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U.S. casino revenue taxes and short-run labor outcomes

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Abstract

This study examines the effect of casino tax rate levels on short-run labor decisions by casino firms. Using a panel data set consisting of all states with legal commercial casino gambling from 1998 to 2009, a 2SLS fixed-effect model that also uses aggregate and sin-based excise taxes as instruments is estimated. We find that maximum casino tax rates negatively affect casino employment with an inelastic average effect of −0.6. We estimate state tax revenue changes per employee from a 1% increase in the gross gaming revenue tax, finding that states with comparatively low tax rates could increase public revenue with relatively small losses in employment. Nevada, New Jersey, and South Dakota – each with maximum tax rates currently below 10% – could increase tax revenue by more than $430,000 per estimated employee lost from the tax change. Results from this study should be included in future analysis of casino tax impacts on economic efficiency.

JEL classification: H21; H71; L83

Keywords: Gaming tax; Casino taxation; Sin tax; Employment

1. Introduction

Throughout the World and even within a given country, casino gaming markets neither exhibit uniform tax structures nor do they appear to follow any consistent economic guidelines.

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Jurisdictional markets vary from monopolies (typically subject to heavy government taxes) to near perfectly competitive markets (generally taxed at much lower rates). The public revenue that is generated from gaming taxes is often highlighted by politicians and other stakeholders as the most important indicator of the economic impact of casino gaming (Chapman et al., 1997; Eadington, 1996, 1998; National Gambling Impact Study Commission, 1998; Paldam, 2008; Smith, 1998); while firms often highlight the importance of job creation that may result from a low tax environment (e.g. Christiansen, 2005).

Two neighboring states, Pennsylvania and New Jersey, are particularly illustrative examples. In 2010, Pennsylvania (with a 55% gaming tax rate) generated close to four times the tax revenue of New Jersey's gaming industry (with a 9.25% gaming tax rate) but employed roughly three times less people (American Gaming Association, 2011). While there are many different factors that affect tax revenue and employment in these two states, clearly, there are differing policy approaches that may not be fully informed about counter factual outcomes. Even policy decisions that strictly focus on revenue maximization (as opposed to efficiency) will benefit from considering employment based tax effects from gaming tax policy. Large variation in gaming tax rates is not limited to the U.S. Gross tax rates on EU lotteries vary from a low of 12% in Estonia to a high of 50% in Poland (Forrest, 2008), while Albon (1997) has described similar themes of tax rate variation in the Australian market.[1]

The welfare implications of developing a better understood gaming tax system are sizeable. The total worldwide gaming industry is estimated to generate over $110 billion in annual revenue (PwC, 2011), while the U.S. commercial casino industry alone contributes $7.59 billion in gaming tax revenue to state and local governments in the U.S. (American Gaming Association, 2011). Secondary effects that gaming taxation can have are similarly important for maximizing economic welfare and market performance. The U.S. commercial casino industry employs 340,564 workers per year totaling $13.1 billion in wages, benefits and tips (American Gaming Association, 2011). Given the large variation in rates applied across jurisdictions, many regions would likely benefit if there are obvious changes to taxation rates that would improve efficiency.

Using a partial equilibrium framework, this study estimates an empirical model of the effect of gross gaming revenue (GGR) excise taxes on short-run labor outcomes in the commercial casino market. To provide a more complete understanding of this public policy trade-off, and to provide decision makers with a useful set of estimates for policy decisions, a statistically consistent empirical model using both panel and instrumental modeling techniques is used. We estimate state tax revenue changes per employee from a 1% increase in the gross gaming revenue tax, finding that states with comparatively low tax rates could increase public revenue with relatively small losses in employment. Nevada, New Jersey, and South Dakota – each with maximum tax rates currently below 10% – could increase tax revenue by more than $430,000 per estimated employee lost from the tax change.

2. Review of literature

Gambling markets are typically taxed different than the rest of the economy. Walker and Jackson (2008) have suggested that governments set gaming tax policy to maximize revenue

[1] It should be noted that since gaming taxes are all applied in different manners by each jurisdiction, comparisons can sometimes be misleading. For example, 12% of the Pennsylvania tax is a transfer to the horse racing industry and their table games are also taxed at a lower rate; in addition to their ad valorum tax, Nevada also levies fees on gaming devices, though these are a small portion of the overall revenue generated from the various levies.

rather than economic welfare. In a similar tone, Smith (1998) has conjectured that the reason for the observed tax levels in the casino industry is that gaming taxes are set in order to capture economic rents, rather than to internalize negative externalities or maximize public welfare. The National Gambling Impact Study Commission (1998) and Meich (2008) both suggest that tax rates reflect a joint objective, to both raise public funds and to punish an activity characterized as sinful.

Higher taxation of gaming, as compared to other goods, is often motivated by the negative externalities associated with problem gambling. This policy design can be optimal if the rates follow the prescription set by Pigou (1920) and Baumol (1972). Higher (Pigovian) taxes are efficient if they are applied to offset social costs, or even as a double dividend to reduce other distorting taxes, such as income taxes (Glomm, Kawaguchi, & Sepulveda, 2008). In practice, gaming taxes do not appear to follow any sort of Pigovian objective. Chapman et al. (1997) found that the most socially harmful forms of gaming (e.g. Pokies, slot machines located outside of casinos) were not taxed at a higher rate in Australia, and similarly distorted tax structures have been described in the U.S. by Clotfelter (2005). In general, the least harmful form of gambling, lottery, has been taxed at the highest rate.

An important distinction of the gaming industry compared to most other "sin" goods or industries with negative externalities, is that gaming is often introduced as an export good to other jurisdictions. Many casinos are built on jurisdictional borders or are operated with restrictions on the admission of local residents. The domestic state is able to capture the economic rents from foreign state visitors, while exporting many of the negative externalities when the visitors return to their foreign homes. This changes the efficient strategy of the home state, and may lead to economically inefficient proliferation of gaming (Eadington, 1999).[2] However, regardless of any Pigovian objectives, a sound policy decision on appropriate casino tax levels still requires an understanding of firms' responses to changes in the tax rate. That is, while jurisdictions have applied various tax structures (perhaps with Pigovian objectives in mind), appropriate analysis of the efficient policy decision must also examine how the tax rate policies affect other outcomes in the gambling industry. To date, no studies have provided an empirically sound analysis of this relationship. One item of particular interest is how firms will respond in the labor market, given the employment benefits of casino development are often touted as a key component of their positive impacts on the economy and local community. In the next section, we provide a description of the method used to estimate the impact of gross gaming revenue taxes on short-run labor outcomes, along with the data used as part of the analysis.

3. Data and methodology

Data on the twelve states that offer commercial casino gaming was obtained from the American Gaming Association (AGA) for the period from 1998 to 2009 to form a panel (American Gaming Association, 2010). This data consists of an annual census made to all commercial casinos in the U.S., including their employment, gross gaming revenue, and maximum tax rates. Differences in data collection after 2009 inhibited use of figures after this year. Since firm level data is not

[2] This exportation strategy may also help explain the emergence of small island nations – such as Antigua, the Isle of Man, and Alderney – as large suppliers of online gaming licenses and regulation. However, this competitive result may only lead to short-run economic rents and eventually a long-run oversupply of gaming, as neighboring jurisdictions seek to legalize gaming to capture some of the economic benefits of gaming to offset the negative externalities that are being exported to their region.

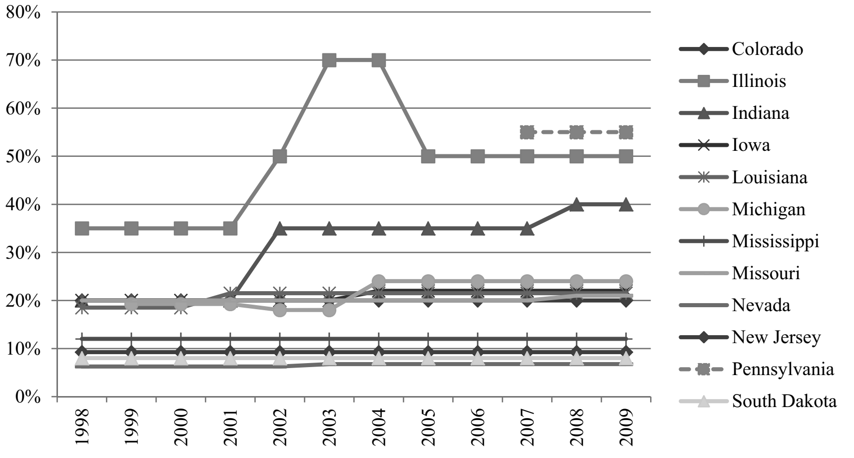

Fig. 1. State maximum gaming tax rates from 1998 to 2009.

provided by all gaming commissions, maximum tax rates are the most representative figure for marginal rates, as they indicate the marginal tax paid by the largest operators. The maximum tax rates are illustrated in Fig. 1. Six states showed variation in tax rates during the period of study, while the remaining six states whose rates did not change during the period of study, served as controls.

Employment is used as a proxy variable to identify short-run labor decisions. Employment is commonly used as a variable to measure economic impacts (e.g. Daley, Ehrlich, Landefeld, & Barker, 1997; Lehmus, 2014), and may even be a better economic impact response variable to changes in tax rates than, say, capital expenditures since they can be more readily adjusted by operators. Although capital investment is an interesting dependent variable to examine because it reflects operators investments decisions, this variable tends to be relatively static since casino investments can be quite lumpy – most modern integrated-resorts require upfront capital investments ranging from hundreds of millions to billions of dollars. Short-run changes in employment should be adequately captured within a given year of any change in the tax rate, and employment is not restricted by casino license quotas. Reliable estimates of employment are also reliably available from all U.S. commercial casino gaming markets due to the AGA's annual census.

Eq. (1) defines the underlying relationship between economic output and gaming taxes:

$$y_{it} = \alpha_0 + \beta_1 \cdot Tax_{it} + \boldsymbol{x_{it}} \cdot \lambda + \boldsymbol{d_t} \cdot \boldsymbol{\delta} + v_i + u_{it} \tag{1}$$

where y_{it} is the indicator of casino gaming development, employment; α_0 is the model constant, and Tax_{it} is the primary variable of interest, including the maximum gaming tax. $\boldsymbol{x_{it}}$ is a vector of factors that affect gaming development that vary by state and year; $\boldsymbol{d_t}$ is a vector of non-state specific factors that affect gaming development and vary by year (proxied by year dummy variables); $\boldsymbol{\delta}$ are the coefficients for non-state specific factors that affect gaming development and vary by year; v_i are state specific constant factors that affect gaming development; and u_{it} is the model error term.

Given that we have a panel of data to analyze, a first-differencing of Eq. (1) along with the use of time dummy variables would produce consistent estimates, if there were no time varying unobserved variables that are correlated with *Tax*. However, this seems unlikely to be the case. Casino gaming is a highly politicized and regulated industry. Changes in policy design that are difficult to identify with proxy variables, such as licensing or responsible gambling requirements, seem likely to affect both taxation rates and casino employment. Coefficient estimates from a fixed-effect model without other corrections would therefore be subject to omitted variable bias. To measure Eq. (1), we therefore adopt an instrumental variable approach in addition to the fixed-effects, two-stage least squares (2SLS).

The 2SLS estimator consistently estimates the endogenous tax rate coefficient by using an instrument to purge out the correlation between the explanatory variable and the model error term. Two necessary conditions need to be satisfied by valid instruments. The first condition is a correlation of zero between the instrument and the structural model error term, i.e. $Cov(StateTaxRate_{it}, u_{it}) = 0$ and $Cov(AlcoholTaxRate_{it}, u_{it}) = 0$. Second, the instrument and the endogenous variable must be correlated, i.e. $Cov(StateTaxRate_{it}, GamingTaxRate_{it}) \neq 0$ and $Cov(AlcoholTaxRate_{it}, GamingTaxRate_{it}) \neq 0$. Two instruments are proposed to correct the endogenous gaming tax variable. The first instrument is the total state wide tax revenue as a percentage of state GDP. The second instrument is the total state wide alcohol tax revenue, as a percentage of state GDP. This second variable is similar to the first, but focuses on revenue from another specific "sin tax" and thus may explain a difference aspect of the variance in gaming taxes.

It seems likely that the overall statewide tax rate will not provide any additional explanatory power to gaming employment beyond what is already addressed by the model through the gross gaming revenue tax, economic control variables, and the fixed-effect variables. For example, if the presence of a particularly pronounced recession in a single state causes both the gaming tax and the statewide tax to change simultaneously, the economic control variables such as real GDP or the unemployment rate will likely capture this variation in the structural regression model. With regards to the alcohol tax rate variable, this seems even more likely to satisfy the first necessary condition of valid instruments. The variable focuses on a tax attributable to another industry and should not have a direct effect on casino employment. An empirical overidentification test (Hansen, 1982) is also conducted on the data to support the validity of the instruments.

The second condition of a non-zero correlation between the gaming tax and statewide tax has not been established empirically in the literature; however, Furlong (1998) did find that tax collections contributed to casino adoption at the state level. Calcagno, Walker, and Jackson (2010) also found that other fiscal variables affected casino policy adoption. With regards to the alcohol tax rate, it seems plausible that states that choose to heavily tax one sin good will also heavily tax other legal sin goods, so a positive relationship is expected between these variables. As a robustness check, empirical tests for this assumption will also be conducted, including an F-test of weak identification (Staiger & Stock, 1997).

Model control variables include gross state product and real personal income per capita (US Bureau of Economic Analysis, 2011), the state unemployment rate (US Bureau of Labor Statistics, 2011), the state population (US Census Bureau, 2011), gaming availability proxied by number of instate commercial casinos, and productivity proxied by gross gaming revenue per employee (American Gaming Association, 2010).

4. Results

4.1. Fully specified empirical model

The first stage results of the fully specified empirical model are provided in Table 1. The model appears to fit the data well. Both instruments, the natural logarithm of alcohol tax revenue per unit of state domestic product (Log Alcohol Tax) and the natural logarithm of all state tax revenue per

Table 1
First-stage model.

	Log of Maximum GGR Tax Rate			
	b	se	*z*	*p*
Log of alcohol tax revenue per GDP	0.27***	0.08	3.40	0.00
Log of all tax revenue per GDP	0.41*	0.24	1.70	0.09
Log of number of commercial casinos	0.06	0.07	0.88	0.38
Log of population	−0.74***	0.17	−4.30	0.00
Log of average GGR per casino	0.03	0.07	0.48	0.63
Log of real income per capita	−0.77**	0.35	−2.20	0.03
Log of unemployment rate	0.14*	0.08	1.69	0.09
Years 1999–2009 (dummy variables)	Yes***	–	–	0.00

Heteroskedasticity robust standard errors provided.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

Table 2
Tests of IV assumptions.

Instruments: Log Alcohol Tax/GDP & Log All Tax/GDP	
Observations	133
F-test of weak identification	15.04
Hansen-*J* statistic	0.01
Hansen-*J* *p*-stat	0.93

unit of state domestic product (Log All Tax), have positive and statistically significant coefficients; $z(1\ 1\ 4) = 3.40$, $p = .001$ and $z(1\ 1\ 5) = 1.70$, $p = .09$, respectively. This finding supports the second necessary condition for the instruments. To further establish the joint validity of the instruments, as the alcohol tax variable initially shows more power than the all tax variable, additional statistical tests were conducted and are provided in Table 2. The *F*-test of weak identification = 15.04, exceeded the benchmark value of 10, suggesting that these variables jointly satisfied the second necessary condition of strong instruments (Sovey & Green, 2011; Staiger & Stock, 1997). The Hansen *J* statistic, $HJ = 0.01$, $p = 0.93$ (also known as the overidentification test), failed to reject the assumption that Log Alcohol Tax and Log All Tax do not belong in the structural model. This finding supports the first necessary condition of valid instruments. The presence of the dummy year variables is indicated instead of fully described, to improve readability (Table 3).

The structural model produced results that were consistent with theory. The elasticity of casino employment with respect to the maximum gaming tax rate is estimated to be $z = -0.60$, and is statistically significant, $z(1\ 1\ 5) = -2.99$, $p = .003$. A 1.0% increase in the maximum tax rate is predicted to reduce casino employment by 0.6%. Findings from other gaming variables appeared to be reasonable. The gaming availability variable (log of number of commercial casinos) produced a reasonably inelastic coefficient (0.67), and the productivity variable (log of average GGR per casino) also produced an inelastic estimate (0.36). The findings support the assertion that U.S. casinos may be subject to economies of scale in labor. A doubling of the gaming revenue per casino would only increase employment by an estimated 36%. Indeed, Gu (2001) has previously provided evidence that casino operations are subject to economies of scale in payroll and other expenses.

Table 3
Full model specification.

	Log of employees			
	b	se	*z*	*p*
Log of Maximum GGR Tax Rate	−0.60***	0.20	−2.99	0.00
Log of number of commercial casinos	0.67***	0.09	7.17	0.00
Log of average GGR per casino	0.36***	0.08	4.24	0.00
Log of population	0.45**	0.21	2.10	0.04
Log of real income per capita	0.27	0.46	0.58	0.56
Log of unemployment rate	0.16*	0.09	1.92	0.05
Years 1999–2009 (dummy variables)	Yes	–	–	0.19

Heteroskedasticity robust standard errors are provided.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

The population variable produced a significant and positive elasticity coefficient (0.45), which suggests a positive relationship between total population growth and growth in short-run casino development. The economic variable, log of real income per capita, failed to produce a significant coefficient. Log of the unemployment rate was significant, $z(1\ 1\ 5) = 1.92$, $p = .05$, with an elasticity of 0.16. Part of the impact of these variables may be explained by an indirect effect on casino employment through the average GGR variable. That is, higher income and employment levels will lead to increased spending on casino gaming, thereby increasing employment through the average GGR variable, in lieu of a directly measured effect.[3] Other statistical tests produced results consistent with a well-defined model.[4]

4.2. Regression-adjusted models

The robustness of the coefficient estimates were further validated by estimating various regression-adjusted models. Table 4 includes several of these regression-adjusted (second-stage) models, along with a non-2SLS model (model 1). A few noteworthy results arise. First, the inclusion of simple year dummy variables ensures that the coefficient on the variable of interest (Log of Maximum GGR Tax Rate) is statistically significant, negative in direction, and inelastic. Second, the addition of Average GGR per Casino leads to a reduction of significance on the Unemployment Rate variable. This may indicate that the effect of the economy on casino employment is indirectly occurring through the change in gross gaming revenue. The change in the Bayesian information criterion (BIC) further supports this assertion, as this value increases (decreases in absolute value) from model (7) to (8), despite the addition of a statistically significant population variable. The

[3] Additional variables were tested for significance as part of the empirical analysis, but were omitted from the results due to high collinearity with the fixed-effects and the other explanatory variables. These excluded variables included the AGA measures of national gaming acceptability, the admission tax dummy variable, real gross state product, and alternative transformations of all variables.

[4] The Skewness/Kurtosis, $\chi^2(2, n = 133) = 2.21$, $p = .331$, and Shapiro–Francia W, $z(1\ 3\ 3) = 0.854$, $p = 0.196$, tests failed to reject the assumption of normality. To examine serial correlation, several regression-adjusted models were estimated with Parzen kernel estimators that are robust to the presence of arbitrary heteroskedasticity and one period serial correlation (Baum, Schaffer, & Stillman, 2007). Only minor differences appeared in the magnitude of the t-stats, and the differences did not cause a change in the interpretation of hypotheses tests for any variable of interest.

Table 4
Regression-adjusted structural models.

	Log of employees								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log of Maximum GGR Tax Rate	−0.13	−0.85	−0.72**	−1.07***	−0.86***	−1.13***	−0.56***	−0.62***	−0.60***
Log of number of commercial casinos	0.62***	–	–	0.69***	0.67***	0.64***	0.66***	0.69***	0.67***
Log of average GGR per casino	0.36***	–	–	–	–	–	0.35***	0.37***	0.36***
Log of population	0.70	–	–	–	−0.06	–	–	0.46**	0.45**
Log of real income per capita	0.73	–	–	–	–	−0.11	–	–	0.27
Log of unemployment rate	0.12*	–	–	–	–	0.32***	–	–	0.16*
Years 1999–2009 (dummy variables)	Yes*	No	Yes**	Yes***	Yes***	Yes**	Yes	Yes	Yes
Instrumental variables	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	134	134	134	134	134	134	133	133	133
Weak ID (*F*-Test)	N/A	1.24	10.35	9.28	15.19	10.00	9.22	14.56	15.04
Hansen-*J* statistic	N/A	3.92	2.59	4.23	5.63	1.33	1.59	0.20	0.01
Hansen-*J* *p*-stat	N/A	0.05	0.11	0.04	0.02	0.25	0.21	0.65	0.93
BIC	−255.5	−64.4	−56.7	−84.63	−103.4	−79.0	−196.9	−187.1	−184.7

Heteroskedasticity robust standard errors provided in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

non-2SLS model (1) does not show a statistically significant estimate of the maximum GGR tax rate, likely the result of a biased coefficient estimate.

There is a noteworthy change in the 2SLS maximum GGR tax rate coefficient when average GGR per casino is added to the equation. Average GGR per casino is an imperfect proxy variable for the average casino size (and therefore the number of employees needed to operate the facilities). Average GGR is affected by both supply and demand factors, and therefore there is a possibility that the variable inclusion may be over-controlling the model, reducing the (absolute value) impact of the tax rate. It is unclear if the change in the maximum GGR tax rate coefficient is due to a non-orthogonal relationship with supply side aspects of the casino size proxy variable, or due to a better controlled model, but controlling for casino size is a crucial element of the model and therefore we proceed under an assumption of theoretical validity.

4.3. Log-linear model

As an alternate means to estimate the robustness of both the estimates and the tax rate elasticities, a log-linear model was fitted. The dependent variable (employment) is transformed by the natural logarithm, but the right hand side variables all appear in level form. As shown in Table 5,

Table 5
Log-Lin model specification.

	Log of employees			
	b	se	*z*	*p*
Maximum GGR tax rate	−2.365***	0.752	−3.145	0.002
Number of commercial casinos	0.003**	0.001	2.446	0.014
Average GGR per casino (millions)	0.159***	0.033	4.809	0.000
Population (millions)	0.078	0.127	0.615	0.539
Real income per capita (thousands)	−0.002	0.017	−0.116	0.908
Unemployment rate	1.241	1.673	0.742	0.458
Years 1999–2009 (dummy variables)	0.081	–	–	0.187
Observations	133			
F-test of weak identification	12.18			
Hansen-*J* statistic	0.82			
Hansen-*J* *p*-stat	0.37			

** $p < 0.05$.
*** $p < 0.01$.

the results appear to be consistent with the log–log model estimations. The *F*-test of weak identification = 12.18, exceeded the benchmark value of 10, and the Hansen *J* statistic, $HJ = 0.82$, $p = 0.37$, again failed to reject the assumption of the instruments as structural variables. All of the explanatory variables that were significant at the .05α level in the log–log model are significant in the log-linear model, with the exception of population. It may be the case that a linear relationship between the log of employment and population does not adequately capture the true relationship of these variables.

The advantage of the log-linear model specification is that it allows for the computation of non-constant elasticity values. In particular, elasticities of employment can be computed as a function of the state tax rate, allowing for non-average values to be estimated, which may be more useful for policy making at the state level. The elasticity of employment with respect to the maximum tax rate is quite inelastic at the lowest levels of tax rates that are observed in the sample (e.g. Nevada at a 6.75% tax rate is estimated to have an elasticity of −0.16). Estimated elasticities reach the unitary level at roughly a 42% rate. Pennsylvania's 55% rate is estimated to have an elasticity of −1.3.

5. Discussion

To date, no study has empirically estimated the effect that casino excise taxes have on the decisions made by firms. Using an estimation method that controlled for potential endogeneity in the selection of a tax rate, this study found strong evidence that maximum gross gaming revenue taxes have an adverse, but relatively inelastic, effect on casino employment. The study revealed a constant elasticity model estimate of roughly −0.6, with the entire 95% confidence interval narrowly lying in the inelastic range [−0.999, −0.208]. The log-linear model revealed relevant elasticity estimates for all presently observed state tax rates. Findings from other gaming related variables were also consistent with expectations. The gaming availability variable (log of number of commercial casinos) produced an inelastic coefficient (0.67), and the productivity variable (log of average GGR per casino) also produced an inelastic estimate (0.36). A doubling of the gaming revenue per casino would only increase employment by an estimated 36%. This helps validate

Table 6
Summary of change in tax income and employment from a 1% change in state GGR tax rate. Land-based and riverboat casinos.

	Maximum GGR tax rate (%)	Estimated elasticity	Baseline casino employment	Estimated loss of employees	Estimated tax Inc. per lost employee
Colorado	20	−0.47	8821	8.3	$123,014
Illinois	50	−1.18	7083	41.8	$118,690
Indiana	40	−0.95	15,857	60.3	$145,710
Iowa	22	−0.52	9241	11.5	$265,331
Louisiana	21.5	−0.51	8122	8.8	$309,694
Michigan	19	−0.45	10,961	11.5	$364,807
Mississippi	12	−0.28	177,397	19.2	$342,264
Missouri	21	−0.50	36,377	7.4	$407,505
Nevada	6.75	−0.16	9126	65.3	$434,263
New Jersey	9.25	−0.22	1512	0.3	$470,098
Pennsylvania	55	−1.30	8821	8.3	$142,374
South Dakota	9	−0.21	7083	41.8	$629,882

Note: Elasticities based on results shown in Table 5. Estimated changes in tax revenue assume 1% increase in the total tax revenue.

the wave of firm consolidation in the U.S. casino industry during the late 20th century and early 21st century.

States with relatively low maximum tax rates should re-examine their current tax structure, if there is a need for public revenue. For example, Nevada is currently considering implementation of a revenue tax on all businesses (Deloitte, 2013), in order to fund education initiatives in the state. While a comprehensive review of state tax structure is beyond the scope of this study, given that taxes on intermediary businesses have been shown to be non-optimal (e.g. Diamond & Mirrlees, 1971a, 1971b), and the relatively small predicted impact of a change in gaming taxes in this study, it seems likely that the tax currently under consideration is sub-optimal. To provide further guidance for policy makers, we summarize estimated state elasticities for each state included in this study, based on the results shown in Table 5. We also estimate the tax revenue change per employee, from a 1% increase in the state GGR tax revenue.[5] As shown in Table 6, states with comparatively low tax rates could increase public revenue with relatively small losses in employment. Nevada, New Jersey, and South Dakota – each with maximum tax rates currently below 10% – could increase tax revenue by more than $430,000 per estimated employee lost from the tax change.

Using these estimates, policy makers should make more informed and explicit decisions about their casino tax policy. Even a policy framework that ignores wider welfare effects and strictly focuses on public revenue maximization could find value in these results, as they are applicable to a study of net tax changes, comparing direct tax revenue from gaming excise taxes against wider sources of tax revenue (e.g. comparing losses in employment related payroll/income taxes against gains in GGR taxes). Of course, tax based policies are just one part of an efficient casino public policy framework.

[5] As a point of clarification, the 1% increase is in GGR, not a full percentage point increase in the applied rate. For example, this should be interpreted as a change from 10% to 10.1%, not 10% to 11%.

While we note that this study focused on the short-run responses in employment to changes in casino excise taxes, long-run capital investment changes in response to tax policy may ultimately lead to different employment equilibriums than are observed in the short-run. For example, increases in tax costs may incentivize casinos to pursue a more capital intensive production function over the long-run. Of course, given the lumpy financial investments that are made in modern resort-style casinos, and the quotas imposed by casino licenses, the long-run response to changes in tax rates may take many years or decades to occur. Therefore, the current results may hold the most meaningful policy implications.

Future study using firm level data would be useful in attempting to estimate tax effects on long-run investment decisions, such as capital allocation. Such analysis could benefit from an ability to closely examine accounting data figures. Using firm level data, a full panel of the U.S. may not be entirely necessary, as relatively straightforward difference-in-difference studies could yield accurate estimates. Admission taxes also deserve study, as their effect on both operator and consumer incentives are interesting. In a jurisdiction with a 20% GGR tax and an average 10% theoretical win, $500 in coin-in would be required to generate the same per player tax revenue as a $10 admission tax. Given the limited use of admission taxes in the U.S. casino industry, an empirical test of how behavior changes in response to these different excise taxes could yield evidence of many potential pareto improvements. While the most widely used taxation tool in the gaming industry is an ad valorem tax on GGR, specific excise taxes may yield welfare improvements.

Finally, expanding this study beyond commercial casinos would be useful in order to increase reliability and generalizability of the findings. Tribal gaming, lotteries, video lottery terminals, online casinos, and other forms of gaming all may react in different ways to changes in their cost structure, and this is worth exploring.

This study was also limited to the use of a comparative static approach to policy modeling. A general equilibrium approach would yield better insight into the secondary effects of casino tax policy. For example, the global competitiveness of online gaming may exacerbate the sensitivity of those firms behavior to changes in the tax rate. Understanding these subtleties will be important for the development of optimal gaming policy mechanisms.

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