Do Casinos Cause Economic Growth?

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ABSTRACT. Casino gambling is a popular form of entertainment and is purported to have positive effects on host economies. The industry surely affects local labor markets and tax revenues. However, there has been little evidence on the effects of casino gambling on state economic growth. This paper examines that relationship using Granger-causality analysis modified for use with panel data. Our results indicate that there is no Granger-causal relationship between real casino revenues and real per capita income at the state level. The results are based on annual data from 1991 to 2005. These findings contradict an earlier study that found that casino revenues Granger-cause economic growth, using quarterly data from 1991 to 1996. Possible explanations for the differences in short- and long-run effects are discussed.

I

Introduction

CASINO GAMBLING HAS BECOME a very popular, widely available form of entertainment in the United States and many other countries. The industry has spread rapidly in the last 20 years but, relative to its size worldwide, there has been little scientific analysis of the social and economic effects of gambling. This is starting to change, as more than just a handful of researchers are now studying casino gambling. Still, there is little empirical evidence on its economic effects. While the industry clearly contributes tax money to state coffers, there

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have been few studies on whether casinos otherwise contribute to economic development. Indeed, the rapid expansion of the casino industry in the United States during the 1990s was rather surprising, given how little research had been performed. This is not to say that there was not debate in the literature. There was, but there has been little empirical evidence presented on the economic effects of the casino industry.

In this paper, we examine the relationship between casino gambling and state-level economic growth using a Granger-causality test modified for use with panel data. Our results indicate that there is not a Granger-causal relationship between casino gambling and state-level economic growth, at least when annual data are analyzed. These results contradict results from an earlier study that used quarterly data, and call for a rationalization.

The paper is organized into six sections: Section II is a brief review of the casino economics literature. In Section III, we explain our empirical methodology and the data; Section IV explains the model and results. Section V is a discussion of the results, and Section VI concludes the paper.

II

Brief Literature Review

RELATIVELY FEW STUDIES have examined the general positive impacts of casino gambling. These include Eadington (1999) and the Federal Reserve (2003). Some authors have studied the relationships among casinos, other gambling industries, and tax revenues. These papers include Anderson (2005), Anders, Siegel, and Yacoub (1998), Elliott and Navin (2002), Fink and Rork (2003), Kearney (2005), Mobilia (1992), Popp and Stehwien (2002), Ray (2001), Siegel and Anders (1999, 2001), and Thalheimer and Ali (1995). Others have focused on the negative consequences of casino gambling and pathological gambling behaviors like crime and bankruptcy. Studies of this type include those by Albanese (1985), Curran and Scarpitti (1991), Friedman, Hakim, and Weinblatt (1989), Grinols and Mustard (2006), Stitt, Giacopassi, and Nichols (2003), and Thalheimer and Ali (2004). The "social cost of gambling" literature is particularly controversial, as described by Walker (2007a). Oddly lacking in the literature on casino gambling is empirical analysis of the economic growth effects of the industry.

Grinols (2004: chap. 4) does offer a general discussion of economic development as it relates to job growth, but no empirical evidence. Still, he provides a detailed discussion of development as it relates to casino gambling. He argues that researchers who have written export multiplier or cost-benefit analyses of the casino industry often have been confused. Grinols's critique is mostly on-target; he correctly argues that economic development occurs when welfare or utility increases. Development may or may not be associated with employment growth. What is necessary for development is that individuals are better off.

Grinols (2004: 78), Thompson and Quinn (2000), and others focus on monetary flows. "Leakages" from the local economy occur, for example, when a casino does not spend its profits locally. Thompson and Quinn (2000) argue that when South Carolina purchased video gaming machines from out of state, it amounted to an economic loss for South Carolina. This argument is reminiscent of mercantilism and has been criticized by Walker (2007a). Although these authors offer conceptual discussions of economic development and casino gambling, little valid empirical evidence exists.

One original peer-reviewed paper that does address the economic growth issue is Walker and Jackson (1998). Using a panel of quarterly data from 1991–1996, we found that casino gambling Granger-causes state per capita income. However, the study does not fully capture the effects of casino gambling during its explosive expansion during the 1990s, or during the slow-expansion years since. An additional limitation of the analysis is that, while their casino gambling data were collected by quarter, our per capita income data are linearly interpolated from annual data. Ideally, both data sets would be collected using the same method.

The paucity of studies in this area is surprising, given that "economic growth" is a commonly expected benefit of casino legalization. Aside from the Walker and Jackson (1998) paper, we are aware of no other econometric study that addresses this issue. However, there are some studies that superficially examine economic growth. One example is Arthur Anderson (1996), which is a consulting project for the American Gaming Association. This study describes the number of employees in the casino industry, average wages paid to employees, taxes paid to states, and so forth, but does not examine the economic growth effects of the industry. Other studies by the American Gaming Association provide similar descriptive analyses. Grinols's (2004) analysis is detailed, but it provides no empirical evidence and has an arguably biased perspective on the economic effects of casinos.

Despite its data limitations, our paper (1998) provides an ideal framework with which to reexamine the relationship between casino gambling and state-level economic growth during and after the industry expansion of the 1990s. We developed a process for adapting Granger-causality testing to panel data. The purpose of this current paper is to determine whether the Granger-causal relationship found in our earlier paper (1998) continues.

III

Methodology and Data

A. Methodology

We needed to develop a methodology to use Granger-causality testing with panel data because, at the time of our analysis (1996), legalized casino gambling was in its infancy in most adopting states.[1] Having at most six years of data for the states, it was impossible to analyze the states individually. Even if the states were pooled, there were still insufficient data to use annual observations. Consequently, we were required to use quarterly data to bolster the number of observations. In this study, we use data from 1991 to 2005. Because the industry is better established, we can now use annual data. Still, pooling the states is helpful because only two of the states (Nevada and New Jersey) have had casino gambling much longer than 15 years. Therefore, the methodology developed in our earlier paper is ideal for use in our current analysis.[2] An additional advantage is that the results of this study can be compared with the earlier study.

An overview of the Granger-causality test for panel data developed by Walker and Jackson (1998)[3] starts with standard Granger-causality analysis. Granger causality is said to exist between two variables, say *x* and *y*, when past values of one variable (*x*) significantly enhance our ability to predict future values of the other variable (*y*). The implication is that the first variable affects the second. Admittedly, Granger causality does not "prove" the two variables are related, and it does not imply that the one variable is the only, or even most important, factor affecting the other variable. What it does do is to allow us to assess the relative likelihood of the following four possibilities: (i) *x* and *y* are not related; (ii) *x* Granger-causes *y*; (iii) *y* Granger-causes *x*; or (iv) *x* and *y* Granger-cause each other.

In order to adapt Granger-causality analysis to panel data, we proposed (1998: 52–55) a three-step process: (i) filtering trend and state-specific effects from the data; (ii) finding the appropriate time series process that generates each variable; and (iii) conducting the Granger-causality tests based on the results of the two previous steps.

The first step involves "filtering" the casino revenue and per capita income data. The basic goal is to extract from the data any systematic information associated with state-specific factors (laws, institutions, etc.), time trend factors, and any idiosyncrasies of the data or data collection. The filtered variables, that is, the residuals from these filtering equations, should be stationary series. This is tested using a unit root test such as Phillips-Perron. Once the filtered series are confirmed to be stationary, we move to the next step.

Step (ii) involves determining the time series (autoregressive or ARMA) process that generates each variable. In other words, we are trying to determine how many lagged periods of each variable have a significant predictive power for current observations of the filtered data. The goal is to use the shortest possible lag length for each series, such that no systematic relationship remains among the residuals of the estimated process. Once the proper lag length has been determined, the Granger-causality test is set up. This is step (iii) in the testing procedure. It involves estimating a two-equation vector autoregressive (VAR) system in which the current value of each filtered variable is regressed on the appropriate number of past values of both variables. Then a set of *F*-tests are performed to test whether the filtered residuals have a Granger-causal relationship. These steps are explained in more detail in Section IV below.

B. Data

We collected annual data on aggregate state casino revenues and per capita income from 1991 to 2005 for the 11 states that have commercial casinos.[4] The data were adjusted for inflation using CPI data from the Bureau of Labor Statistics. The states, along with the first year that casino data are available in each state, are as follows: Colorado (1991), Illinois (1991), Indiana (1996), Iowa (1991), Louisiana (1993), Michigan (1999), Mississippi (1992), Missouri (1994), Nevada (1991), New Jersey (1991), and South Dakota (1991).[5] This yields an initial 165 observations. Additional variables are included in the model, as explained in the next section.

IV

Model and Results

THE FIRST STEP is to "filter" the data. The dependent variables in the filtering equations are real casino revenue (*RCR*) and real per capita income (*RPCI*). The filtering equations include the variables listed in Table 1.

Once the filtering regressions are run, the filtered variables, that is, the residuals from the filtering equations (*Revresid* from *RCR* and *Incresid* from *RPCI*), are tested for unit roots using the Phillips-Peron test. These tests indicate that both filtered series are stationary. The null hypothesis for these tests is that there is a unit root in the series. The hypothesis is rejected for both sets of residuals.[6]

The next step is to determine the optimal number of lag periods to include in the Granger-causality tests. This is done by examining the correlograms and *Q*-statistics for the filtered series, estimating an appropriate autoregressive model, and confirming that the residuals from these "evolutionary" equations are white noise. Our analysis indicates that two lag periods are required for *Revresid* to yield white

Table 1

Filtering Equation Variables

Explanatory Variable	Description
Trend	Variable to account for changes through the years (1991 = 1 for each state)
State Dummies (10)	To account for differences among the states ($SD_i = 1$ for state i, $SD_i = 0$ otherwise, $i = 1, \ldots, 10$)
State Dummy-Trend Interaction Terms (10)	To allow different trends and intercepts for the different states ($SD_i * Trend_i$, $i = 1, \ldots, 10$)
New State	A dummy for the first period of each state to mitigate the "jumps" from stacking the data
No Casino Revenue (*RCR* model only)	A dummy that takes a value of 1 during years in which there was no casino revenue in a particular state
Data 2000–2005 (*RPCI* model only)	A dummy to account for a change in data source for per capita income beginning in 2000

noise residuals and four lag periods for *Incresid* to yield white noise residuals.[7] At this point, we are ready to run the Granger-causality tests.

The test requires that each filtered series be specified so as to include the lagged values for both filtered series. That is, the *Revresid* model includes the two *Reversid* lags plus four *Incresid* lags, and the *Incresid* model includes its four lags plus two *Revresid* lags. The VAR estimation results appear in Table 2. This table shows which lag periods of which variable help to explain current values of the two filtered series. As indicated, past (lagged) observations of *RPCI* are not individually significant in the *RCR* equation. Similarly, past observations of *RCR* are not individually significant in the *RPCI* equation. The final step in the analysis is to perform an *F*-test for the joint

Table 2

Granger-Causality Equations

Variable	Filtered RPCI *(Incresid)*	Filtered RCR *(Revresid)*
Constant	44.23*	1257897
	(1.655)	(0.155)
Incresid(−1)	0.411***	10176.17
	(3.768)	(0.307)
Incresid(−2)	0.236**	17495.63
	(2.088)	(0.509)
Incresid(−3)	−0.379***	−24941.86
	(−3.312)	(−0.718)
Incresid(−4)	−0.322***	−7197.02
	(−2.832)	(−0.209)
Revresid(−1)	1.24E-07	0.9522***
	(0.474)	(11.967)
Revresid(−2)	−1.51E-07	−0.423***
	(−0.601)	(−5.528)
R^2	0.50	0.58

significance of the coefficients on the appropriate lagged variables in each equation. These Granger-causality *F*-tests are illustrated in Table 3.

The upper entries in Table 3 deal with the question of whether casino revenues Granger-cause economic growth. The test is an *F*-test on the joint significance of the coefficients on the two *Revresid* variables in the *RPCI* equation. As can be seen, the probability that a random variable following an *F* distribution with 2 and 114 degrees of freedom exceeds the computed value of 0.195 is 0.824. Thus, the null hypothesis that casino revenues do not Granger-cause economic growth cannot be rejected at anything remotely close to conventional levels.[8] The lower entries in Table 3 deal with the question of whether economic growth Granger-causes casino revenues. The test is an *F*-test on the joint significance of the coefficients on the four *Incresid* variables in the *RCR* equation. As can be seen, the probability that a random variable following an *F* distribution with 4 and 114 degrees of

Table 3

Granger-Causality *F*-Tests

Model	Test Stat. (F^*)	DF	Probability $F > F^*$
RCR does not Granger-cause *RPCI*	0.195	2, 114	0.824
F-test: *Revresid(−1) = Revresid(−2) = 0*			
RPCI does not Granger-cause *RCR*	0.433	4, 114	0.785
F-test: *Incresid(−1) = Incresid(−2) = Incresid(−3) = Incresid(−4) = 0*			

freedom exceeds the computed value of 0.433 is 0.785. Thus, the null hypothesis that economic growth does not Granger-cause casino revenues also cannot be rejected at anything remotely close to conventional levels.

The results indicate there is no Granger-causal relationship between casino revenue and per capita income. That is, *RCR* does not Granger-cause *RPCI*, and *RPCI* does not Granger-cause *RCR*, at least using annual data during the 1991–2005 period. The next section discusses these results and compares them to the earlier study (Walker and Jackson 1998).

V

Discussion

Walker and Jackson (1998) is a bit broader in scope than the current effort, looking at the effect of introducing a new good into a state's consumption menu on economic growth. However, a key finding of that study was that casino revenues Granger-cause economic growth. Clearly, the finding of our current effort is in direct opposition to this earlier result. What might explain this dichotomy?

One obvious possibility is the data employed. The present study considers a longer period (15 years) but uses annual data; the earlier study considered a shorter period (six years) but used quarterly data. It is possible that the earlier study could have been misleading because it interpolated quarterly income figures from annual data. However, aggregate incomes were pretty stable over that period, so any errors due to interpolation are likely random.[9] One might argue that the shorter one-quarter time interval would allow us to measure a greater sensitivity of income to casino revenue changes. But it seems to us that if there is an actual short-run phenomenon at work here, then we should be able to detect its presence in a longer-period study as well.

On the other hand, the annual results could be misleading because we ignore the drop in tourism associated with the terrorist attacks of September 11, and we take no account of the effect of Hurricanes Katrina and Rita on the Gulf Coast. We view this argument with skepticism. While both of these phenomena could be expected to reduce gambling revenues, they would be expected to affect income the same way. In addition, the periodicity and coverage of both phenomena are likely to have been relatively short and narrow. All in all, it seems to us that both studies have analyzed appropriate data appropriately; thus, we must look beyond data differences to explain the dichotomy of results.

One alternative explanation is that the expansionary effects of casino gambling on the average state have been largely diminished over time, either by competition for the gambling dollar with other legal gaming industries within the state itself or through direct competition for the casino gambling dollar with casino gaming opportunities in neighboring states or online. Tangential support exists for both views. Our recent study (Walker and Jackson 2007), concerning the economic interrelationships between the various gaming industries available to a state, found casino gambling to be complementary to horse racing but a substitute for a state-run lottery. It also found that the presence of casino gambling in adjacent states decreased casino revenues for the state in question.

If it is true that adjacent states compete away the casino gambling rents that spur economic growth, then one would expect states such as Nevada, New Jersey, and Colorado that have no casino gambling neighbors, and even states that have only one casino gambling neighbor such as Mississippi, Louisiana, and South Dakota, to exhibit a unidirectional causality between casino revenues and economic growth. We tested this hypothesis by reestimating the models in

Table 3 using data on these six states alone. We found the *F*-statistic for testing the hypothesis that casino revenues Granger-cause income to be 1.27. While this is somewhat more impressive than the full sample results, it is still statistically significant only at about the $\alpha = 0.28$ level—hardly convincing evidence of an important effect.

A final explanation for the dichotomy is that the initial expansionary effect that casino gambling brings to a state's consumption menu as a new good is simply dissipated through the state's economy over time. That is, after an initial push to the state's economy, the casino effect loses significance or wears out. This is consistent with the explanation that has been offered by some anti-casino advocates like Grinols. He has argued (2004), albeit without any empirical evidence, that casinos "cannibalize" other industries.[10] Empirical evidence of this effect with respect to lottery spending has been offered by Kearney (2005) and Walker and Jackson (2007). In effect, as the casino industry expands, other businesses and industries may contract.

It is perhaps useful to discuss our results in the context of Grinols's (2004) discussion of economic development. Grinols argued that development occurs when welfare or utility increases. The issue we have tested empirically is economic growth, or increases in per capita income. Presumably, an increase in income would be associated with an increase in welfare, but this is not always the case (Frank 1999). Although we do not find a long-term effect of casinos on economic growth, and we do not attempt to measure changes in overall employment, there may still be a positive (or negative) development effect from casinos.

To see this, consider Walker's (2007a) discussion of mutually beneficial voluntary transactions. Grinols discusses the development effect of a casino as if it depends on whether the consumers and casino owners are local to the region or outsiders. We would argue this is a superficial dichotomy. With any voluntary transaction, both parties expect to benefit, regardless of the direction of money flow. Yes, a new firm (e.g., casino) in an economy might put competitive pressure on other local firms. But this is how capitalism works, and consumers benefit from competition.

Adopting casino gambling appears to at first provide a boost to the economy, but that boost appears to be relatively short-lived. Further research on individual states would be beneficial once adequate data become available.

VI

Conclusion

THE RESULTS IN THIS PAPER provide some important (updated) evidence for states considering the introduction or expansion of the casino industry. Our results indicate that the casino industry does not have an impact on economic growth at the state level. This is based on annual data from 1991 to 2005. These results contradict results from an earlier study that used quarterly data from 1991 to 1996. Together, these results may indicate that casino gambling has initial positive growth effects but that these die out over time. This is not to say that casinos do not positively impact economic growth in some states. We would be very surprised if states such as Nevada, New Jersey, and even Mississippi, once it has recovered from Katrina, did not show significant economic growth from casino gambling. It does say, however, that the average state should not expect any long-term growth effects from legalizing casino gambling.

Perhaps more important than the economic growth question is the question of whether casino gambling has an impact on employment or aggregate tax revenues in a state or region. These two effects, perhaps more than economic growth (per capita income), are the primary reason that politicians and the general public support casino gambling expansion. However, there has yet to be much empirical work in the economics literature on these issues.

Finally, researchers should address the benefits to consumers from legalized gambling. As casinos enter local markets, they represent competition for other entertainment industries. This competition may put downward pressure on prices and result in increased consumer surplus. Consumers benefit from increased variety in their consumption menu. These consumer benefits have not been measured, and are often ignored by researchers (e.g., Grinols 2004). Working to offset these effects, of course, are the potential social costs from pathological gambling. However, these issues are tangential, not fundamental, to this paper.[11] Nevertheless, casino gambling is still a very new industry, and its industrial organization deserves increased attention from researchers.

Notes

1. Outside of Nevada and New Jersey, commercial casinos began operations in South Dakota in 1989, and on riverboats in Iowa in 1991. After that, casino gambling spread rapidly among a number of other states.

2. Granderson and Linvill (2002) use the Walker and Jackson methodology in their analysis of regulation and efficiency. Walker and Jackson (1999) also examine the effect of state isolation on the relationship between lotteries and economic growth.

3. For a full explanation, see the original paper.

4. Indian casinos cannot be included in the model because they are not required to publicly disclose their revenue data. The casino revenue data come from each state's gaming commission website. Per capita income data are from the U.S. Department of Commerce, Bureau of Economic Analysis.

5. Obviously, casino gambling was available earlier in Nevada (1933), New Jersey (1978), and South Dakota (1989). However, we use data only since 1991 so that states are more equally represented in the sample, and so Nevada and New Jersey do not have disproportionate influence on the results.

6. For *Revresid,* the PP test statistic is −8.20 (prob. = 0.00); for *Incresid* the PP test statistic is −8.44 (prob. = 0.00).

7. The regression output and correlograms are available from the authors by request.

8. At conventional levels of significance, $P(F > F^*)$ should be less than 0.10, 0.05, or 0.01.

9. If one takes an "errors in variables" view of this problem, then one might conclude that we understated the effect of income on casino revenues, prompting a question of possible simultaneity. But the significance of casino revenues in the income equation would be unaffected.

10. Walker (2007a) discusses some problems in gambling research particularly relevant to advocacy regarding the casino industry. Walker (2007b) is a critical review of Grinols (2004).

11. For a detailed discussion of social costs, see Walker and Barnett (1999) or Walker (2007a).

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