

Pennsylvania Casinos' Cannibalization of Regional Gambling Revenues

Simon Condliffe

Abstract

Gambling opportunities are expanding rapidly in the U.S. Mid-Atlantic area. Fifteen gambling venues have opened since 1996. The introduction of these venues has the potential to shift the balance of gambling activity away from New Jersey, which had enjoyed a monopoly position in the area for decades. Delaware and, more recently, Pennsylvania have entered the marketplace, raising the question of whether aggregate gambling activity has increased in the area, and whether all states have benefited. Contrary to previous research, a multivariate analysis reveals that *aggregate* gambling revenue among the three states *has not* increased with the introduction of Pennsylvania gambling venues. The research extends the literature by including Delaware in the analysis, which has drawn significant gamblers from Pennsylvania and the greater region, and by greatly expanding the data employed. In the Philadelphia-Northern Delaware-Atlantic City market (where the competition of gambling revenue is most intense), there is empirical evidence that the introduction of gambling in Pennsylvania has decreased the overall volume of gambling.

Keywords: Gambling, Casinos, Gambling Revenue, Cannibalization.

Acknowledgements: Figure 1 was created with the assistance of Marija Skoog, West Chester University.

Introduction

Casino gambling in the United States is on the rise, and today forty states now permit some form of it (McGowan, 2009). Dramatic shifts in this gaming landscape have taken place over the past fifteen years. Perhaps nowhere is this more evident than in the Mid-Atlantic region of Delaware, Pennsylvania and New Jersey. This region is noteworthy because it combines Atlantic City, one of the oldest gambling locations in the country, with some of the newest locations. Atlantic City's first casino opened in 1978 (Atlantic City Free Public Library, 2006) and enjoyed a monopoly position in the region for several years. In 1996, Delaware opened three slots venues: Delaware Park in New Castle County, Dover Downs in Kent County, and Harrington Raceway in southern Kent County. Pennsylvania opened its first casino in 2006 and has added casinos every year through 2010.¹ As competition for gambling revenue has intensified, states have expanded their gambling offerings in an effort to lure patrons. Delaware added sports betting in 2009 and table games in 2010. Pennsylvania added table games in 2010.²

1 Two in 2006, four in 2007, one in 2008, two in 2009, one in 2010.

2 Maryland added slots gambling in 2011. More data are needed to analyze the impact of Maryland on regional gambling.

Simon Condliffe
West Chester University
of Pennsylvania

Correspondence concerning
this article should be
addressed to Simon
Condliffe, Department of
Economics and Finance,
West Chester University
of Pennsylvania, 323D
Anderson Hall, West
Chester, PA, 19383. E-mail:
scondliffe@wcupa.edu

These developments lead us to ask the following questions: Has total casino gambling increased among Pennsylvania, New Jersey and Delaware? And to what extent do Pennsylvania, New Jersey and Delaware cannibalize each other's gambling revenues? The answers to these questions will provide insight into the competition among states for gamblers as well as the resultant revenue.

Gambling has become an important source of revenue for states (Dadayan and Ward, 2009). For a state with gambling, revenue is threatened by competition from neighboring states. For a state without gambling, residents may gamble out-of-state, thereby generating revenue for the host state, while incurring costs for the state of residence through lost personal expenditures and gambling addiction (Garrett and Nichols, 2005).

Of the three Mid-Atlantic States in question (New Jersey, Pennsylvania and Delaware), Delaware has the highest reliance on gambling revenue (Dadayan and Ward, 2009). Gambling revenue as a share of the state's own-source general revenue is 6.1% for Delaware (fifth in the nation behind Nevada, West Virginia, Rhode Island and South Dakota). New Jersey's gambling revenue is fifteenth with 3.4%, and Pennsylvania's is nineteenth with 2.8% (fiscal year 2007). See Figure A1 in appendix for a ranking of states by gaming revenue as a share of state's own source revenue. As Wenz (2008) states, understanding the impact of casino gambling remains an important issue. This analysis, therefore, has implications for casino revenues, and in turn, gambling-related tax revenues for states.

The paper's contribution to the literature is threefold. First, Delaware, which has been excluded in previous research, is added to the analyses of tri-state gambling activity. This paper provides evidence of the importance of Delaware to the tri-state gambling market. Delaware has been reliant on out-of-state gamblers to frequent its gambling venues. Pennsylvania has been a major source of gamblers to Delaware with 19% in 2002. Moreover, Delaware Park drew 30% of its patrons from Pennsylvania. Therefore, the introduction of Pennsylvania gaming poses a significant threat to this pattern of gambling activity between the states.

Second, the paper employs significantly greater time series data than previous research. This longer time series provides a more complete picture of the interplay between Delaware, Pennsylvania, and New Jersey, as well as the intense competition between the casinos of Philadelphia, northern Delaware, and Atlantic City. The market has changed dramatically since 2007. Four casinos have opened in Pennsylvania and new gambling options (namely, table games) have been introduced.

Third, the paper considers the separate influence of slot machines and table games. In this way, this paper captures the scale of gambling in Pennsylvania rather than simply the impact of the introduction of gambling, as seen in prior research.

Literature Review

Early literature in this area focused on lottery gambling, the most ubiquitous type of gambling in the country (e.g., Heavey, 1978; Clotfelter, 1979; Mikesell, 1989; Hersch and McDougal, 1989; Gulley and Scott, 1989; Jackson, 1994; Hansen, 1995; Mason, Steagall and Fabritius, 1997). In particular, this early research concentrates on the relationship between personal income and the level of sales or revenues from state lottery products.

More recently, an emerging research effort has been directed at the tax incidence of casino gambling (e.g., Thalheimer and Ali, 2003; Elliot and Navin, 2002; Fink and Rork, 2003). These papers also consider the competition among gambling types. Less attention is paid to the interstate competition for gamblers and gaming revenue.

These developments lead us to ask the following questions: Has total casino gambling increased among Pennsylvania, New Jersey and Delaware? And to what extent do Pennsylvania, New Jersey and Delaware cannibalize each other's gambling revenues?

Two recent papers have addressed the nature of interstate competition. Eadington, Wells, and Gossi (2010) consider the impact of California's tribal gaming on Nevada's gaming revenue. The empirical findings point to a negative impact on Nevada, with the brunt being felt by the gaming regions outside of Las Vegas. McGowan (2009) considers the relationship between gaming in New Jersey and Pennsylvania. Using aggregate revenue data for Pennsylvania and New Jersey, McGowan (2009) concludes that the total amount wagered across the two states increased with the inception of gambling in Pennsylvania. This finding also held when analyzing the narrower market of Southeastern Pennsylvania and New Jersey.

McGowan's (2009) model uses total gaming revenue across the two states, a dummy variable for the introduction of gambling to Pennsylvania, and a time variable. The period analyzed is 2000 to 2007.

Walker and Jackson (2008) consider relationships between gambling alternatives. They find not only complementarities between certain industries (for example, casinos and horse racing, and dog racing and lotteries), but also substitution effects (casinos and lotteries cannibalize one another, as do horse and dog racing). Furthermore, the presence of casinos in adjacent states reduces the casino revenue. Moreover, the authors mention that few studies have considered adjacent-state effects.

Walker and Jackson (2011) even find that the addition of casino gambling can reduce overall government revenue as consumers substitute gambling expenditures for other expenditures.

Gambling in Delaware predates gambling in Pennsylvania by a decade. Given Delaware's proximity to the Pennsylvania and New Jersey markets, its inclusion in any model of Mid-Atlantic gambling is important. Furthermore, recent developments in the competitive marketplace may have bearing on the interrelationships between these three states. The addition of sports betting in Delaware, followed by table games in Delaware and Pennsylvania may have shifted the balance of gambling activity. Until 2010, Atlantic City enjoyed a monopoly position for table games in the mid-Atlantic area.

Delaware Park, the northernmost casino in Delaware is 37 miles (44 minutes) from Philadelphia, and 90 miles (90 minutes) from Atlantic City. Philadelphia and Atlantic City are a mere 60 miles (1 hour 5 minutes) apart. Figure 1 displays a map of casino locations in Pennsylvania, New Jersey, and Delaware.



Legend

- Currently Open Casinos
- Proposed Casinos

Note:
Atlantic City contains 12 individual Casinos

Map Number	Casino Name	Map Number	Casino Name
1	The Meadows	10	Sugar House Casino
2	Mount Airy	11	Dover Downs
3	Parx Casino	12	Harrington Raceway and Slots
4	The Rivers	13	Delaware Park Racing and Slots
5	Hollywood Casino at Penn National	14	Atlantic City
6	Presque Isle	15	Nemacolin Woodlands Resort
7	Sands Bethlehem	16	Valley Forge Convention Center
8	Mohegan Sun at Pocono Downs	17	Valley View Downs and Casino
9	Harrah's Chester		

Note. Foxwoods Philadelphia's license has been revoked and is therefore excluded from the map.

Figure 1. Casino locations in Pennsylvania, New Jersey and Delaware.

The introduction of table games in Delaware and Pennsylvania also poses questions about their impact on slot revenues. For example, does the introduction of table games increase overall gaming volume?

Using Clark County (Las Vegas) data Levitzky, Assane, and Robinson (2000) find that table games have a negative impact on overall gaming revenue. They hypothesize that this reflects casinos' efforts to move patrons toward slot machines as a revenue growth strategy.

Mallach (2010) states that Pennsylvania and Philadelphia have experienced positive economic and fiscal impacts since the introduction of gambling because it has recaptured

The introduction of table games in Delaware and Pennsylvania also poses questions about their impact on slot revenues. For example, does the introduction of table games increase overall gaming volume?

This paper conducts an empirical study of gambling revenue to quantify the impact of expanded gambling options in the mid-Atlantic region.

gambling activity of residents who previously would have traveled out of the state. Moreover, Mallach (2010) expects the introduction of table games to Pennsylvania to further erode the Atlantic City casino industry.

Garrett and Nichols (2005) confirm the significance of interstate gambling activity. Nearly 64% of visits to New Jersey casinos are from out-of-state residents. This highlights the importance of taking a broad view of the gambling marketplace.

Recent developments in the mid-Atlantic gaming marketplace provide the motivation to discern the net impact on the gaming revenue. A preliminary analysis of gamblers in Delaware reveals a substantial degree of cross-state gamblers (see Appendix). In 2010, 70% of Delaware's gamblers were from other states, with Pennsylvanians account for fifteen percent of Delaware Park's gamblers.

Methodology

This paper conducts an empirical study of gambling revenue to quantify the impact of expanded gambling options in the mid-Atlantic region. The models draw from McGowan (2009) and Pakko (2005).

There are four forms of the equation to estimate. Equation 1 below follows McGowan (2009).

$$\text{Revenue}_t = \alpha_0 + \beta_1 \text{ PA Gambling} + \beta_2 \text{ Trend} + \varepsilon_t \quad (1)$$

where Revenue_t is the total revenue in the market (New Jersey, Delaware and Pennsylvania slots in McGowan (2009)) in time period t , PA Gambling is a dummy for the introduction of gambling in Pennsylvania, and Trend is a trend variable. The sample is 1990 to 2010, which is longer than McGowan (2009).

The research then extends McGowan (2009) by employing additional regressors. Equation 2 substitutes the number of Pennsylvania slot machines for the dummy variable in (1).

$$\text{Revenue}_t = \alpha_0 + \beta_1 \text{ PA Slots} + \beta_2 \text{ Trend} + \varepsilon_t \quad (2)$$

Equation 3 adds the number of tables:

$$\text{Revenue}_t = \alpha_0 + \beta_1 \text{ PA Slots} + \beta_2 \text{ Trend} + \beta_3 \text{ PA Tables} + \varepsilon_t \quad (3)$$

The next models focus on the revenue in Delaware Park (northern Delaware), Atlantic City, and Southeastern Pennsylvania (this combination will be referred to as Revenue_{se})

$$\text{Revenue}_{se,t} = \alpha_0 + \beta_1 \text{ PA Slots} + \beta_2 \text{ Trend} + \beta_3 X + \varepsilon_t \quad (4)$$

where X is a vector of regressors including Delaware Park slots, Delaware Park Tables, Southeast Pennsylvania slots, Southeast Pennsylvania tables, and a measure economic activity. Autocorrelation was corrected using a generalized least squares procedure. Where positive serial correlation was detected via the Durbin Watson statistic, it was corrected using an AR procedure.

Data

The data are drawn from the filings of casinos to their respective controlling authorities. For Delaware this is The Delaware Lottery. For Pennsylvania it is the Pennsylvania Gaming Control Board. For New Jersey it is the New Jersey Division of Gaming Enforcement (formerly the Casino Control Commission). There are no tribal gaming venues in Pennsylvania, Delaware, New Jersey, Ohio, or Maryland (source: National Indian Gaming Commission, 2012). Therefore, tribal gaming is excluded from

the analysis. The closest Indian gaming venues are in upstate New York. However, the majority of Pennsylvania casinos are centered around the Philadelphia and Pittsburgh metropolitan areas, which would mitigate their impact on New York's Indian gaming. Moreover, Walker and Jackson (2011) state that Indian casino revenues are not always reliably reported.

Table 1 below shows the descriptive statistics for the data. All monetary data are adjusted for inflation. Adjusted gross revenue (AGR) is used as the measure of gambling activity. AGR equals the total handle³ minus payouts to gamblers. There is a clear relationship between the total amount gambled and the AGR. Therefore, AGR is an indicator of the total volume of gambling at casinos. While tax revenue will not be discussed here, AGR is also important since it is the basis on which casinos pay taxes to their respective states.

Table 1

Descriptive Statistics of Casino Filings in New Jersey, Pennsylvania, and Delaware

	Mean	Maximum	Minimum	Std. Dev.
Monthly Revenue				
Atlantic City	427,831,338.34	533,185,024.62	275,982,254.44	47,050,662.43
Delaware	34,050,512.52	76,681,527.51	0	23,578,560.76
Pennsylvania Slots	28,019,400.94	203,172,933.33	0	60,041,615.24
Delaware Park Slots	16,056,246.08	35,807,251.04	0	11,035,740.97
Delaware Park Tables	77,179.96	3,358,386.97	0	475,704.04
Delaware Tables	153,367.43	6,869,713.33	0	935,019.70
Pennsylvania Tables	845,173.66	44,080,346.09	0	5,579,893.66
Total NJ, PA, DE	641,826,838.16	356,922,313.46	57,116,565.03	641,826,838.16
Total Revenue_SE	455,105,770.26	580,852,086.52	356,922,313.46	40,650,595.25
Slot Machines and Table Games				
Pennsylvania Slot Machines	2,922.2	26,916	0	7,473.4
Pennsylvania Table Games	16.62302	783	0	107.0
Southeast Pennsylvania Slot Machines	849.6	8,004	0	2,136.426
Delaware Slot Machines	3,874.3	8,364	0	2,991.7
Southeast Pennsylvania Table Games	4.8	270	0	31.6
Delaware Table Games	5.1	197	0	29.
Other				
PA Gambling (dummy)	0.37	1.00	0	0.49
Index of Coincident Economic Activity	128.4	153.0	99.5	17.9

Note. N=252, 1990:01-2010:12. Data are seasonally adjusted and adjusted for inflation.

(Table games were not seasonally adjusted because these variables did not meet the minimum number of observations required for the seasonal adjustment process).

REVENUE_SE is revenue from Philadelphia area casinos, northern Delaware, and Atlantic City.

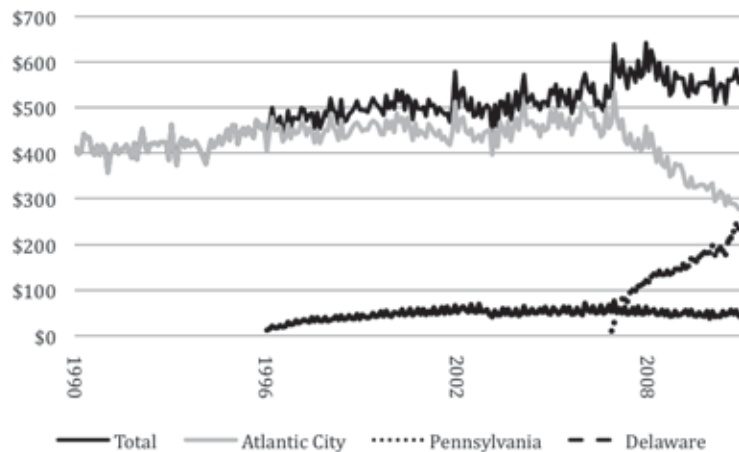
The index of coincident economic activity⁴ is a gauge of the relative health of the state economies (Pakko 2005). The index combines the following economic variables: nonfarm payroll employment, average hours worked in manufacturing, the unemployment rate, and wage and salary disbursements. The index for each state is averaged to arrive at a single measure for the three states of interest.

At the time of this research, Atlantic City constituted the largest market of the three states, with \$427 million monthly revenue on average. Delaware and Pennsylvania share similar average monthly revenues of approximately \$32 million. However, Pennsylvania's maximum revenue exceeds \$200 million compared to \$77 million for Delaware. At its peak, Atlantic City collected \$533 million in a single month. Pennsylvania's peak revenue to date is \$203 million. Pennsylvania and Delaware table games garnered \$44 million and \$7 million respectively in their peak months.

Results

Figure 2 shows the total AGR for Atlantic City, Pennsylvania and Delaware for the period 1990 to 2010. After a period of rapid growth from 1979 to the late 1980s, Atlantic City's revenue growth slowed during the 1990s. Delaware's slots venues began operations in 1996. This increased the total volume of gambling, while Atlantic City revenue growth remained relatively weak.

Delaware's revenues grew steadily for the first six years, and then leveled until approximately 2006. Pennsylvania added casinos in 2006. There was rapid increase in revenues in Pennsylvania with the addition of new casinos. This coincided with a pronounced decline in Atlantic City revenues.



Note: Data are seasonally adjusted and adjusted for inflation. Atlantic City Revenue is total revenue. Delaware is slot and table revenue. Pennsylvania is slot and table revenue. Total is the aggregate of the three states.

Figure 2. Casino revenue by state 1990-2010 (millions of dollars).

3 Handle is the total amount of money wagered by customers not factoring in payoffs by the casino (McGowan, 2009). Gross revenue is more widely reported by state gaming commissions than alternatives such as the total amount exchanged for chips ("drop").
 4 For a full description of the index of coincident economic activity, see the Philadelphia Federal Reserve Bank (<http://www.philadelphiafed.org/research-and-data/regional-economy/indexes/coincident/>).

The estimation of equation 1 is provided in table 2 below.

Table 2
Gambling Revenue for New Jersey, Pennsylvania and Delaware

	1	2	3
Pennsylvania Gambling	35,200,731*** (13492226)		
Trend	535387.9*** (97911.17)	738118.3*** (62688.47)	741837.3*** (58823.76)
Pennsylvania slots		-1261.882** (532.8588)	-973.4456* (543.7523)
Pennsylvania tables			-35108.83 (21673.56)
N	252	252	252
Adj. r-squared	.86	.84	.84

Note. McGowan Replication (inflation adjusted and seasonally adjusted). Note: all regressions include trend variable. Dependent variable is total revenue (New Jersey, Pennsylvania and Delaware slots) seasonally adjusted and adjusted for inflation. Columns include adjustments for autocorrelation. Monthly data from January 1990 to December 2010.

*** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

Table 2 replicates and extends McGowan (2009). Column 1 shows the impact of Pennsylvania gambling on total revenue in Pennsylvania, Atlantic City and Delaware. The coefficient on the introduction of Pennsylvania casinos suggests that overall gambling revenues were \$35m higher per month. This is somewhat lower in magnitude to McGowan's (2009) of \$57.1m. Because of the longer time series than McGowan (2009), the impact of gambling is perhaps not as pronounced as during the 2000-2007 period previously studied.

Column 2 includes the number of Pennsylvania slots and finds that the number of slot machines negatively impacts the amount of gambling among the three states. Each additional Pennsylvania slot machine decreases overall gambling among the three states by \$1,262.

Column 3 adds Pennsylvania tables. The empirical evidence suggests that Pennsylvania slot machines did reduce total gambling revenues in the three states. Each additional Pennsylvania slot machine reduced gambling revenues among the three states by \$973. The number of table games was negative also, albeit not statistically significant.

Table 3 presents the regression results with the dependent variable of gambling revenues of Southeastern Pennsylvania, Delaware Park, and Atlantic City. This area is noteworthy for the proliferation of casinos in relatively close proximity via easy road access (e.g. I-95, Atlantic City Expressway). Southeastern PA includes the Philadelphia area casinos of Harrah's Chester, Parx, and Sugarhouse. The fit of the models is relatively strong. Column 1 reveals a negative impact of Southeast Pennsylvania slots and tables on REVENUE_SE. That is, each additional slot machine in Southeast Pennsylvania reduces overall revenue in the REVENUE_SE marketplace. Although the number of table games in Southeast Pennsylvania is found to have a negative impact also, it is statistically insignificant. Column 2 adds a measure of economic activity to the regression, and still finds that each additional Southeast Pennsylvania slot machine reduces the total amount of gambling.

Column 3 adds the regressors of Delaware Park slots and tables. The negative

The empirical evidence suggests that Pennsylvania slot machines did reduce total gambling revenues in the three states.

Table 3
Gambling Revenue for Southeast Pennsylvania, Delaware Park, and New Jersey

	1	2	3	4
Southeast Pennsylvania slots	-10819.76*** (2244.547)	-5263.582** (2039.409)	-11228.92*** (1961.403)	-4991.618** (2018.915)
Southeast Pennsylvania tables	-41749.06 (83075.26)	-17892.96 (64749.36)	150065.2 (113093.3)	116726.2 (107971.8)
Trend	351185.2*** (81493.78)	-619833.9*** (591631.8)	47247.85 (183038.5)	-500084.4*** (175370.5)
Delaware Park slots			21651.08** (10484.98)	-12987.19 (10267.51)
Delaware Parks tables			-564518.0* (308721.1)	-528681.5* (294090.7)
Index of Coincident Economic Activity		3817552*** (591631.8)		4188703*** (716017)
N	252	252	252	252
Adj. r-squared	.72	.76	.73	.76

Note. Columns include adjustments for autocorrelation. Dependent variable is total revenue for Southeast Pennsylvania, Delaware Park, and New Jersey. Monthly data from January 1990 to December 2010. *** significant at the 1% level, ** significant at the 5% level, * significant at the 10% level.

coefficient for Southeast Pennsylvania slots confirms the negative relationship. Table games at Delaware Park are found to have a negative, statistically significant impact on REVENUE_SE. Delaware Park slots are found to have a positive effect. Column 4 adds a control for economic activity. The impact of Southeast Pennsylvania slot machines continues to be a negative and significant influence on REVENUE_SE.

In sum, the regression suggests a negative and significant impact of Southeastern Pennsylvania slots and tables on the total revenue in the Southeastern Pennsylvania-Northern Delaware-Atlantic City marketplace. These results are robust in terms of signs and significance under a semi-log left specification.

The regression suggests a negative and significant impact of Southeastern Pennsylvania slots and tables on the total revenue in the Southeastern Pennsylvania-Northern Delaware-Atlantic City marketplace.

Discussion

Gambling opportunities are expanding rapidly in the Mid-Atlantic area. Since 1996, fifteen casinos have opened: three in Delaware, ten in Pennsylvania, and two in Atlantic City. The results presented here offer evidence that the expansion of gambling has not benefitted all states. Moreover, in the area of arguably the greatest competition (the Southeastern Pennsylvania-Atlantic City-Delaware Park market) the impact of Pennsylvania gambling may have reduced overall revenue.

The entry of Pennsylvania into the gambling market had the potential to expand total gambling activity among the three states. In other words, gambling in Pennsylvania could counterbalance losses in Delaware and Atlantic City, thereby raising the total amount of gambling in aggregate. However, the empirical evidence highlights that the addition of Pennsylvania casinos has hurt Atlantic City and Delaware's gambling

revenues. Approximately \$1,262 less is gambled every month in Delaware, New Jersey, and Pennsylvania with the addition of each Pennsylvania slot machine. Not only may Pennsylvania be cannibalizing gambling activity from neighboring states, but the aggregate amount of gambling in the region may be falling. The cannibalization result is consistent with Walker and Jackson (2008) which found a negative adjacent state effect of casinos. However, the finding that aggregate gambling may be falling extends the current literature.

In sum, for the Southeastern Pennsylvania-Atlantic City-Delaware Park market (where the competition of gambling revenue is most intense), there is empirical evidence that the introduction of gambling in Southeastern Pennsylvania has *lowered* the overall volume of gambling. One possible explanation may be that Pennsylvanians are gambling less locally than they did at Delaware Park or Atlantic City, thereby lowering the total gambling volume in the combined Southeastern Pennsylvania-Atlantic City-Delaware Park market.

The paper does have some limitations. The research does not account for related spending at casinos: rooms, food, entertainment, which would generate economic benefits for states. Sports betting was only introduced in Delaware at the very end of the time period in question, and was therefore in its infancy. More data will be needed to analyze its impact.

The empirical results suggest that the addition and expansion of gambling in one state can reclaim revenues that would otherwise have been lost to other states with gambling options. However, there is evidence that, as a region, gambling may fall as a result of overexpansion in the marketplace. For states/regions that are considering the expansion/introduction of gambling, the results suggest that gambling revenues are not without limit. The question of the optimal number of casinos in a region is left for future research.

Not only may Pennsylvania be cannibalizing gambling activity from neighboring states, but the aggregate amount of gambling in the region may be falling.

The paper does have some limitations. The research does not account for related spending at casinos: rooms, food, entertainment, which would generate economic benefits for states.

References

- Atlantic City Free Public Library. (2006). History of casino gambling in Atlantic City Retrieved from http://www.acfpl.org/index.php?option=com_content&task=view&id=67&Itemid=186
- Clotfelter, C. T. (1979). On the regressivity of state-operated 'numbers' games. *National Tax Journal*, 32(4), 543-548.
- Crone, T. M. (2003). Consistent economic indexes for the 50 states. *Federal Reserve Bank of Philadelphia, Working Paper 02-7/R*. Retrieved from <http://www.philadelphiafed.org/research-and-data/publications/working-papers/2002/wp02-7r.pdf>
- Dadayan, L., & Ward, R. B. (2009). For the first time, a smaller jackpot. Trends in state revenues from gambling. *Fiscal Studies, The Nelson A. Rockefeller Institute of Government*. Retrieved from http://www.rockinst.org/pdf/government_finance/2009-09-21-No_More_Jackpot.pdf
- Delaware Lottery Office. (n.d.). *The Delaware Lottery financials*. Retrieved from <http://lottery.state.de.us/financials.asp>
- Eadington, W. R., Wells R. H., & Gossi, D. (2010). Estimating the impact of California tribal gaming on demand for casino gaming in Nevada. *UNLV Gaming Research & Review Journal*, 4(2), 33-45.
- Elliot, D. S., & Navin, J. C. (2002). Has riverboat gambling reduced state lottery revenue? *Public Finance Review*, 30(3), 235-247.
- Fink, S., & Rork, J. (2003). The importance of self-selection in casino cannibalization of state lotteries. *Economics Bulletin*, 8(10), 1-8.
- Garrett, T. A., & Nichols, M. W. (2005). Do casinos export bankruptcy? Working Paper 2005-019A, *Federal Reserve Bank of St. Louis*. Retrieved from <http://research.stlouisfed.org/wp/2005/2005-019.pdf>
- Gulley, O., & Scott, F. (1989). Lottery effects on pari-mutuel tax revenues. *National Tax Journal*, 42(1), 89-93.
- Hansen, Ann. (1995). The tax incidence of the Colorado state lottery instant game. *Public Finance Quarterly*, 23(3), 385-398.
- Heavey, J. F. (1978). The incidence of state lottery taxes. *Public Finance Quarterly*, 6(4), 415-426.
- Hersch, P. L., & McDougall, G. S. (1989). Do people put their money where their votes are? The case of lottery tickets. *Southern Economic Journal*, 56(1), 32-38.
- Jackson, R. (1994). Demand for lottery products in Massachusetts. *The Journal of Consumer Affairs* 28(2), 313-325.
- Levitsky, I., Assane, D., & Robinson, W. (2000). Determinants of gaming revenue: extent of changing attitudes in the gaming industry. *Applied Economics Letters*, 7(3), 155-158.

- Mallach, A. (2010). Economic and social impact of introducing casino gambling: A review and assessment of the literature. [Discussion Paper]. Reserve Bank of Philadelphia. Retrieved from http://www.philadelphiafed.org/community-development/publications/discussion-papers/discussion-paper_casino-gambling.pdf
- Mason, P.M., Steagall, J.W., & Fabritius, M.M. (1997). The elasticity of demand for lotto tickets and the corresponding welfare effects. *Public Finance Quarterly*, 25(5), 474-490.
- McGowan, R. (2009). The competition for gambling revenue: Pennsylvania v. New Jersey. *Gaming Law Review and Economics*, 13(5), 145-155.
- Mikesell, J. L. (1989). A note on the changing incidence of state lottery finance. *Social Science Quarterly* 70(2), 513-521.
- National Indian Gaming Commission. (2012). *Gaming tribe report*. Retrieved from <http://www.nigc.gov/>
- New Jersey Casino Control Commission. (n.d.). The official website of the State of New Jersey. *New Jersey Casino Control Commission-Historical Statistics*. Retrieved from <http://www.state.nj.us/casinos/financia/histori/>
- Pakko, M. R. (2005). No smoking at the slot machines: The effect of a smoke-free law on Delaware gaming revenues. Federal Reserve Bank of St. Louis. Retrieved from <http://research.stlouisfed.org/wp/2005/2005-054.pdf>
- Pennsylvania Gaming Control Board. (n.d.). *Gaming revenue fiscal year 2010/2011*. Retrieved from <http://www.pgcb.state.pa.us/?p=189>
- Philadelphia Federal Reserve Bank. (n.d.). *State coincident indexes Philadelphia Federal Reserve*. Retrieved from <http://www.philadelphiafed.org/research-and-data/regionaleconomy/indexes/coincident/>
- Studenmund, A.H. (2011). *Using econometrics: A practical guide* (6 ed). Boston: Addison-Wesley.
- Thalheimer, R., & Ali, M. M. (2003). The demand for casino gaming. *Applied Economics*, 35(8), 907-918.
- U.S. Bureau of Labor Statistics. (n.d.) *Consumer price index*. Retrieved from <ftp://ftp.bls.gov/pub/special.requests/cpi/cpi.txt>
- Walker, D.M. & Jackson, J. D. (2008). Do U.S. gambling industries cannibalize each other? *Public Finance Review*, 36(3), 308-333.
- Walker, D.M. & Jackson, J. D. (2011). The effect of legalized gambling on state government revenue. *Contemporary Economic Policy*, 29(1), 101-114.
- Wenz, M. (2008). Matching estimation, casino gambling and the quality of life. *Annals of Regional Science*, 42(1), 235-249.

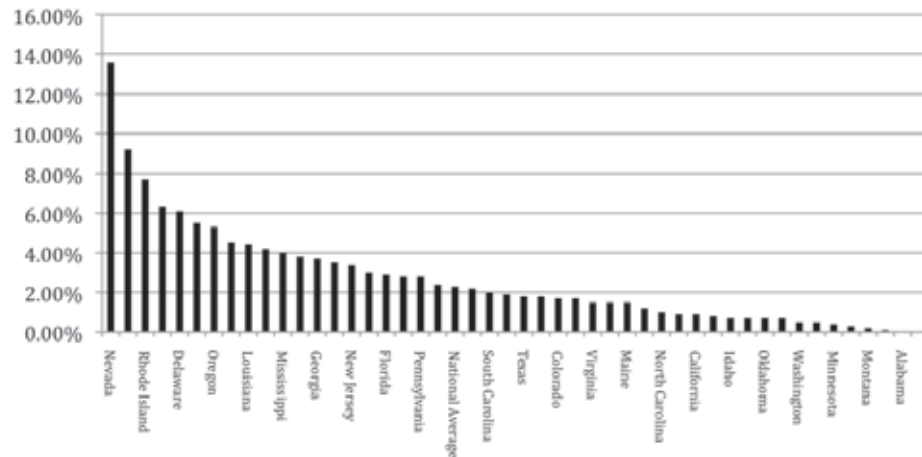
Appendix

A measure of interstate gambling activity is presented here. Casinos furnish tax forms (W2G) to gamblers whose winnings meet certain criteria (e.g. \$1,200 or more in winnings from bingo or slot machines). These gamblers must include this W2G with their tax filings. These filings include the gambler's state of residence. This provides a sample of gamblers at local slot venues. Data for gamblers at Delaware slots venues will be analyzed to provide a more detailed measure of interstate gambling activity than has been published previously. Table A1 below shows the sources of gamblers in Delaware.

Table A1
Percent of Delaware Gamblers by Source

2010							
TRACK	DE	DC	MD	NJ	PA	VA	OTHERS
DELAWARE PARK	38	1	36	4	15	2	4
DOVER DOWNS	19	3	52	1	3	17	5
HARRINGTON	39	4	45	0	1	8	2
ALL TRACKS	30	3	45	2	7	9	4
2007							
TRACK	DE	DC	MD	NJ	PA	VA	OTHERS
DELAWARE PARK	34	1	37	3	20	1	3
DOVER DOWNS	21	4	50	1	4	16	4
HARRINGTON	35	6	42	0	4	10	3
ALL TRACKS	28	3	42	2	10	10	6
2002							
TRACK	DE	DC	MD	NJ	PA	VA	OTHERS
DELAWARE PARK	29	1	28	5	30	3	4
DOVER DOWNS	26	6	41	1	6	13	7
HARRINGTON	32	6	47	1	3	8	3
ALL TRACKS	28	3	35	3	19	7	5

Note. Source: Delaware Department of Finance custom data analysis.



Note. Source: Adapted from Dadayan and Ward 2009. Hawaii and Utah have no legalized gambling. In Alaska, the only permitted gambling is Indian Tribal gaming, data on which is unavailable.

Figure A1. Gambling revenue as share of state's own-source general revenue, FY 2007.

In 2002, 19% of Delaware's gamblers were from Pennsylvania. Delaware Park, the venue most northern and closest to Pennsylvania, relied on Pennsylvania for 30% of its gamblers. Dover Downs and Harrington, which are significantly farther from Pennsylvania, were less reliant on Pennsylvanians.

Dover Downs and Harrington were more dependent on Maryland for gamblers, with 41% and 47% respectively coming from that state.

By 2007, the first full calendar year of competition for Delaware from Pennsylvania slots venues, the share of Delaware gamblers from Pennsylvania had receded to 10% from 19%. This change was felt most keenly by Delaware Park, whose share of gamblers from Pennsylvania fell by ten percentage points. Correspondingly, Delaware and Maryland account for greater shares of Delaware Park's gamblers (growing five and nine percentage points respectively).

The decline in Pennsylvanians gambling in Delaware continued through 2010. Delaware Park's Pennsylvania gamblers fell to 15%, which is a fifteen percentage point drop from 2002. The statewide decline in Pennsylvanian gamblers was twelve percentage points from 2002.

Simultaneously, Delaware and its three venues have grown more dependent on Maryland as a source of gamblers. Statewide the percentage of gamblers from Maryland has increased ten percentage points to 45%, implying an increasing dependence on Maryland residents for Delaware's gambling activity.

The author is grateful to Dr. Bo Bernhard and two anonymous reviewers for their suggestions.