opening of casinos agrees with the host county effects described in the previous section. Figure 10 plots the host county and neighbor county coefficients for property crime. The pattern of increased crime in neighboring counties beginning three or four years after introduction of casinos is apparent for larceny and burglary. As before, the effect in neighboring counties is smaller than in the host county.

Figure 10: Neighbor County Effects: Property Crime Rates



In our discussion of host county auto theft rates we speculated as to why the host county estimated coefficients presented a different pattern of continually growing crime. This pattern of host county coefficients did not appear to be closely related to the introduction of casinos. However, auto theft for neighbor counties displays the pattern of crime increases observed for other crimes. There is a discernably different crime rate three or more years after the opening of the neighboring casino, but not in the years before. The neighbor county effect suggests spillover of auto theft crimes due to the casino, even though host county effects are primarily driven by non-casino factors.

Taking all crimes into account, the data contain no evidence of compensating reductions in the crime rate of neighboring counties when crime rises in casino counties. The evidence more strongly supports spillover effects for all crimes but murder when casinos are introduced. The spillover effects are on the order of half the size of the casino host county effect. Therefore, we would conclude that casinos create crime, rather than attract it from elsewhere.

VI. Cost Implications

The Table 2 coefficients allow us to estimate the fraction of observed crime due to casinos. In this section we combine these estimates with information about the cost of each crime to estimate social costs.

A. Share of Observed Crime Due to Casinos

Summing the estimated number of crimes attributable to casinos (for each county accounting for how many years the casino was in operation) and dividing by the casino counties' total population for each year measures the contribution of casinos to observed crime. Very little crime was due to casinos until the 1990s. Thereafter a growing percentage of observed crime was attributable to casinos. In 1996, the last year of our sample, casinos accounted for 10.3 percent of violent crime, and 7.7 percent of property crime in casino counties. Estimates of the share of crime attributable to casinos in the same year for individual crimes ranged between 3 and 30 percent. Auto theft was the highest, followed by robbery at 20 percent. The values for the rest of the offenses were between 3-10 percent.

B. Costs of Casino-Induced Crime

Recent studies have estimated the social costs of index crimes. We use total cost per victimization figures adjusted to 1998 dollars using the CPU-U to calculate the total cost of the crimes committed in casino counties that are attributable to the casino presence according to the coefficients in Table 2.[32] We also compute the crime cost for casino counties on a per adult basis. Both results are shown in Figure 11.

Figure 11 shows that total costs were relatively low over most of the 1980s, rising significantly only after 1988. By the end of the period, total costs for the 167 casino counties reached $1.3 billion per year in 1995 and 1996.[33] On a per adult per year basis, the costs were $1.10 or below until 1984, between $5 and $9 through 1988, $33 in 1990, $65 in 1995, and $63 in 1996, the last year of our sample.

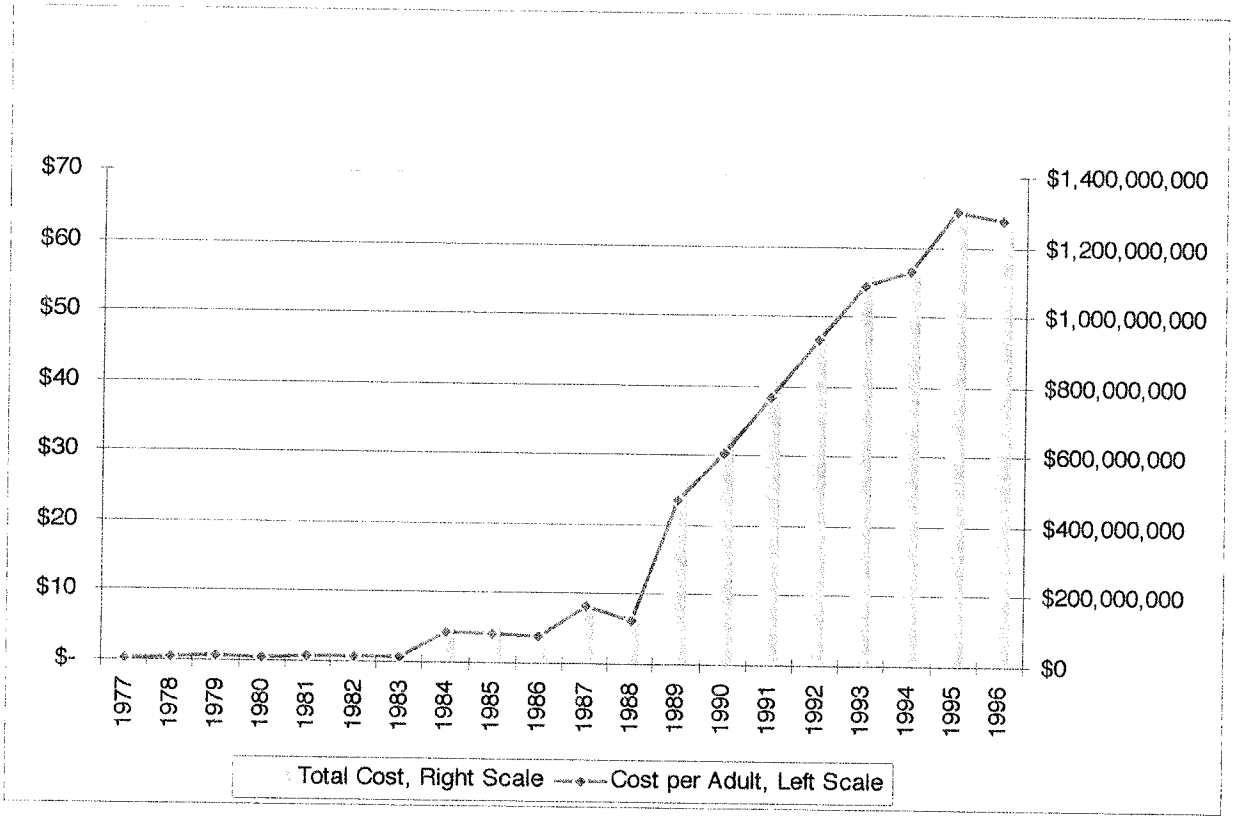
We can compare these cost estimates with others that relied on different methodology. Social costs of casinos have commonly been estimated in terms of the average cost imposed on society by a representative problem and pathological (P&P) gambler[34] multiplied by their number. In the most recent comprehensive

[32]See Miller, Cohen, and Wiersema, 1996, column 4 of Table 9, p. 24.

[33]The precise figures were $1.302 billion in 1995 and $1.275 billion in 1996.

[34]Some studies group problem and pathological gamblers, some treat them separately. Costs are computed by learning the behavior of P&Ps through direct questionnaires and surveys.

Figure 11: Casino Crime Costs: 1977-1996



study of this type of which we are aware, Thompson, Gazel, and Rickman (1996b) found that total social costs were $135 per adult in 1996 dollars, of which $57 (42 %) were due to police and judicial-related costs and thefts.[35] Thompson, *et al.* reported that they intentionally "projected numbers believed to be very conservative," and that the crime costs in their sample (Wisconsin) were probably lower than similar costs in other locations. For all of these reasons, and taking into account the different samples and methodology, their estimate is remarkably close to the direct costs estimated here for 1995-96 of $65 and $63. Applying the Thompson, *et al* proportions to our data, total social costs in those years would be $156 and $151 per adult.

[35]The social-cost impact of casino-related serious problem gamblers was $138,453,113. Dividing this by the number of adults over 20 in the counties with casinos gives the per adult figure in the text. The proportion of costs due to police, theft, and judicial-related costs is determined from their tables A-2 and A-5.

C. Pigouvian Taxes

What are the policy implications of casino-induced crime? Standard Pigouvian corrective theory for an industry with externalities is that it should be taxed by an amount equal to the costs that it imposes on society. By internalizing the externalities, corrective taxes would cause casinos to adjust their operations or go out of business. Only those that could pass a cost-benefit test by compensating society for the damage they cause would continue to operate. Relative to the revenues for a representative casino of about $230 per adult each year from nearby residents, Pigouvian corrective taxes for the seven index I crimes would represent 25-30 percent of revenues. If other social costs are ultimately identified, required taxes would be higher.

An alternative to Pigouvian taxes depends on whether gambling can be offered in a manner that does not lead to externalities. For example, can gambling be provided in a manner that does not generate problem and pathological gamblers, and thereby lead to fewer crimes? If so, it may be less costly to society to implement than the response based on Pigouvian taxes.

VII. Conclusions

Our analysis of the relationship between casinos and crime is the most exhaustive ever undertaken in terms of the number of regions examined, the years covered and the control variables used. Using data from every U.S. county from 1977 to 1996 and controlling for over 50 variables to examine the impact of casinos on the seven FBI Index I crimes (murder, rape, robbery, aggravated assault, burglary, larceny and auto theft), we concluded that casinos increased all crimes except murder, the crime with the least obvious connection to casinos. Most offenses showed that the impact of casinos on crime increased over time and began about three years after casino introduction. This pattern is consistent with the theories that problem and pathological gamblers commit crime as they deplete their resources, that nonresidents who visit casinos may both commit and be victims of crime, and that casinos lower information costs of crime and increase the potential benefits of illegal activity. These effects outweigh the potentially positive effects on crime that casinos may have through offering improved labor market opportunities.

According to our estimates, between 3 and 30 percent of the different crimes in casino counties can be attributed to casinos. This translates into a social crime cost associated with casinos of $65 per adult in 1995 and $63 per adult in 1996. These figures do not include other social costs related to casinos such as crime in neighboring counties, direct regulatory costs, costs related to employment and lost productivity, social service and welfare costs. Overall, 8 percent of property crime and 10 percent of violent crime in counties with casinos was due to the presence of the casino. Although robbery, the offense that exhibited the largest increase, is classified as a violent crime, it is more appropriately classified as a property crime in that its motivation is financial.

We also investigated whether the crime in casino counties is attracted (moved) from other regions or is created. Counties that neighbor casino counties generally experienced crime increases whose pattern matched the pattern in casino counties, but smaller. This indicates that crime spilled over from casino counties into

neighbor counties, rather than shifting crime from one area to another.

In future research we hope to refine this study. Questions include whether different types of casinos have different impacts on crime. For example, do riverboat casinos affect crime in the same manner as land-based casinos or casinos based on Indian Reservations? Is there a difference based on geographic areas? Do casinos in rural areas affect crime in the same way as those in more highly populated areas? We will also try to decompose the total effect into the fraction due to local residents and visitors. We will also extend the data set as new data become available.

APPENDIX I

Definitions of FBI Part I Index Crimes[36]

The FBI Uniform Crime Report Part I offenses as follows:

I. Violent Crime–includes murder, rape, robbery and aggravated assault.

A. Murder and Non-negligent Homicide is the willful (non-negligent) killing of one human being by another and is based on police investigations, rather than the evaluations of a medical examiner or judicial body. Deaths caused by negligence, attempts to kill, assaults to kill, suicides, accidental deaths, and justifiable homicides are excluded from this category. Justifiable homicides are limited to the killing of a felon by a law enforcement officer in the line of duty and the killing of a felon by a private citizen.

B. Forcible Rape is the carnal knowledge of a female forcibly and against her will. Included are rapes by force and attempts or assaults to rape. Statutory offenses (where no force was used and the victim is under age of consent) are excluded.

C. Robbery is the stealing, taking or attempting to take anything of value from the care, custody or control of a person or persons by force, threat of force or violence and/or by putting the victim in fear. Robbery includes attempted robbery. Robbery is divided into seven subclassifications: street and highway (which accounted for 52 percent of all robberies in 1992), commercial house (11.9 percent), residence (10.1 percent), convenience store (5.3 percent), gas or service station (2.5 percent), bank (1.7 percent) and miscellaneous (13.1 percent).

D. Aggravated Assault is the unlawful attack by one person upon another for the purpose of inflicting severe or aggravated bodily injury. It includes assault with intent to kill. This type of assault is usually accompanied by the use of a weapon or by means likely to produce death or great bodily harm. Simple assaults are excluded.

[36]The definitions are taken from *Crime in the United States: 1993* (U.S. Department of Justice, Federal Bureau of Investigation), Appendix H, 380-381. The statistics quoted for 1992 are taken from *Crime in the United States: 1992, Section One.*

II. Property Crime–includes burglary, larceny and auto theft.

A. Burglary is the unlawful entry of a structure to commit a felony or a theft. It includes attempted forcible entry, attempted burglary and burglary followed by larceny.

B. Larceny (except motor vehicle theft) is the unlawful taking, carrying, leading or riding away of property or articles of value from the possession or constructive possession of another. Larceny is not committed by force, violence or fraud. Attempted larcenies are included. Embezzlement, "con" games, forgery, worthless checks, etc., are excluded. Larceny is subdivided into a number of smaller classifications: items taken from motor vehicles (22.6 percent of all larcenies in 1992), shoplifting (15.8 percent), taking of motor vehicle accessories (14.0 percent), taking from buildings (14.0 percent), bicycle theft (5.9 percent), pocket picking (1.0 percent), purse snatching (0.9 percent), taking from coin operated vending machines (0.9 percent), and all others (24.8 percent).

C. Motor vehicle theft is the theft or attempted theft of a motor vehicle. A motor vehicle is self-propelled and runs on the surface and not on rails. Motor vehicle theft includes all cases where vehicles are driven away and abandoned, but excludes vehicles taken for temporary use and returned by the taker. Specifically excluded from this category are motorboats, construction equipment, airplanes and farming equipment.

APPENDIX II

Explanation of County level Data

The number of arrests and offenses for each crime in every U.S. county from 1977-1996 was obtained from the Federal Bureau of Investigation's Uniform Crime Report County-level Data. When the UCR data had an observation with a FIPS code that did not match any county listed in the codebooks, that observation was deleted.

One significant problem with the offense data has occurred since 1985. When ICPSR compiles the FBI data, it cannot distinguish between legitimate values of 0 and values of 0 that should have been coded missing.[37] If an individual offense or arrest category had a value of 0 and that county had non-zero values for other crime categories, we used the raw data. This rule was followed because the FBI and ICPSR indicated that law enforcement agencies normally report the data for all crimes and do not selectively send data for some types of crimes and not for others. If the number of offenses and arrests was 0 for all categories in a given county in a given year, then that county was assigned missing values for all offense and arrest rates.

State populations were taken from the Statistical Abstract of the United States. The county population, age, sex and race data for all years except 1990 and 1992 were obtained from the U.S. Department of Commerce, a division of the Bureau of the Census. All population measures estimate the July 1 population for the respective years.[38] The age distributions of large military installations, colleges, and institutions

[37]Ken Candell of the FBI and Chris Dunn of ICPSR have provided much assistance with these problems.

[38]For further descriptions of the procedures for calculating intercensus estimates of population, see ICPSR (8384): "Intercensal Estimates of the Population of Counties by Age, Sex and Race (United States): 1970-1980." U.S.

were estimated by a separate procedure. The counties for which special adjustments were made are listed in the report.[39] The 1990 and 1992 estimates were not available from the Census Bureau. The 1990 data were estimated by taking an average of the 1989 and 1991 data. The 1992 data were estimated by multiplying the 1991 populations by each county's 1990-1991 growth rate. The Bureau of the Census provided the data on land area in square miles.[40]

Data on income, unemployment, income maintenance and retirement were obtained from the Regional Economic Information System, a component of the Bureau of Commerce. Income maintenance includes Supplemental Security Insurance (SSI), Aid to Families with Dependent Children (AFDC), food stamps, and other income maintenance (which includes general assistance, emergency assistance, refugee assistance, foster home care payments, earned income tax credits, and energy assistance). Unemployment insurance benefits include state unemployment insurance compensation, Unemployment Compensation for Federal Civilian Employees (UCFE), Unemployment for Railroad Employees, and Unemployment for Veterans (UCX), and other unemployment compensation (which consists of trade readjustment allowance payments, Redwood Park benefit payments, public service employment benefit payments, and transitional benefit payments). Retirement payments included old age survivor and disability payments, railroad retirement and disability payments, federal civilian employee retirement payments, military retirement payments, state and local government employee retirement payments, federal and state workers' compensation payments, and other forms of government disability insurance and retirement pay.

Department of Commerce, Bureau of the Census. Winter 1985. ICPSR, Ann Arbor, MI 48106. Also, see "Intercensal Estimates of the Population of Counties by Age, Sex and Race: 1970-1980 Tape Technical Documentation." U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 103, "Methodology for Experimental Estimates of the Population of Counties by Age and Sex: July 1, 1975." U.S. Bureau of the Census, Census of Population, 1980: "County Population by Age, Sex, Race and Spanish Origin" (Preliminary OMB-Consistent Modified Race).

[39]U.S. Bureau of the Census, Current Population Reports, Series P-23, No. 103, "Methodology for Experimental Estimates of the Population of Counties by Age and Sex: July 1, 1975." U.S. Bureau of the Census, Census of Population, 1980: "County Population by Age, Sex, Race and Spanish Origin" (Preliminary OMB-Consistent Modified Race), pp. 19-23.

[40]Land area includes intermittent water and glaciers that appear on census maps and in the TIGER file as hydrographic features. It excludes all inland, coastal, Great Lakes and territorial water. Inland water consists of any lake, reservoir, pond or similar body of water that is recorded in the Census Bureau's geographic data base. It also includes any river, creek, canal, stream or similar feature that is recorded in the data base as a two-dimensional feature (rather than a straight line). Rivers and bays that empty into these bodies of water are treated as inland water from the point beyond which they are narrower than one nautical mile across. Coastal and territorial waters include portions of the oceans and related large embayments, such as the Chesapeake Bay and Puget Sound, the Gulf of Mexico and the Caribbean Sea, that belong to the United States and its possessions.

References

Albanese, Jay S. (1985) "The Effect of Casino Gambling on Crime," *Federal Probation*, 49, 2, June, 39-44.

Albanese, Jay S. (1999) "Casino Gambling and White Collar Crime: An Examination of the Empirical Evidence." Presented at the conference "Gambling and Gaming: Winners or Losers?" Omaha, NE (April).

Ayres, Ian and Steven D. Levitt (1998) "Measuring Positive Externalities from Unobservable Victim Precaution: An Empirical Analysis of Lojack," *Quarterly Journal of Economics*, 113 (February) 43-77.

Buck, Andrew J., Simon Hakim and Uriel Spiegel (1991) "Casinos, Crime and Real Estate Values: Do They Relate?" *Journal of Research in Crime and Delinquency*, 28, August, 288-303.

Chesney-Lind, Meda and Ian Y. Lind (1986) "Visitors Against Victims: Crimes Against Tourists in Hawaii," *Annalys of Tourism Research*, 13, 167-91.

Chiricos, Ted (1994) "Casinos and Crime: An Assessment of the Evidence." University of Nevada, Las Vegas, Special Collections.

Florida Department of Law Enforcement (1994) "The Question of Casinos in Florida: Increased Crime: Is It Worth the Gamble?" Tallahassee, FL: State of Florida.

Florida Sheriffs Association (1994) "Casinos and Crime: Is It Worth the Gamble? A Summary Report and Position Paper," Tallahassee, FL: Florida Sheriffs Association.

Frey, James H. (1998) "Federal Involvement in U.S. Gaming Regulation," *Annals of the American Academy of Political and Social Science*, 556 (March) 136-152.

Friedman, Joseph, Simon Hakim and J. Weinblatt (1989) "Casino Gambling as a 'Growth Pole' Strategy and Its Effect on Crime," *Journal of Regional Science*, 29, November, 615-623.

"Gaming Conference" (1999) Sponsored by the Federal Bureau of Investigation, The United States Attorney's Office, the Kentucky Association of Chiefs of Police and the Kentucky Association of Commonwealth Attorneys, Louisville, KY (August 10).

Gazel, Ricardo and William Thompson (1996) "Casino Gamblers in Illinois: Who Are They?" Report for The Better Government Association of Chicago, June.

Glaeser, Edward L., Bruce Sacerdote and Jose A. Scheinkman (1996) "Crime and Social Interactions," *Quarterly Journal of Economics*, 111, May, 507-548.

Gould, Eric, David B. Mustard and Bruce Weinberg (1998) "Crime Rates and Local Labor Market Opportunities in the United States: 1977-1995." University of Georgia Working Paper.

Government Accounting Office (2000) "Impact of Gambling," GAO/GGD-00-78, April, 1-68.

Nelson, Dennis J., Howard L. Erickson, and Robert J. Langan (1996) "Indian Gaming and Its Impact on Law Enforcement in Wisconsin," API Consulting Services, October.

Reno, Ronald A. (1997) "False Hope," *Citizen*, 11, 6, June, 10-13.

Thompson, William N., Ricardo Gazel and Dan Rickman (1996a) "Casinos and Crime in Wisconsin: Is There a Connection?" Milwaukee: Wisconsin Policy Research Institute, 9, 8 (October).

Thompson, William N., Ricardo Gazel and Dan Rickman (1996b) "The Social Costs of Gambling in Wisconsin," Milwaukee: Wisconsin Policy Research Institute, 9,6, 1-44.

Wheeler, David L. (1999) "A Surge of Research on Gambling Is Financed in Part by the Industry Itself," *The Chronicle of Higher Education*, 60, 26, 17-18.