The Spatial Evolution of Casino Gambling

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Abstract

This article examines the proliferation of gambling in United States counties during the 1990s and examines the factors that influence a region's decision to allow or prohibit casino gambling. Native American casino openings are driven by somewhat different factors than non-Native American casino openings. Both types of casinos are more likely to open in counties with large populations. More importantly, non-Native American casinos are more likely to locate near large populations across state borders. Strong regional variation in the probability of casino adoption exists, and the Mississippi River had a strong influence on the spatial evolution of gambling. As expected, Native American casinos are more likely to open in counties with large concentrations of Native Americans. Surprisingly, this study finds no evidence of strategic behavior among bordering counties and no evidence of competition between Native American and non-Native American casinos.

Introduction

On the list of socially acceptable pursuits, gambling ranks alongside such vices as smoking, drinking, and illegal drug use. Gambling is seen as addictive, and pathological gambling can cost people their homes, their jobs, their families, and even their lives. Yet over the past two decades, we have seen communities across the country open their arms to casino gambling in hopes that it would spur economic development. The study described in this article examines the factors that influence casino adoption and pays particular attention to the interrelationships among neighboring communities.

The casino location decision depends on the willingness of casino developers to supply gambling to the region and the willingness of local governments to enact laws that permit the casino to open. Developers are primarily interested in their ability to earn positive profits, while local governments may be influenced by the characteristics of their own region and those of neighboring jurisdictions. The model developed in the following paragraphs examines the importance of these characteristics as well as some other institutional factors that seem to have played a role in the growth of casino gambling.

The study uses two empirical strategies. First, a multinomial logit model examines the importance of various supply, demand, and institutional factors on the casino location decision and distinguishes how these influences have differed for Native American and non-Native American casinos. The most important factors in the casino location decision are the population of the host county and the proportion of Native Americans living in the county. A larger population increases the likelihood of a casino's opening in the region and an increase in the proportion of Native Americans increases the likelihood of a Native American casino but decreases the likelihood of a non-Native American casino. In addition, non-Native American casinos are attracted to locations near large numbers of people across state lines, but Native American casinos are not. The ability to attract tourists from outside the county is more important in predicting casino adoption than the characteristics of the host region itself. In addition, the riverboat casino and access to the Mississippi River played a large role in the early days of gambling expansion in the United States.

The second empirical strategy examines whether counties behave strategically. A number of researchers have considered the possibility that counties may turn to casino gambling as a way to protect themselves against cannibalization from nearby casinos in neighboring states, and that this strategy may lead to an equilibrium level of gambling that is too high (see, for example, Felsenstein and Freeman, 2001; Felsenstein, Littlepage, and Klacik, 1999; Grinols and Omorov, 1996). A discrete time hazards model is used to examine how the introduction of a casino in a bordering county affects the probability of a casino opening. This study finds no evidence that this sort of destructive competition is actually occurring. In addition, an examination of the data indicates that very little competition exists between Native American and non-Native American casinos. Local governments do not react to nearby casinos by expanding gambling in their own jurisdiction.

This article begins with a brief look at the history of casino gambling. The next section reviews the key issues in the academic and public debate over the expansion of casino gambling. The third section presents a set of hypotheses regarding potential influences on casino gambling. The fourth section discusses the empirical strategy and data. The fifth section presents results. The sixth section examines whether interstate competition has had an influence on casino adoption, and the final section concludes the study.

A Brief History of Casino Gambling

Although gambling has long been legal in 48 of the 50 states, mostly in the form of state-sponsored lotteries, casino-style gambling has largely been prohibited. In 1976, Atlantic City, New Jersey, joined the state of Nevada as the second jurisdiction in the United States with legalized casino-style gambling. In the 1970s, a handful of Native American tribes operated high-stakes bingo parlors, including the Penobscot Tribe of Maine, which opened a high-stakes bingo parlor in 1973, and the Seminoles of Florida, which opened a high-stakes bingo parlor in 1978. Questions about the legality of Indian gaming came to a head when the case of *California v. Cabazon and Morongo Bands of Mission Indians* went to the U.S. Supreme Court. The court ruled in 1987 that if states allow a particular form of gambling within the state, they have no ability to regulate that form of gambling on tribal lands.

In response to this decision, Congress passed the Indian Gaming Regulatory Act (IGRA) in 1988. The IGRA identifies three classes of gaming.[1]

> Class I: Social games for prizes of minimal value and traditional forms of Indian gaming engaged in as part of tribal ceremonies or celebrations. Subject to tribal regulation.
>
> Class II: Bingo and games similar to it, such as pull-tabs, tip jars, and certain nonbanking card games. Subject to oversight from the National Indian Gaming Commission.
>
> Class III: All other forms of gaming, including banking card games, slot machines, craps, parimutuel horseracing, dogracing, and lotteries. Subject to an agreed-upon compact between the tribe and the state.

Casino gambling is Class III gaming. A tribal-state compact can permit Class III gaming only in forms that are legal in some form in the state, although the courts have very loosely interpreted this provision. For instance, Connecticut allowed nonprofit organizations to host "Casino Nights" as fundraisers, and the Mashantucket Pequots successfully used these events as legal support to open Foxwoods Resorts Casino, which until recently was the largest casino in the world (Evans and Topoleski, 2002). Compacts outline the size, scope, and types of gaming allowed. Sometimes they include a payment to the state, often in exchange for some form of local monopoly rights.

Passage of the IGRA triggered rapid expansion of casino gambling throughout the United States, both on and off reservations. Iowa legalized riverboat gambling in 1989 and opened its first riverboat casino in 1991. In November 1989, the mining town of Deadwood, South Dakota, became the first jurisdiction outside of Atlantic City and Nevada to open a non-Native American casino. Riverboat casinos were legalized in Illinois, Mississippi, Louisiana, Missouri, and Indiana between 1990 and 1993, and New Orleans (1992) and Detroit (1996) authorized land-based casinos as well. Not including Nevada, by 2000, 358 Class III-style casinos operated in 28 states. Of these, 176 were Native American and 182 were non-Native American.

Exhibit 1 provides detail on the number of casinos and gaming positions in each state. Native American and non-Native American casinos average roughly the same number of gaming positions, with Native American casinos averaging 1,044 gaming positions, and non-Native American casinos averaging 1,024, although Native American casinos have more bingo seats and fewer slot machines. The largest casino in the United States, Foxwoods, a Native American casino located in Connecticut, has more than 10,000 gaming positions. At the other extreme are the card clubs scattered throughout California and the small casinos in the gaming towns of Deadwood, South Dakota, Cripple Creek, Colorado, Black Hawk, Colorado, and Central City, Colorado. In all, 65 casinos had fewer than 200 gaming positions in 2000, and 55 of those were in the gaming towns listed previously or were California card clubs. By 2000, 188 counties had at least one operating casino, either Native American or non-Native American.

The rate of growth in casino locations has slowed, but expansion continues to be an important political topic in many states, including Illinois, Minnesota, and Kentucky. Even as the growth in

[1] Industry publications, official statistics, and some other sources generally call casino gambling "gaming," which has a broader connotation, but this article makes no distinction between gaming and gambling.

the number of casinos has slowed down, the number of gaming stations at each location continues to increase, and, beginning with Delaware in 2000, casino-style gambling is expanding into racetracks. In addition, the rate of growth of consumer spending on casino gambling remains high, growing from $16 billion in 1995 to $24.5 billion in 2000 and $30.3 billion in 2005 (American Gaming Association, 2006).

Exhibit 1

Locations, Types, and Sizes of Casinos in the United States as of 2000 (excludes Nevada)

State	Number of Native American Casinos	Number of Non-Native American Casinos	Total Number of Bingo Seats	Total Number of Table Games[b]	Total Number of Slot Machines[c]	Total Square Footage
Arizona	19	0	6,280	259	7,838	871,799
California	32	14	16,200	1,830	18,231	2,270,988
Colorado	2	39	680	224	14,793	860,094
Connecticut	2	0	4,700	520	8,685	491,000
Delaware	0	3	0	0	5,435	78,700
Florida	3	1	2,150	66	2,900	207,500
Iowa	3	13	400	435	14,068	455,962
Idaho	3	0	0	69	1,747	90,000
Illinois	0	9	0	360	8,760	247,242
Indiana	0	9	0	668	14,743	460,060
Kansas	4	0	440	86	2,172	98,000
Louisiana	1	15	0	853	22,539	823,104
Michigan	16	3	2,878	656	20,366	977,337
Minnesota	16	0	5,390	407	16,448	1,094,681
Mississippi	1	30	2,500	1,449	43,366	1,791,469
Missouri[a]	0	10	0	581	15,200	527,101
Montana	4	0	680	0	291	39,000
Nebraska	1	0	300	4	116	20,000
New Jersey	0	12	1,000	1,211	33,757	1,120,789
New Mexico	11	1	2,250	204	7,579	417,500
New York	2	0	1,100	225	1,950	150,000
North Carolina	1	0	0	0	2,500	60,000
North Dakota	5	0	1,250	54	2,430	356,175
Oregon	7	0	2,645	149	3,993	478,000
South Dakota	8	23	800	121	4,462	389,166
Texas	2	0	1,030	62	1,100	100,000
Washington	18	0	5,550	549	5,290	554,660
Wisconsin	15	0	5,699	720	13,670	672,816
Total	176	182	63,922	11,762	294,429	15,703,143

[a] Maryland Heights and Players Casino opened adjacent to each other on March 11, 1997, and subsequently merged into one casino. They are treated as one casino in the data set.

[b] Exhibit games include roulette, blackjack, craps, and other card games not played on a machine.

[c] Slot machines include slot machines and video poker terminals.

Source: Gambling Answers (2003)

Modeling Casino Adoption

Very little empirical modeling of the determinants of casino locations has been performed, although the adoption of state lotteries has been examined somewhat. Berry and Berry (1990) use an event history analysis model to show that the adoption of state lotteries depends on the characteristics of the hosting state and the actions of neighboring states. Erekson et al. (1999) also model the determinants of state lottery adoption and find that the profit potential of the lottery and the fiscal health of the state are important determinants of lottery adoption. Neibergs (2007) suggests that state-level expansion of gambling, including lotteries and casinos, depends on fiscal health and some form of competition between states. This article is the first to empirically examine the casino location decision both across and within states.

Public arguments in favor of legalized casino gambling tend to focus on two main areas. The first is the promise of economic benefits to the area through job creation, new investment, increased levels of tourism, urban revitalization, and improvement of the status of the underprivileged or unemployed (Eadington, 1999). A primary difficulty in evaluating the economic benefits of casinos involves identifying the impact of casinos on other businesses and other regions. New jobs in the casino industry may come at the expense of existing jobs in movie theaters or restaurants, and tourist dollars spent in a casino are dollars that are not spent elsewhere. In looking at the whole economy, rather than just the regional one, local politicians are unlikely to consider the losses realized elsewhere. In areas where resources are involuntarily unemployed, however, casinos may in fact represent new economic activity. Eadington (1999) notes that locations that can become net exporters of gambling services by attracting consumers from outside the region are likely to benefit much more than locations that rely on local residents.

The second public justification for casino gambling is the additional source of revenue to the public sector. Marginal tax rates on gambling revenues range from zero for many Native American casinos to 50 percent for casinos in Illinois. The recent sale of a casino license in Illinois generated a bid of $563 million from Isle of Capri Corporation (*Chicago Sun-Times,* 2004). This evidence suggests the presence of significant above-normal profits accruing to local monopoly casino operators. The size of these profits is directly related to the amount of regulation regarding the number of locations; as more and more locations open casinos, excess returns will fall in all locations.

On the negative side, casinos have been associated with a number of negative externalities, such as pathological gambling, reduced worker productivity, higher bankruptcy rates, and increased illness and crime (see, for example, Grinols and Mustard, 2001). In addition, gambling is viewed by many as immoral. Computing the social costs of gambling is a particularly difficult task because many of the social costs are difficult or even impossible to measure (Walker, 2003; Wenz, 2007).

Absent from most of the public debate is the utility benefit provided to local gamblers, due primarily to the status of gambling as a vice and the significant public moral opposition to the expansion of gambling (Eadington, 1999). The utility benefit and the moral opposition are likely to influence the behavior of voters and, therefore, the casino location decision.

Predicting Casino Locations

The analysis in the following paragraphs begins by grouping casino location determinants into four broad categories: supply factors, intraregional demand factors, interregional factors, and institutional factors. In the empirical results section, regions are represented by counties. Supply factors refer to the characteristics that make a location desirable to casino operators. Intraregional demand factors refer to host county characteristics that influence the decision of a county to open a casino. Interregional demand factors refer to the characteristics of neighboring counties that influence casino policy in the host county. Finally, institutional factors, such as riverboat gambling, residents' voting behavior, and geographic size have had an influence on casino adoption.

Supply Factors

The supply of casinos to a location depends on the ability of casino owners to earn a profitable return on their investment. To earn a profit, they first and foremost need to have a sizable enough market to support casino gambling. Thus, casino locations are expected to be a positive function of the population of the host county and neighboring counties. In addition, residents' attitudes toward gambling may influence participation rates. Berry and Berry (1990) and Erekson et al. (1999) show that religious beliefs toward gambling influence lottery adoption. Based on the results of these earlier studies, casino locations are predicted to be negatively related to the concentration of fundamentalist Christians and positively related to the concentration of Catholics in the local area. Finally, the income of local residents may play a role in how much residents participate in gambling. The direction of the impact of differences in local incomes on the supply of gambling is not entirely apparent. If gambling is a normal good, increases in resident incomes should lead to more gambling; however, if gambling is an inferior good, casinos should want to supply their services in lower income areas. Empirical evidence on the income elasticity of gambling has primarily focused on demand for lottery tickets. The evidence is mixed and not particularly strong in either direction (Garrett and Coughlin, 2008; Mason, Shapiro, and Borg, 1989). In addition, higher incomes in the area mean higher wages for casino employees, driving up the wage cost of operating a casino in the area.

Intraregional Demand Factors

The demand for casino gambling in a location is reflected by whether the local jurisdiction allows the casino to enter. To a first approximation, the decision depends on whether the casino is viewed as a net benefit for the region. Grinols and Mustard (2001) construct a closed economy model for assessing the bottom line effect of casino gambling and identify a number of items that represent true benefits or costs to a region. At the forefront of their analysis is a recognition of the need to appropriately account for the displacement of other activities. Some potential benefits include increased resource utilization, business profits, and tax revenues. Potential costs focus primarily on externalities associated with the increased incidence of pathological gambling. A formal discussion of their model is presented in appendix A. This section focuses on the conditions under which a closed economy will be more likely to find that casino gambling provides net benefits.

First, casinos are expected to have a greater benefit and, thus, be more likely to locate in areas with high levels of underutilized resources, which are measured in the following discussion as

unemployment and housing vacancies. Bringing workers out of unemployment, for example, has a greater economic benefit than moving employed workers from their existing job into the casino industry. Evans and Topoleski (2002), who observe that Native Americans suffer from relatively high rates of unemployment, find that Native American casinos have led to reductions of Native American unemployment. In addition, because manufacturing employment has been declining in the United States (DOL BLS, 2006), the model considers whether counties with high concentrations of manufacturing employment may have turned to casinos to replace jobs lost from this sector.

Second, casinos may provide a benefit by increasing business profitability. To the extent that casinos crowd out movie theaters and restaurants, casino profitability represents a net benefit in a closed economy only if the casinos are more profitable than the businesses they replace. When a casino represents new business in the region, however, those profits provide a net benefit directly. One way to represent the existence of other activity is to measure the degree of urbanization. Casinos are expected to be more likely to locate in less urbanized areas. This argument carries to consumer surplus as well—if consumers enjoy gambling more than other available forms of consumption, the introduction of a casino will represent a net benefit to the area.

Finally, casinos may increase the ability of a jurisdiction to generate tax revenues. Berry and Berry (1990) argue that gambling may represent a politically palatable way to raise tax revenues, and tax rates on gambling tend to be higher than taxes on other businesses. Marginal tax rates are as high as 50 percent in Illinois, for instance. The potential for casinos to raise additional tax revenues suggests that casinos would be more likely to locate in areas having fiscal difficulties.

These potential benefits associated with casinos in a location must be weighed against the increase in negative externalities that they bring. Casinos will be permitted in areas where the expected benefits exceed the expected costs.

Interregional Demand Factors

The Grinols and Mustard (2001) model that forms the basis of the previous section is based on a closed economy, but from the perspective of a particular local jurisdiction, many of the costs and benefits travel across county and state lines. The interaction of different jurisdictions plays a critical role in the casino location decision. A central planner acting to maximize welfare in a closed economy can internalize many of the spillover effects associated with casino gambling, but a local planner in an open economy will not completely account for these effects. For example, a pathological gambler who travels to a casino in a distant location, runs up large debts, and returns home to rob his neighbor will enhance welfare in the casino region but reduce welfare in his home region. Although the Grinols and Mustard model makes no such distinction, the analysis in the following paragraphs accounts for it explicitly. A formal version of an open economy cost-benefit function for a region is presented in appendix A.

Local business profitability is likely to be affected in two important ways by interjurisdictional factors. First, an increase in tourism associated with casino gambling has the potential to increase local profits not at the expense of other local businesses but at the expense of businesses located in other areas. This tourism potential suggests that casinos will want to locate near large populations outside the jurisdiction. Native American casinos, which are typically but not always on reserva-

tions, will want to locate near large populations outside the reservation. Non-Native American casinos will want to locate in counties that are near other large counties. To the extent that state governments can act as a higher level of planner than local governments, however, the states will direct these casinos to counties that are near large populations across state lines. Native American casinos, however, should not have any preference for whether the residents come from the same or neighboring states. The prediction, then, is that non-Native American casinos should border large out-of-state populations, but Native American casinos should simply border large populations. The presence of negative externalities associated with pathological gambling leads to an identical prediction. Both Native American and non-Native American casino counties would like pathological gamblers to take their troubles home with them, and non-Native American casino counties would especially like that home to be in a different state.

In addition, business profitability will be enhanced in a region if casinos have a disproportionately high share of local ownership compared to the businesses they crowd out. A high concentration of local ownership is more likely to be the case for Native American casinos than for non-Native American casinos, which are generally owned by publicly traded corporations with widely dispersed shareholders.

Of high interest is reaching an understanding about whether neighboring jurisdictions behave strategically regarding casino adoption. The possibility of a prisoner's dilemma problem in the face of negative externalities and spillovers may lead to a situation in which cross-jurisdictional competition leads to an equilibrium level of gambling that is too high. Intuitively, one location may open a casino and export gambling to tourists from other regions. The casino region may find itself better off initially, but the tourists' home region may see a decline in welfare as tourists spend their consumption dollars outside the region and bring back some of the externalities associated with gambling. The tourists' home region, which may not have found casino gambling to be optimal initially, may now realize that it is faced with the negative externalities anyway and may turn to its own casino as an import substitution strategy. With a casino near home, the tourist now does not need to travel to gamble, and the region that opened the first casino may find itself in a less desirable position than had it never opened a casino. A number of studies have examined this possibility (Felsenstein, Littlepage, and Klacik, 1999; Grinols and Omorov, 1996). Felsenstein and Freeman (2001) go so far as to estimate the possible effects of cross-border competition in casino gambling between Egypt and Israel and find that this interjurisdictional competition can lead to the prisoner's dilemma outcome mentioned previously.

Left unexplored so far in the literature, however, is identifying whether this sort of destructive competition actually occurs. Neibergs (2007) conducts a state-level analysis of casino locations and finds some very weak evidence of competition but does not examine smaller jurisdictions. Shroder (1995) examines an analogous problem with the level of welfare benefits in different states and finds that, despite a theoretical potential for cross-border competition, no such competition occurs. If in fact communities are turning to casino gambling only in response to casinos in neighboring communities, the data should show that a nearby casino opening in a neighboring state should increase the probability of a casino in the home county. Finding this sort of interregional influence would suggest that cross-border competition leads to the overprovision of casino gambling. From a policy standpoint, finding cross-border competition would suggest a greater role for national-level

regulation of casino locations, but a failure to find this result would suggest no need for such oversight.

Institutional Factors

Aside from the supply and demand factors listed previously, some institutional factors may have played a role in the expansion of casino gambling. One quirk that helped shape expansion in the early 1990s was the phenomenon of riverboat gambling. Illinois and Iowa were two early adopters of legalized gambling, but these states restricted it to riverboats. The reason for this restriction is not particularly clear, although it may have something to do with zoning restrictions, a desire to make casinos seem less like a permanent part of the community, a nostalgic ploy used to market the idea to local voters, or a method to hold participant visits to a limited amount of time. Now, several riverboat casinos are still in existence, but few of them actually leave the dock. In any case, access to the Mississippi River or a coastal waterway suitable for a riverboat seems to have had a large influence on the early adoption of casino gambling. In addition, the voting behavior of local residents, the region of the country, and the geographic size of the county are considered as possible influences on the casino adoption decision.

Econometric Specification and Data

The previous discussion suggests a model of the following form:

$$C_i = f(S_i, D_i, D_j, I_i) \quad (1)$$

Here, C_i represents region i's casino status, S_i represents factors that affect the decision of casino operators to supply casinos to the region, D_i represents characteristics of region i that influence the region's willingness to permit casino gambling, D_j represents factors outside region i that influence i's demand for casinos, and I_i represents institutional factors that have had an influence on casino locations.

The period of analysis is from 1990 to 2000. The wave of casino gambling expansion was triggered by the 1988 passage of the IGRA. In 1989, Iowa became the first state to legalize non-Native American casinos, with its first casino opening in 1991. Nevada, New Jersey, Hawaii, Alaska, and the District of Columbia are omitted from the analysis. Much of the data on initial conditions in each county comes from the U.S. Census Bureau's Census of Population and Housing, *1990 Census*. A few counties already had casinos by then: Deadwood, SD, opened casinos in November 1989, and a small number of counties already had Native American casinos. Since 2000, most of the growth of gambling in the United States has come in the form of an increase in casino size rather than an increase in the number of locations.

The unit of observation is the county. The ease of data availability for counties and the recognition that county governments are likely to play an important role in the casino decision are important factors in the decision to use counties as the unit of analysis. Using counties also provides the opportunity to distinguish between intrastate and interstate effects. If the effects of casino gambling are concentrated in a smaller area than the county, or if the influence of municipal governments is much stronger than the influence of the county government, the predictive power of the model

will be somewhat weaker than might be hoped. The data set used in the analysis reported in this article has 3,072 counties. A total of 175 Native American casinos are spread over 132 counties and 182 non-Native American casinos are spread over 61 counties. Five of these counties contain both types.

The dependent variable is a categorical variable representing the possible casino outcomes. Four possible states exist: no casino, Native American casino, non-Native American casino, or both types of casino. A casino is defined in this article as a facility that has Class III-style gaming, as defined under the IGRA, except for racetrack-only facilities. This definition includes card clubs but excludes facilities such as convenience stores that have video lottery terminals. When a county decides to open a casino, it must also make decisions about the amount of gambling activity it will allow and the type of market structure that will prevail. Certainly differences exist among the gaming town of Biloxi, Mississippi, with its nine large casinos containing a total of more than 17,000 gaming positions; Mashantucket, Connecticut, home of the 340,000-square-foot Foxwoods Casino; and Prescott, Arizona, with its two small Native American casinos totaling 900 positions. Although understanding these differences is important, this article focuses on the decision to allow casino gaming without regard to market structure.

The categorical nature of the casino variable suggests a multinomial logit specification of the following form:

$$\text{Prob}(\text{Casino}=m) = \Lambda(\beta' X) \qquad (2)$$

In this equation, m represents the different casino outcomes for each county. Because some factors have different influences on Native American casino adoption than non-Native American casino adoption, distinguishing between the two is important. Because only five counties have both types of casinos, making estimation problematic, these counties are dropped from the models estimated in the following sections, leaving three possible outcomes for the dependent variable. Λ represents the distribution function for the logistic distribution, and X is a vector of explanatory variables that influence the casino location process, as hypothesized in the preceding section.

Summary statistics for the explanatory variables are presented in exhibit 2[2] and separated by the county casino type—none, Native American, non-Native American, or both. Unless otherwise mentioned, the data from each county come from 1989 or 1990, right before the great wave of casino expansion in the 1990s. The average amount of gaming in each casino county type, as measured by the number of gaming positions, is shown in the first row of exhibit 2. Counties with Native American gaming tend to have fewer gaming positions than those with non-Native American casinos.

Key demand factors include the county population, county median income, and county religious characteristics. Population is expressed in natural logarithmic form. Casino counties in general are much more populous than noncasino counties; this statement is especially true for non-Native American casinos. Counties with Native American casinos average about 115,000 people, and counties with non-Native American casinos average about 425,000 people. Counties with no

[2] Variable names and data sources are presented in appendix B, exhibit B-1.

Exhibit 2

Variable Means and Standard Deviations for Casino and Noncasino Counties (1 of 2)

Variable	No Casinos in County	Only Non-Native American Casinos in County	Only Native American Casinos in County	Both Types of Casinos in County
GAMING POSITIONS		2,436 (3,333)	1,386 (1,716)	4,607 (3,760)
POP	67,047 (192,244)	425,990 (1,215,033)	114,974 (286,569)	752,156 (925,153)
MEDHINCOME	23,623 (6,252)	27,758 (8,361)	23,507 (5,235)	30,047 (4,222)
CATHRELIG	0.122 (.15)	0.200 (.14)	0.222 (.18)	0.183 (.015)
FUNDRELIG	0.279 (.22)	0.202 (.15)	0.097 (.07)	0.099 (.03)
UNEMP	0.061 (.028)	0.061 (.02)	0.076 (.04)	0.068 (.03)
VACANCY	0.147 (.10)	0.098 (.08)	0.195 (.14)	0.102 (.06)
MANUF	0.189 (.11)	0.182 (.06)	0.138 (.08)	0.131 (.04)
URBANPCT	0.353 (.30)	0.712 (.29)	0.383 (.29)	0.897 (.07)
FISCAL	0.031 (.13)	0.034 (.08)	0.029 (.12)	0.049 (.04)
FISCALCHG	43.88 (36.0)	38.21 (19.1)	42.943 (26.8)	62.08 (23.6)
NATIVEPOP	0.011 (.047)	0.004 (.004)	0.098 (.17)	0.010 (.005)
POP50IN	1,054,982 (1,310,205)	1,884,080 (2,799,788)	935,861 (1,544,529)	3,360,835 (5,128,634)
POP50OUT	354,818 (860,490)	949,285 (1,641,591)	137,107 (377,397)	96,452 (124,465)
NEARBYIN	0.015 (.12)	0.9018 (.13)	0.126 (.33)	1.00
NEARBYOUT	0.002 (.05)	0	0.023 (.15)	0.40 (.54)
COASTAL	0.088 (.28)	0.268 (.45)	0.276 (.45)	0.40 (.54)
RIVER	0.028 (.17)	0.321 (.41)	0.024 (.15)	0
lnLANDAREA	865 (1,018)	677 (672)	2,267 (2,782)	2,858 (2,746)
VOTEDEM	0.396 (.11)	0.461 (.09)	0.410 (.09)	0.421 (.06)
VOTEPEROT	0.203 (.72)	0.182 (6.25)	0.241 (.05)	0.206 (.05)

Exhibit 2

Variable Means and Standard Deviations for Casino and Noncasino Counties (2 of 2)

Variable	No Casinos in County	Only Non-Native American Casinos in County	Only Native American Casinos in County	Both Types of Casinos in County
RNORTHEAST	0.067 (.22)	0.038 (.18)	0.024 (.15)	0
REASTNORTHCENTRAL	0.137 (.34)	0.250 (.43)	0.212 (.41)	0
RWESTNORTHCENTRAL	0.196 (.40)	0.303 (.46)	0.260 (.44)	0.20 (.45)
RSOUTHATLANTIC	0.202 (.40)	0	0.016 (.12)	0.200 (.45)
REASTSOUTHCENTRAL	0.123 (.33)	0.125 (.33)	0.008 (.09)	0
RWESTSOUTHCENTRAL	0.159 (.36)	0.142 (.35)	0.024 (.15)	0
RMOUNTAIN	0.083 (.28)	0.053 (.22)	0.173 (.17)	0
RPACIFIC	0.031 (.17)	0.089 (.29)	0.283 (.45)	90.60 (.55)
N	2,884	56	127	5

Source: See appendix B

casinos, however, average just 67,000 people. Median income is about 15 percent higher in non-Native American casino counties but is about the same in Native American casino counties and noncasino counties. The religious makeup of the county population differs widely by casino category as well. Data on church membership and adherents come from the American Religious Data Archive (Bradley et al., 1992). That archive identifies church members and adherents for 133 different denominations. The work of Smith (1990) and Lehrer and Chiswick (1993) classifies religious participants as fundamentalist Christian, Catholic, or other. Noncasino counties have on average about 28 percent fundamentalist Christians and 12 percent Catholics, but casino counties of all types have many more Catholics and many fewer fundamentalist Christians.

Intraregional demand factors hypothesized to influence casino location include unemployment and housing vacancy rates, the fraction of manufacturing employment, the degree of urbanization, fiscal conditions, and the proportion of Native Americans. Unemployment and housing vacancy rates in 1990 were higher in counties that would adopt Native American gaming, but unemployment was not much different and vacancy rates were lower in counties that opened a non-Native American casino. Manufacturing employment in 1990 was about the same in noncasino and non-Native American casino counties but was much lower in Native American casino counties. The degree of urbanization in the county is measured as the percentage of residents living in an urbanized area. Approximately 35 percent of residents in noncasino counties lived in urban areas, compared with 38 percent in Native American casino counties and 71 percent in non-Native American casino counties. Fiscal health is measured by the ratio of county budget surplus or deficit

to total expenditures in 1987 and the percentage change in government expenditures from 1982 to 1987.[3] Differences between counties with and counties without casinos are small. As would be expected, Native American populations are much higher in counties that open Native American casinos—about 10 percent of the population versus about 1 percent in other counties.

Interregional demand factors that may affect casino locations include the nearby population and the proximity to other casino counties. Geographic Information System software was used to measure the population within 50 miles of the county border and to determine whether that population resided in the same state as the casino or in a different state. The average noncasino county has slightly more than 1 million residents nearby in the same state and 350,000 nearby across state lines. The average non-Native American casino county has about 1.9 million residents nearby in the same state and nearly 1 million residents nearby across state lines. Native American casino counties, in contrast, have fewer than 1 million residents nearby in the same state and fewer than 150,000 residents nearby across state lines. In some cases, reservation boundaries have served as a buffer against urban sprawl, so it is perhaps surprising that Native American casinos are not particularly likely to be near large populations. In addition, dummy variables were constructed for each county to represent whether they bordered on another casino county and whether that casino county was in the same state or a different one. In general, casino counties were more likely to be near other casino counties, both in the same and different states. This finding reflects the wide regional variation in gambling levels.

Some peculiar institutional factors have also played a role in casino expansion. One particularly important factor is the riverboat. To capture the role of riverboats, a dummy variable was constructed to represent whether a county bordered on the Mississippi River and another was constructed to represent whether a county bordered on an ocean, the Gulf of Mexico, or one of the Great Lakes. Casino counties are much more likely to border a coast, and non-Native American casinos are much more likely to border the Mississippi River than noncasino counties.

In addition, the model includes dummy variables for political attitude, county size, and region. Voter attitudes are measured by the way residents voted in the 1992 Presidential election.[4] The model examines whether gambling has been a partisan issue. The summary data show that casino counties tended to vote Democratic by a wide margin. County geographic size, measured as the natural log of square miles, is included because introspection suggests that the larger the county, the larger the likelihood a casino will fall within its borders. Native American casinos tend toward disproportionately large counties. Finally, dummy variables based on census divisions are included to capture regional diffusion effects.[5] Casino gambling has not spread evenly across the country. Some regions have been much more receptive to it than others. One possibility is that region dummies capture some unobserved differences in regional characteristics; a second possibility is

[3] These dates were chosen purely for ease of data availability.

[4] The 1992 election was chosen over the 1988 election because Ross Perot ran in 1992, adding an additional source of variation to the data.

[5] The Mid-Atlantic and New England regions are combined into one region. In the empirical results section, estimation is otherwise problematic because no non-Native American casinos exist in New England. By combining the two census divisions into one region, the algorithm used to estimate the logit model converges and produces consistent estimates.

a regional diffusion argument, in which a new policy or initiative gains popularity and spreads to neighboring communities. Berry and Berry (1990) find evidence of this sort of regional diffusion with state lotteries. In general, the level of gambling increases from the Northeast to the Southwest.

Empirical Results

A binomial logit model was used to produce maximum likelihood estimates for the parameters in equation (2). The results are presented in exhibit 3. Column 1A identifies the effect of various factors on the likelihood that a county would open a non-Native American casino; column 1B presents estimates for the effects of the same factors on the likelihood that a county would open a Native American casino. Clear differences exist between the two casino types. These parameter estimates measure the significance of the various supply, intraregional demand, interregional demand, and institutional factors outlined previously. In addition to computing parameter estimates, the model computes marginal effects. The nonlinear nature of logit estimation means that the marginal effect of a change in an explanatory variable depends on its level and the level of each

Exhibit 3

Logit Model Estimates (1 of 2)

Parameter	Multinomial Logit				Discrete Time Hazards	
	(1A) Non-Native American		(1B) Native American		(2)	
	Estimate (StdError)	Marginal Effect	Estimate (StdError)	Marginal Effect	Estimate (StdError)	Marginal Effect
Intercept	– 9.566** (4.10)		– 12.516*** (2.70)		– 9.631*** (1.92)	
lnPOP	0.818*** (.26)	0.007	0.749*** (.19)	0.020	– 0.603*** (.13)	0.003
MEDHINCOME	0.000051 (.00003)	0.000005	0.00008** (.00003)	0.000002	– 0.00005 (.00003)	– 0.000003
CATHRELIG	1.819 (1.59)	0.0001	1.150 (.87)	0.0004	0.126 (.64)	0.0006
FUNDRELIG	– 2.069 (1.62)	0.051	– 7.545*** (1.99)	– 0.143	– 3.171*** (1.00)	– 0.016
UNEMP	7.687 (7.31)	0.021	4.165 (3.69)	0.059	5.426** (2.65)	0.027
VACANCY	4.114 (2.54)	0.031	1.652 (1.09)	0.087	2.023** (.86)	0.010
MANUF	– 1.114 (2.48)	0.003	0.656 (1.83)	0.009	– 0.200 (1.32)	– 0.0009
URBANPCT	1.600 (1.15)	0.008	– 0.536 (.72)	0.023	0.783 (.53)	0.004
FISCAL	– 0.965 (1.76)	0.0003	0.676 (.77)	0.001	0.175 (.73)	0.0008
FISCALCHG	– 0.0096 (.008)	– 0.00008	0.004* (.003)	0.00002	0.001 (.002)	– 0.000005
NATIVEPOP	– 106.4** (54.51)	0.064	5.07*** (1.01)	0.181	3.169*** (.65)	0.016

Exhibit 3

Logit Model Estimates (2 of 2)

Parameter	Multinomial Logit				Discrete Time Hazards	
	(1A) Non-Native American		(1B) Native American		(2)	
	Estimate (StdError)	Marginal Effect	Estimate (StdError)	Marginal Effect	Estimate (StdError)	Marginal Effect
lnPOP50IN	– 0.472* (.27)	– 0.005	– 0.311** (.15)	– 0.014	– 0.343*** (.11)	– 0.0016
lnPOP50OUT	0.088** (0.04)	0.0002	0.018 (0.02)	0.0006	0.029* (.01)	0.0001
NEARBYIN	– 0.611 (1.16)	0.007	0.802* (0.38)	0.0186	1.18*** (.18)	0.0058
NEARBYOUT	– 13.19 (1773)	0.010	1.097 (0.88)	0.029	– 0.335 (.335)	– 0.0017
COASTAL	1.167** (.50)	0.012	1.025*** (.31)	0.033	0.811*** (.24)	0.0040
RIVER	1.813*** (.42)	0.018	0.211 (.66)	0.051	1.447*** (.28)	0.007
lnLANDAREA	– 0.389 (.29)	0.0002	0.382* (.19)	0.0007	– 0.130 (.14)	– 0.0006
VOTEDEM	0.026 (.02)	0.0001	0.019 (.02)	0.0004	0.011 (.01)	0.00005
VOTEPEROT	– 0.035 (.05)	0.0002	0.075** (0.03)	0.0006	0.04* (.02)	0.0002
EASTNORTHCENTRAL	2.648*** (.92)	0.018	2.199*** (.67)	0.050	1.273** (0.51)	0.006
WESTNORTHCENTRAL	3.678*** (.99)	0.00000	2.382*** (0.70)	0.057	1.677*** (.53)	0.008
SOUTHATLANTIC	– 12.44 (296.1)	– 0.008	0.896 (1.03)	– 0.023	– 0.852 (.88)	– 0.004
EASTSOUTHCENTRAL	2.678** (1.09)	0.019	2.509* (1.36)	0.054	1.711** (.72)	0.008
WESTSOUTHCENTRAL	2.823*** (1.08)	0.013	1.163) (.99)	0.036	0.828 (.64)	0.004
MOUNTAIN	3.881*** (1.29)	0.019	2.313*** (.77)	0.055	1.622*** (.59)	0.008
PACIFIC	3.811)*** (1.16)	0.035	3.740*** (.71)	0.099	2.294*** (.55)	0.011
TIME					0.580*** (.13)	0.003
TIMESQ					– 0.061*** (.01)	– 0.0003
N	3058				32610	
Likelihood ratio	611.20				– 828.21	

**Statistically significant at a 90-percent confidence level.*

***Statistically significant at a 95-percent confidence level.*

****Statistically significant at a 99-percent confidence level.*

Source: See appendix B.

other variable. The marginal effects presented here represent the mean marginal effect of a change in the explanatory variable on the probability that a county would adopt a particular casino type for each observation in this data set.

Of the supply factors, the county population is an important and statistically significant determinant of casino adoption. A 1-percent increase in population is associated with a 0.7-percentage-point increase in the probability that a non-Native American casino would open and a 2.0-percentage-point increase in the likelihood that a Native American casino would open.[6] As a practical matter, population is the most important factor in determining casino adoption. Local income has a statistically significant but very small positive effect on Native American casino adoption but no impact on non-Native American casinos. The proportion of Catholics in the county has no effect on casino adoption, but the proportion of fundamentalist Christians reduces the likelihood that a casino would open. Referring to religious affiliation as a supply factor is perhaps misleading. If fundamentalist Christians participate less in gambling, then clearly their low demand for casino gambling reduces the willingness of casino operators to supply gambling to the region; however, it is also possible that religious participation has its effects through the legislative process as well.

The second most important factor in casino adoption is the size of the local Native American population in the county. A 1-percent increase in the county proportion of Native Americans leads to an 18-percent increase in the likelihood of opening a Native American casino. The coefficient estimate for non-Native American casinos is negative and statistically significant. This finding is consistent with the hypothesis that casinos controlled by Native American tribes do a better job of keeping the casino profits in the local community. Tribes also may have an easier time clearing legislative hurdles.

The other demand characteristics of the local region have no statistically significant effect on casino adoption. Unemployment, vacancy rates, manufacturing, the degree of urbanization, and the fiscal health of the county are not statistically significant, except that the change in county expenditures has a weak positive association with Native American casino adoption. Because the change in county expenditures is theoretically a more important factor for non-Native American casinos, this result is likely to be anomalous. Taken together, these parameter estimates suggest that counties do not give much consideration to whether economic activity associated with a casino is primarily displacing other activity. Also worth noting is that the unemployment result is insignificant for both types of casinos. Recall that Native American casinos are located in counties with higher unemployment rates and that unemployment has been a persistent problem for Native Americans. The results here suggest that, although the coefficient on unemployment has the expected positive sign, the presence of a large number of Native Americans drives casino adoption more so than their high levels of unemployment.

Characteristics of neighboring communities do influence casino demand, however, and, as predicted, the effects differ by casino type. Exhibit 3 shows that access to a large population across state borders has a sizable and statistically significant effect on non-Native American casino adoption. A 1-percent increase in the population within 50 miles but across state lines leads to a marginal

[6] Remember that these are point estimates that may change substantially for larger changes in the explanatory variables.

increase of 0.02 percent in the probability of a casino opening. Note from exhibit 2 that substantial variation exists in the size of the nearby out-of-state population; therefore, this factor has considerable practical influence on casino locations. The size of the nearby out-of-state population, however, has no effect on the location of non-Native American casinos. Tribal governments do not have the same concerns that state and county governments have regarding where their patrons come from. A large population in nearby counties within the state has negative impacts on casino probabilities for both casino types. The model shows that if a neighboring in-state county opened a casino during the 1990s, the county was somewhat more likely to open a Native American casino during the period as well. A complete discussion of the interaction of neighboring casinos has an important dynamic component and is investigated further in the next section.

Some institutional factors have played a role as well. Access to the Mississippi River has had a significant influence on non-Native American casino adoption, but has had no effect on Native American casinos. Being near a coast has been important for both kinds of casinos, although few Native American riverboat casinos exist. One possible explanation is that coastal boundaries correspond with tourism and are thus desirable for both types of casinos. The geographic size of the county had a small positive effect on the likelihood of finding a Native American casino in the county. Places with high concentrations of Perot supporters were more likely to open Native American casinos, but the effect was small. Finally, some evidence of regional diffusion exists, because many of the regional dummies were statistically significant. In general, casino adoption was more likely to occur moving from the Northeast to the Southwest.

Exhibit 4 presents the predicted probability that selected counties would open a casino based on the results of the logit model presented in exhibit 3. The probabilities in the exhibit are the combined probability of opening either a Native American or non-Native American casino. These predicted probabilities provide some insight regarding the types of counties that would be most likely and least likely to open casinos. Of the 3,058 counties included in the model, 1,183 have a predicted probability of less than 1 percent. This large and diverse group is made up of primarily of rural counties in the northeast part of the country. Some counties with low predicted probabilities have in fact opened casinos. The 10 casino counties with the lowest predicted probability are all rural counties in remote areas of large states. Swain County, North Carolina, with a predicted probability of 0.6 percent, is representative of this group. Swain County, which is located in the Smoky Mountains, has a casino despite being nearly 50 miles from the nearest population centers of Asheville, North Carolina, and Knoxville, Tennessee.

Of the 59 counties with predicted probabilities above 50 percent, 37 have casinos. The highest predicted probability is actually a county without a casino—Apache County, Arizona, at 96.1 percent. Apache County derives most of its high probability for a casino opening from its 77-percent Native American population. The other counties with high predicted probabilities have a large concentration of Native Americans, such as Shannon County, South Dakota (p=95.8%); a very large population, such as Los Angeles County, California (p=94.2%); or some combination of both, such as St. Louis County (Duluth), Minnesota (p=74.5%). Among the noncasino counties with high predicted probabilities, several have strongly considered casino openings. In Cook County, Illinois, for instance, the state sold a license for a casino in the county, but the license has been tied up in the courts since 2003 with no signs of resolution.

Exhibit 4

Predicted Probabilities and Casino Status for Selected Counties

10 Lowest Predicted Probabilities for Casino Counties	Predicted Probability (%)
Ohio, Indiana	0.5
Swain, North Carolina	0.6
Massac, Illinois	0.6
Allen (Parish), Louisiana	1.1
Neshoba, Mississippi	1.1
Gilpin, Colorado	1.1
Bossier (Parish), Louisiana	1.3
Oneida, New York	1.6
Doniphan, Kansas	1.8
Teller, Colorado	1.9
10 Highest Predicted Probabilities for Casino Counties	**Predicted Probability (%)**
Shannon, South Dakota	95.8
Los Angeles, California	94.8
Rolette, North Dakota	89.2
Menominee, Wisconsin	80.6
Humboldt, California	77.6
King, Washington	77.0
Sioux, North Dakota	74.7
St. Louis, Minnesota	74.5
Orleans (Parish), Louisiana	73.6
La Paz, Arizona	69.1
10 Highest Predicted Probabilities for Noncasino Counties	**Predicted Probability (%)**
Apache, Arizona	96.1
Todd, South Dakota	92.0
McKinley, New Mexico	83.1
Imperial, California	76.2
Navajo, Arizona	76.0
Cook, Illinois	75.5
Orange, California	69.7
Glacier, Montana	66.5
San Francisco, California	65.6
Lane, Oregon	63.9

Note: Predicted probabilities of a casino opening based on logit model in exhibit 3.

Testing for Cross-Border Competition

A prime reason for examining the factors that influence casino adoption is to gain an understanding of whether interaction between neighboring regions leads to an overexpansion of gambling. The existence of negative externalities associated with gambling suggests a role for regulation, but competition between regional governments for gambling revenues has the potential to undermine the ability of a particular government to find the appropriate level of regulation. As mentioned previously, the potential for a prisoner's dilemma situation exists in the case of casino gambling.

The features of casino regulation in the United States also provide an opportunity to test whether regions are in fact engaging in this sort of destructive competition. The decision to allow casino

gambling is made at two levels: state and local. Both Native American and non-Native American casinos are regulated in some form at each level. In the prisoner's dilemma scenario, the cooperative outcome is better for society than the competitive one. State-level regulation represents a method of enforcing the cooperative outcome, but when nearby counties are across state lines, this creates the potential for an inferior noncooperative equilibrium.

The approach employed in this article to test for this type of interregional competition is a discrete time proportional hazards model. In this model, the probability that a location will open a casino is a function of three types of regressors. The first type is time. Probability changes directly as a function of time, and the nature of this relationship is given a functional form in the following equation. The second type of regressor does not vary over time. Each variable used in the previous multinomial logit model is included and treated as time invariant and pegged at its 1990 values. This approach is perhaps questionable, but it has the advantage of not introducing a source of feedback into the model. The third type of regressor is time variant and includes a dummy variable for identifying whether a casino has opened in a neighboring county in the state or across state lines. These dummy variables are the variables of interest. If cross-border competition exists, the coefficient estimate for opening a casino in a neighboring county across state lines should be positive.

The proportional hazards model takes the following form:

$$\text{logit}(h_{it}) = \log(h_{it}/(1-h_{it}) = \alpha(t) + \beta' x_{it} \quad (5)$$

Here, $\alpha(t)$ is the baseline hazards function and x_{it} is a vector of time variant or invariant explanatory variables. In the discrete time model, the risk set includes each county that has not opened a casino at each time interval. In this data set, annual intervals spanning 1990 to 2000 are used; therefore, a county that opened a casino in 1990 would appear once, and a county that never opened a casino would appear 11 times. When the data set has been expanded to include a time dimension, the estimation using maximum likelihood is straightforward. Logit is used here. The logit estimates and estimated marginal effects are in column 2 of exhibit 3.

The hazards function is estimated with a quadratic specification and suggests that after the initial wave of casino openings in 1990, the probability of a casino opening fell quite dramatically at first but has since leveled off. Estimates of the other parameters are similar to the estimates presented previously in columns 1 and 2 of exhibit 3. Note that the marginal effects are much smaller in magnitude; this trend reflects the fact that the probability of a casino opening now has a time dimension, and the effect of a factor on a casino opening at a particular time is smaller than its effect on a casino opening at any point in the period of observation. One difference is that unemployment and vacancy rates are now found to have a positive effect on casino adoption. The coefficient on the opening of casinos in bordering in-state counties is positive and significant. The estimated coefficient likely reflects the fact that when prohibitions on casino gambling fall in one part of the state, they tend to fall in other places in the state as well.

There is no evidence that counties are engaging in cross-border competition. The coefficient on the dummy variable representing a bordering county across state lines opening a casino is statistically insignificant and actually negatively signed. This result holds up even in models in which the river and coastal variables are dropped and in which the river, coastal, and region variables are dropped. This result is particularly interesting given the number of casinos that opened on the Mississippi

River just across the state border from each other. Riverboat casinos in St. Louis, Missouri, and East St. Louis, Illinois, as well as in Moline, Illinois, and Dubuque, Iowa, operate in the same market, for instance. Their close proximity, however, does not indicate cross-border competition. Rather, it is likely that they simply have other common characteristics that led to casino adoption. Given the role of riverboats and the Mississippi River in the early days of casino expansion, it should not be surprising that the casinos in the early adopting states located in the more populated areas along the Mississippi River. As a counter example, the five casinos located in northwest Indiana draw heavily on customers from the Chicago area, yet they have not induced the opening of a casino in Cook County. This study finds no evidence that the instances of nearby casinos across state lines arise as a result of cross-border competition.

Additional evidence in support of no competition is the fact that very few states see direct competition between Native American and non-Native American casinos inside their borders. Given the contentious nature of early Native American casinos, it is perhaps surprising that states do not respond to Native American gaming with casinos of their own. Of the 28 gambling states listed in exhibit 1, 19 have only one type of gaming. Casinos in the other 9 states do not generally operate in the same regions. Only five counties have both types of gaming; of those, three are geographically large counties in California. In Michigan, for instance, Native American casinos are scattered primarily in the northern part of the state and the Upper Peninsula, with non-Native American casinos located in downtown Detroit. California's Native American casinos are traditional scale casinos, but the non-Native American casinos are generally smaller card clubs with fewer than 200 gaming positions. Recall that the IGRA permits only Native American gaming that is already permitted in some form in the state. Yet states do not respond to Native American casinos with non-Native American casinos.

Although the potential for destructive competition across jurisdictions exists, this study finds no evidence that this type of competition is actually occurring.

Conclusions

This article examines the factors influencing casino adoption within counties. A number of patterns are observed. One important observation is that the decision on casino locations is different for Native American and non-Native American casinos. A large local population is the most important factor in both cases, but non-Native American casinos are also strongly attracted to large nearby interstate populations. Large numbers of Native Americans in the county predict Native American casino openings but crowd out non-Native American casinos. The Mississippi River and riverboat gambling in the early days of casino expansion has had a lasting influence on casino locations, although most riverboat casinos no longer leave the dock. Fundamentalist Christians have been successful at keeping out Native American casinos but have had no effect on non-Native American casinos. Some very weak evidence indicates that underemployed resources lead to casino adoption, but no evidence supports the idea that fiscal conditions play a role. Further research is necessary to determine how communities choose the level of gambling and structure of the market after they have decided to open the doors to casino gambling.

This article also investigates whether counties engage in cross-border competition. This type of competition has potentially important policy implications, because an inability to account for regional spillover effects has the potential to lead to overexpansion of casino gambling. This article, which employs a proportional hazards model to investigate the dynamics of casino expansion, finds no evidence that destructive cross-border competition is occurring.

Appendix A.
A Modified Grinols-Mustard Model of Casino Welfare Impacts

Grinols and Mustard (2001) developed an algebraic model outlining exactly what needs to be calculated to estimate the welfare effects of casinos. Their model is outlined here. Let e(d, p, u) represent the minimum expenditures required to achieve utility u when the consumer buys and sells at prices p and d represents the distance to the nearest casino. This expenditure function is strictly monotonic in u for any choice of d and p. Then for fixed distance d and prices p, e(d, p, u(x)) is a utility function that records utility in dollars. To the consumer of gambling services, the primary benefit of more casinos is closer proximity to the nearest one. Let superscripts represent two alternative states of the world, where 0=no casino and 1=casino. Then $e_i(d^1, p^1, u^1) - e_i(d^1, p^1, u^0)$ represents the change in expenditures (and utility) that results from moving from the no-casino state of the world to the casino state of the world. Assume further that a dollar of utility is the same for each household. Then:

$$\Delta W = \Sigma_i [e_i(d_i^1, p_i^1, u_i^1) - e_i(d_i^1, p_i^1, u_i^0)] \quad (A.1)$$

where i indexes households. Then equation A.1 represents the total change in welfare. Following Grinols and Mustard (2001), expand equation 3.1 in the following fashion:

$$\begin{aligned}
\Delta W &= \Sigma_i [e_i(d_i^1, p_i^1, u_i^1) - e_i(d_i^1, p_i^1, u_i^0)] \\
&= \Sigma_i [e_i(d_i^1, p_i^1, u_i^1) - p_i^1 x_i^1] \\
&\quad + \Sigma_i [p_i^1 x_i^1 - p_i^0 x_i^0] \\
&\quad + \Sigma_i [p_i^0 x_i^0 - e_i(d_i^0, p_i^0, u_i^0)] \\
&\quad + \Sigma_i [e_i(d_i^0, p_i^0, u_i^0) - e_i(d_i^1, p_i^0, u_i^0)] \\
&\quad + \Sigma_i [e_i(d_i^1, p_i^0, u_i^0) - e_i(d_i^1, p_i^1, u_i^0)] \quad (A.2)
\end{aligned}$$

Note that part of each term cancels with part of the previous term, except for the original expression in equation 3.1. This new expression has a useful interpretation. The first term represents consumption constraints in the presence of casinos (state of the world 1). The second term represents income effects associated with moving from the casino state to the no-casino state. The third term represents consumption constraints in the absence of casinos. The fourth term captures the distance benefits associated with casinos, and the final term captures consumer surplus. The first and third terms referring to consumption constraints are zero under market clearing assumptions. In the presence of involuntary unemployment, for instance, the difference between the total expenditure it would take to reach the optimal bundle (p^1x^1) and the least costly way to reach the

optimal bundle ($e_i(d^1, p^1, u^1)$, by definition) captures the welfare impact of the constraint. Also, in the presence of underutilized capital, the presence of a casino that puts the capital to work would net a positive welfare impact. The sum of terms 1 and 3 provides the net change in welfare from changing from the no-casino state of the world to the casino state of the world.

Next, consider the household budget constraint:

$$p_i x_i = \Sigma_j \theta_{ij} \Pi_j + p_\Omega \Omega + T_i + E_i \tag{A.3}$$

where θ represents the household share and Π represents the profits of firm j, Ω represents the household endowment, T represents taxes, and E is the household share of gambling-induced externality expenditures. Summing across households, differencing across states of the world, and substituting A.3 into A.2 yields the following expression:

$$\begin{aligned}
\Delta W &= \Sigma_i [e_i(d_i^1, p_i^1, u_i^1) - e_i(d_i^1, p_i^1, u_i^1)] \\
&= \Sigma_i [e_i(d_i^1, p_i^1, u_i^1) - p_i^1 x_i^1] \\
&\quad + \Sigma_i [p_i^0 x_i^0 - e_i(d_i^0, p_i^0, u_i^0)] \\
&\quad + \Sigma_j \Delta\Pi_j + \Delta p_\Omega \Omega + \Delta T + \Delta E \\
&\quad + \Sigma_i [e_i(d_i^0, p_i^0, u_i^0) - e_i(d_i^1, p_i^0, u_i^0)] \\
&\quad + \Sigma_i [e_i(d_i^1, p_i^0, u_i^0) - e_i(d_i^1, p_i^1, u_i^0)]
\end{aligned} \tag{A.4}$$

This expression is an identity that provides a complete accounting framework for cost-benefit style studies. The first two terms in A.4 represent constraints that keep consumers from reaching their optimum bundle, such as structural unemployment. The third term represents the change in business profits, including the casino industry and all other businesses. The fourth term represents changes in the value of endowments, such as worker skills and land or house prices. The fifth term represents changes in taxes. The sixth term represents changes in externalities. The seventh term represents benefits provided to gamblers due to the increased availability of gambling. The final term represents changes in consumer surplus due to other changes in the price vector.

For a region *k* within this closed economy, we can rewrite this as

$$\begin{aligned}
\Delta W_k &= \Sigma_{i \in k} [e_i(d_i^1, p_i^1, u_i^1) - p_i^1 x_i^1] \\
&\quad + [p_i^0 x_i^0 - e_i(d_i^0, p_i^0, u_i^0)] \\
&\quad + \Sigma_j \theta_{ij} \Delta\Pi_j + \Delta p_{\Omega i} \Omega + \Delta T_i + \Delta E_i \\
&\quad + [e_i(d_i^0, p_i^0, u_i^0) - e_i(d_i^1, p_i^0, u_i^0)] \\
&\quad + [e_i(d_i^1, p_i^0, u_i^0) - e_i(d_i^1, p_i^1, u_i^0)]
\end{aligned} \tag{A.5}$$

where k indexes regions and $\Delta W = \Sigma_k \Delta W_k$. Here, p_i is the price vector facing individual i, including the wage; x_i is the chosen consumption bundle, including public services; d_i is the distance to the nearest casino; θ_{ij} is individual i's share of firm j; Π_j is the profits of firm j; T_i is the taxes facing firm i; Ω_i is individual i's endowment; and E_i is the cost of externalities facing individual i. Local governments are not likely to consider spillover effects and the interactions among communities. A

central planner would act to maximize (A.4) for the entire economy, but local planners would act to maximize (A.5) for their region.

Appendix B. Data Sources

Exhibit B–1

Data Sources for Casino Location Model

Variable	Description	Source
CASINO	Dummy variable identifying whether any casinos are in the county	www.gamblinganswers.com (n.d.) (Note: URL is now defunct.)
UNEMP	County unemployment rate, 1990	U.S. Census Bureau (1990b)
MANUF	Percent of employees in county employed in manufacturing industry, 1990	U.S. Census Bureau (1990b)
VACANCY	Percent of vacant housing units, 1990	U.S. Census Bureau (1990b)
DENSITY	Population per square mile, 1990	U.S. Census Bureau (1990b)
POP50IN	Population for census block groups within 50 miles of the county, inside the same state, 1990	U.S. Census Bureau (1990a, 1990b); Missouri Census Data Center (1997)
POP50OUT	Population for census block groups within 50 miles of the county, outside the same state, 1990	U.S. Census Bureau (1990a, 1990b); Missouri Census Data Center (1997)
NEARBYIN	Dummy variable representing if a bordering in-state county has a casino	Casino locations from www.gamblinganswers.com (n.d.) (Note: URL is now defunct.)
NEARESTOUT	Dummy variable representing if a bordering out-of-state county has a casino	Casino locations from www.gamblinganswers.com (n.d.) (Note: URL is now defunct.)
FISCAL	Ratio of county government revenues-expenses/expenses	UVA Library Geostat (2000).
FISCALCHG	Percentage change in county expenditures, 1982 through 1987	UVA Library Geostat (2000).
VOTEPEROT	Percentage of Ross Perot votes for president, 1992	UVA Library Geostat (2000).
VOTEDEM	Percentage of Democratic votes for president, 1992	UVA Library Geostat (2000).
RELIG	Percentage of county residents adhering to fundamentalist Christian religions, 1990	Bradley et al. (1992)
NATIVEAMER	Percentage of county residents of American Indian/Alaska Native race	U.S. Census Bureau (1990b)
MEDHINCOME	County median household income	UVA Library Geostat (2000).

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