

Recent Research Trends in the Gaming Industry: A Content Analysis of Research Literature on Casino Profits

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Abstract

This content analysis reviews empirical studies of gaming regulatory changes and casino operations changes published between 1995 and 2011. Studies concerned with changes that effect casino volume, revenue, or profit are included with a table summarizing all findings in each category. Suggested modification to existing research has also been suggested in some cases. The author provides proposed hypotheses for future research and the implications the past and future research has to academia and industry.

Keywords: Gaming research, casino profit, casino revenue, gaming operations

Introduction

Gross gaming revenue for commercial casinos in the United States has increased \$8.9 billion, or 34%, over the ten years since 2001 (American Gaming Association, 2011b). Gaming research has also grown over the last 10 to 15 years as gambling spend has increased and more jurisdictions approve gaming. This increase in gaming research has occurred in all areas, including operations, finance, marketing, policy, and problem gambling.

This study reviews gaming articles that evaluate the effects of differing factors on casino volume, revenue or profit.

This study reviews gaming articles that evaluate the effects of differing factors on casino volume, revenue or profit over the last fifteen years. The factors are grouped into regulatory changes and operational changes. A brief overview of each article and how its results compare to those of previously published studies will be provided. In some cases, there is a discussion of limitations of the study and additional items or variables that can be evaluated. Based on the research conducted, proposed hypotheses will be discussed on which to base future research. Included in each section is a table of the studies reviewed, with the focus of the study, the method used, the sample characteristics, and the results. For each subsection of the literature review there is also a brief discussion of the implications of those studies to both academia and industry.

The objective of this research is to provide an analysis of the empirical studies in the areas of regulatory and operational changes and to provide suggestions for future research by providing proposed hypotheses. This content analysis will also aid readers in identifying gaps in the literature and providing potential future research topics. This is the only known content analysis of all empirical studies concerned with regulatory and operational changes and how those changes affect gaming revenue or profits.

Methodology

A total of 22 gaming articles that analyze casino profit from 1995 through 2011

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are evaluated. Articles selected for inclusion include all empirically-based articles concerned with a casino firm's revenue, including gaming volume or profit. There is limited research in these areas in gaming so the articles analyzed are all known empirical studies. The scope of this study is limited to governmental changes and operational changes that management implement, such as marketing promotions, amenity offerings, and changing gaming machines.

Survey based research is not considered because what customers say they do and what they actually do may be different and may or may not affect casino revenue. There are a number of survey-based studies which try to determine what customers believe and how much they say they spend on gaming or casino amenities. There are no known studies which link survey results to actual casino performance. Qualitative research and studies that rely on laboratory experiments or computer simulations are not included for the same reason.

There are also numerous articles that evaluate gaming industry performance based on financial analysis only, which are not considered for this content analysis. These studies are not empirically-based and typically only analyze financial information for a single period so they cannot be used to generalize to the gaming industry.

Literature Review

Regulatory Changes

Studies classified as regulatory changes include those that look at governmental changes that may affect gaming operations. These changes include modifying allowable operating hours, imposing betting limits, implementing smoking bans, revising the number of gaming devices allowed, changing the number of gaming licenses, etc. Some of these changes are within management's control while others are not. If the change precludes the casino from doing something, such as allowing smoking, casino management must comply and adjust their operations. If the change allows more options for the casinos, such as an increase in operating hours, casino management must decide if they want to adjust operations and if so by how much. The number of studies done concerning regulatory changes in the gaming industry and the effect on casino profits is small, and these have mainly been conducted during the last two years.

Nichols (1998) analyzes Atlantic City casinos from May 1978 through July 1996 to find the effect, if any, of deregulation changes on a casino's gaming win. Casino win is gross gaming win and includes complimentary (comps), which are free gaming play given to customers. Comps artificially inflate gaming win since the casino is simply winning back the money they give to players. Accounting rules require that comps be backed out of gaming win to achieve a net gaming win and it is the net gaming win that is considered revenue. Nichols (1998) justifies using gross gaming win instead of net gaming win since the amount of comps as a percentage of gaming revenue did not change significantly over the time period. The deregulation factors of concern are the change in operating hours and the change in the amount of floor space that can be attributed to slot machines; both factors occurred in July 1991. Atlantic City casinos went from only being allowed to operate 18 hours a day to 24 hours a day and the amount of casino floor space that could be used for slot machines and aisles increased from 30% to 45%. The operating hours change took effect immediately with the slot machine increase phasing in over three years.

Nichols (1998) uses an autoregressive moving average (ARIMA) model, a time series model that takes into account trends and seasonality. Results show that the effects of change in operating hours on casino win is not significant, but the change in slot machines is significant and positively related to gaming win for 1992 and after. Although Nichols finds a significant difference in gaming win, which he attributes to the change in allowable slot machine space, there is another main factor not taken into account that may be causing the increase in gaming win - an increase in the casino's

win percentage. This is a concern of this article because a change in win percentage will affect win but not volume, and can cause a misinterpretation of the finding. Results may show that win increased due to regulatory changes when in fact it did not, but instead was due to a change in win percentage. The opposite could be true on the results for the change in gaming hours. If win percentage went down, the results may not show a significant change in casino win, but in fact there may have been a significant change in volume that was offset by a change in win percentage. This limitation could be addressed by converting win to volume and interpreting that variable instead. There may have also been other factors that increased gaming win and not just the increase in slot machines. Such factors could include a general growth in gaming during the time period, more visitors to Atlantic City or an increase in disposable income for the area.

Thalheimer and Ali (2008a) also conduct a study on government-imposed regulations and the effect of those regulations on both slot win and total win. The data set includes casinos and racinos in Illinois, Iowa, and Missouri from 1991 to 1998. Slot win is significant and positively related to days in operations, number of slot machines, accessibility of market area customers to their own casino and accessibility to competitors with betting limits. Slot win is significant and negatively related to government imposed betting limits, boarding hours and competition. The longer a casino is subject to betting limits and boarding restrictions, the lower the slot win. Also, the more competition a particular casino has from Indian casinos, racinos, and other casinos, the lower the slot win. Slot win is not significant in relation to the number of tables. The model for total win finds the same significance and direction for all variables except tables, which is positive and significant, meaning that the more tables games a casino has the more total win they generate.

Some research suggests that casino win decreases when governments impose limitations on gaming. This is logical because governments typically state that the reason for the limitation is to protect its citizens from the ramifications of gambling too much, such as bankruptcy and addiction (Vuong, 2008). Also, as governments increase the number of casinos they allow, each casino's win decreases, as there are more options for customers. As states look to gaming as a way to solve budget problems, state governments and casino management should be aware of the potential effect on casino operations. More research needs to be done on whether the decrease on gaming win after a government limitation is permanent or temporary. In addition, more research should be conducted on whether an increase in the number of gaming licenses in a particular state increases the state's overall gaming win even though it decreases individual casinos' win.

Proposed Hypotheses.

P₁: An increase (decrease) in government imposed gaming limitations will decrease (increase) casino gaming win.

P₂: An increase (decrease) in competitors will decrease (increase) an individual casino's gaming win.

Recent studies have also looked at enacted smoking bans in the United States and abroad. On November 27, 2002, Delaware implemented the Delaware Clean Indoor Air Act, which included a clause prohibiting smoking casinos. Thalheimer and Ali (2008b) evaluate the slot coin-in at three Delaware racinos following this ban. While the authors are mainly concerned with the determinants for casino demand, the results from the smoking ban variable are evaluated as a regulatory change that affects gaming volume. The monthly coin-in from September 1996 to December 2004 is analyzed using seemingly unrelated regression (SUR) and includes seasonal variables for three models, one for each racino. In addition to a dummy variable for the smoking ban, other independent variables include number of machines, market area population and real per capita income. The number of machines at each racino's location is significant and positive in all models while the number of machines at the other locations is negative and

significant in all models. The per capita income variable is significant and positive in two of the models and the population is positive and significant in only one model. The smoking ban is significant and negative in all models and the decline in coin-in ranges from 12.7% to 17.8%.

Another study evaluates the same smoking ban but includes slightly different variables, looking at revenue instead of volume (Pakko, 2008). Pakko (2008) analyzes the effect's existence, the magnitude of the effect and whether the effect corresponds to alternative gaming facilities customers can visit. The sample period is January 1997 to March 2005. Pakko (2008) uses four regression models, one for each racino and one for statewide, and includes variables for trend and seasonality. In all models, the smoking dummy variable is significant and negatively related to gaming win, which is similar to what Thalheimer and Ali (2008b) find. The three racinos show declines of between 8.6% and 15.8% while statewide shows an overall decline of 14.9% (Pakko, 2008). The authors also find this decline was permanent, meaning the revenues did not come back after the customers adjusted to the no smoking policy. A limitation to this study is that the authors determine the decline was permanent but only evaluate 2 years after the ban, which may not be a long enough time period.

The racinos with the largest decline also have the greatest amount of competition from surrounding states that do not have a smoking ban. The racino in the center of Delaware with the least amount of competition, for example, shows the smallest decline. In 2003, the state also implemented regulatory changes increasing the allowable number of machines by 25% and increasing operating hours. Pakko (2008) does not discuss whether he analyzes the effect of these changes. A further analysis of these regulatory changes should be done to see if the change attributed to the smoking ban may actually be the effect of these other regulatory changes. Also, modifying this analysis to volume instead of win may produce different results since as in Nichols's (1998) study the win percentage may have changed during the period and could be affecting the results.

Lal and Siahpush (2008) conduct a similar study, looking at the 2002 smoking ban for casinos in Victoria, Australia. The authors evaluate not only if the smoking ban had an effect, but what the magnitude is and if it is temporary or permanent. Lal and Siahpush (2008) analyze net gaming win on electronic gaming machines (EGM) from 1998 to 2005 using ARIMA and interrupted time series analysis. All data for Victoria is compared to the gaming win in South Australia, which did not implement a smoking ban. This adds to the robustness of the test so the authors can attribute the change to the smoking ban and not general economic factors. The authors find there is an abrupt and permanent decline in gaming win to the tune of 13.8%. Similar to Pakko (2008), Lal and Siahpush (2008) only evaluate 2 years after the smoking ban implementation so there may not be enough time analyzed to determine if the change is truly permanent. In 2003, after the smoking ban, Victoria also implemented other regulations to limit gaming, including limiting ATM withdrawals, banning autoplay, and limiting bill acceptors to \$A10 instead of \$A100. In 2004, all gaming machine advertising was banned. The authors reanalyze the data taking into account these regulation changes and find none of them to be significant.

Illinois's smoking ban of July 2007 was analyzed by Garrett and Pakko (2010). The authors study the effect of the ban on gross revenue and admissions, which is the number of patrons who enter the casino. There is one large assumption the authors make, however, in terms of admissions. The authors assume there is no substitution from other casinos, meaning players are not moving from one casino to another. This has to be assumed to be able to properly evaluate admissions. The authors use multiple regression analysis and include independent variables for seasonality, general economic conditions, policy changes, and weather events. The data period is 1997 to 2008. Results show the smoking ban is significant and negative with an average decline in revenue of 22%. The effect on admissions is also significant and negative but to a smaller effect. The effect on revenue is negative and significant in all markets but ranges in declines from

less than 10% to over 30% when looking at models for individual casinos. The casino with the smallest decline in revenue is the casino with the least amount of competition, similar to Pakko's (2008) findings. Garrett and Pakko (2010) realize the smoking ban took effect at the same time as the recession and some of the decline may be attributed to that factor. To take this into account, they compare the change in Illinois casinos with the change in surrounding states and still find a decrease in revenue of 20% and a decline in admissions of 10% after adjusting for the economic effects in surrounding states.

Results of the smoking ban research indicate that the potential increase in casino win from players who do not like smoking or being around smoke was not enough to offset the decrease from players who want to smoke. In addition, even though there is a significant negative effect on admissions and win, admissions is lower, which indicates that customers are still going to casinos but are gaming less. The most likely reason is that they are leaving earlier to smoke or taking more breaks during their play to have a cigarette. Results of the smoking ban studies may also indicate that customers do not appreciate the fact that something they could previously do has been taken away from them so they choose to go somewhere else.

Proposed Hypotheses.

P₃: An implementation of a ban on what customers can do while gaming will decrease casino volume and win. As these bans are lifted, casino win will increase.

Table 1 is a summary of the discussed regulatory change studies. All known studies on the smoking ban show a significant and negative effect on either volume or revenue. Studies on other regulatory changes, such as hours, number of machines, bet limits, etc., show differing results although most show that a government imposed limitation will decrease gaming volume while a loosening of gaming regulations will increase volume and win. These regulatory changes have not been studied extensively and there is the possibility of additional research in this area as more jurisdictions legalize gaming or modify their gaming regulations by allowing more casinos, loosening betting limits, operating hours or required staffing.

Table 1
Studies Concerning Regulatory Policy Changes

Author(s)/ Year	Focus	Method	Sample	Results
Nichols (1998)	The effect of an increase in operating hours and percentage of casino floor allowed for slot machines on gaming win	ARIMA	Atlantic City casinos from 1978 to 1996	Increase to 24 hour operations is not significant, but increase in allowable casino floor allocated to slot machines has a significant and positive relationship to win
Lal & Siahpush (2008)	The effect, magnitude and length of effect of the smoking ban on casino win	ARIMA & interrupted time series	Victoria, Australia casinos from 1998 to 2005	The smoking ban has a permanent significant and negative effect on casino win of 13.8%
Pakko (2008)	The effect, magnitude and length of the effect of the smoking ban on revenue	Multiple regression	Delaware racinos from 1997 to 2005	Smoking ban is significant and negatively related to revenue with casino declines ranging from 8.6% to 15.8%

Author(s)/ Year	Focus	Method	Sample	Results
Thalheimer & Ali (2008a)	The effect of government imposed betting limits and boarding hours on slot win and total win	Multiple regression	Illinois, Iowa, and Missouri casinos from 1991 to 1998	Betting limits and boarding hours are significant and negatively related to slot win and total win while competitors betting limits is significant and positively related to both
Thalheimer & Ali (2008b)	The effect and magnitude of the smoking ban on slot coin-in	Seemingly unrelated regression (SUR)	Delaware racinos from 1996 to 2004	Smoking ban is significant and negatively related to coin-in with declines from 12.7% to 17.8%
Garrett & Pakko (2010)	The effect and magnitude of the smoking ban on gaming revenue and admissions	Multiple regression	Illinois casinos from 1997 to 2008.	The smoking ban has a significant and negative effect of 22% on revenue and a significant and negative effect on admissions

There are several reasons why casino management should be concerned about the effects of these policy changes. One, they need to understand the effect of these changes when they are considering expanding into new markets. If a new market incorporates some of the government regulations mentioned here, management needs to be aware of how operations may be affected. If a casino firm is already in a market, they also need to understand the potential effect if these policy changes occur. They may have to make some operational changes, such as staffing adjustments, to deal with the effect. If a casino is in a certain market and they have a competitor who is facing these new changes, management may also need to adjust even though the regulation is not directly effecting their operations.

Casino Operations Changes

Studies classified as casino operations changes include management's marketing decisions and amenity offerings that affect revenue or profit. This includes not only subjects that affect gaming win but revenue for the property as a whole, such as food and beverage and entertainment revenue. Studies that evaluate volume, which is a driving factor in revenue for a casino, have also been included.

Lucas and Brewer (2001) study slot coin-in at a Las Vegas locals' market casino for January 1 through June 30, 1998. Multiple regression analysis is run with independent variables for redeemed direct mail coupons, food covers, bingo headcount, number of free slot rooms, free slot tournaments, and major holidays, in addition to trend, seasonality, and lag variables. Food covers and free slot rooms are not significant but bingo headcount, direct mail coupons and free slot tournaments are significant and positively related to slot coin-in. The direct mail coupon and bingo headcount variables, though significant, have a minimal impact on slot revenue when converted from coin-in and an even smaller impact when converted to profit. The small increase in profit needs to be weighed against other expenses, which are not taken into account. These additional expenses may include increased labor in other departments or increased advertising expenses. The free slot tournament is the only variable that

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produces a significant effect on casino profit.

As an extension of Lucas and Brewer's (2001) study, Lucas and Bowen (2002) analyze the same data set with additional variables. The dependent variable is still slot coin-in, but the independent variables include slot tournament, bingo headcount, direct mail coupons, promotion day, and cash promotion amount. Two models are run, one with promotion day as an independent variable and another with cash promotion amount. Multiple regression analysis is run with additional variables for day of week and lags at the .05 level. In the first model all variables are significant except promotion day, which is a dummy variable indicating whether players could earn promotion entries on that day or not. In the model with cash promotion amount as the dependent variable, all variables are positive and significant. These results are not significantly different than the Lucas and Brewer (2001) study.

Another study evaluating direct mail offers is conducted by Lucas and Santos (2003), which also evaluated food covers. They study slot coin-in for three casinos: a Las Vegas locals' market casino and two river boats in the Midwest. The time period is slightly different for each casino but all are measured across 200 consecutive days in 1999 and 2000. Multiple regression analysis is employed with direct mail coupons, food covers, trend and seasonality indicators as independent variables. Food covers are found to be positive and significant in all models, with increases in coin-in ranging from \$201.59 to \$381.73 for each 1 unit increase in food covers. The direct mail coupons variable is only used in one of the boat models and like the previous studies (Lucas & Brewer, 2001; Lucas & Bowen, 2002) is found to be positive and significant.

Lucas, Dunn and Kharitonova (2006) investigated whether bingo headcounts, direct mail offers and lottery entry days affect slot coin-in. Two multiple regression models are run, each for a different locals' market casino, one in Las Vegas and one in Southern California. The Las Vegas data set includes 241 days in 2002 and the California data set includes 139 days in 2003, but both sets span June through October. In the Las Vegas casino model, daily bingo headcount is not significant in relation to aggregate daily slot coin-in. The only factors significant are the variables related to trend, seasonality or holidays. In the California casino model, two additional variables are added that are not available in the Las Vegas data set, cash mail offer and lottery drawing days. In this model neither bingo headcount nor cash mail offers are significant, but again the trend, seasonality and holiday variables are. The lottery drawing variable is significant at the .10 level. The California model is also run only evaluating coin-in from lower denomination slot machines of less than \$1.00. The same variables are found to be significant and not significant as in the Las Vegas model, but in this model the lottery variable is significant at the .05 level. This contradicts Lucas and Brewer's (2001) and Lucas and Bowen's (2002) studies, in which bingo headcount is significantly related to slot coin-in. It also contradicts the previous studies (Lucas & Brewer, 2001; Lucas & Bowen, 2002; Lucas & Santos 2003) in which direct mail offers are significant and positively related to slot coin-in.

Abarbanel, Lucas, and Singh (2011, in press) followed up on Lucas, Dunn, and Kharitonova's (2006) work, examining the relationship between slot machine coin-in and both sports book write and race book wagers, in addition to seasonality, holidays and sporting events variables. An ARIMA model is run, using a 250 day period in 2009. Neither sports book write nor race book wagers demonstrated a statistically significant relationship with slot coin-in, but like Lucas, Dunn, and Kharitonova's (2006) finding, trend, seasonality and holidays, as well as some sporting events. This finding contradicts what many in the casino industry had purported – that the sports book is a driver of revenues elsewhere in the casino.

Lucas, Dunn, and Singh (2005) also evaluate direct mail incentives but are concerned with particular players and the change in trip wagering volume instead of the casino

overall. The data evaluated is from a Las Vegas Strip property for all non-local customers who used a \$50 or \$100 free-play slot offer. This trip is compared to previous trips within the last three years, in which the customer did not have a coupon. Simultaneous multiple regression analysis is used with slot coin-in as the dependent variable. For the customers with the \$50 coupon there is a significant negative relationship to slot coin-in. In the model for customers who received \$100 coupons there is no significant relationship to slot coin-in. In addition to direct mail offers, the researchers look at par level changes between the trips to isolate the change in trip volume that is due to the direct mail offer. Lucas et al. (2005) find in both models that there is a significant negative relationship between par level and coin-in.

Direct mail offers to slot players typically lead to a significant increase in slot coin-in but only in locals' market casinos. Las Vegas Strip properties are typically destination resorts so direct mail offers for slots may not be a driving factor for gamblers. These customers may be more driven by the destination or amenities than the marketing promotion. Customers for a locals' market casino typically go to gamble and may not be going for a vacation, so they are typically driven to a property by the gaming offers. In addition, Las Vegas Strip properties generally have more table games play than local's market casinos. In 2010, slot win accounted for 86.4% of total gaming win for the Boulder Strip locals' market in Nevada, while on the Las Vegas Strip slot win only accounted for 48.3% of total gaming win (Nevada State Gaming Control Board, 2011). Las Vegas Strip customers may not be as driven by a slot promotion as a locals' market player.

Proposed Hypotheses.

P₄: In U.S. casinos that cater to a locals' market, direct mail slot offers will increase slot volume and win.

A common table games marketing promotion is match play coupons. Lucas (2004) studies a Las Vegas Strip property from February 1, 2001 to September 10, 2001 using multiple regression analysis. The dependent variable is blackjack cash drop and the main independent variable is match play coupons redeemed. The model also includes variables for trends, seasonality, lags, and holidays. Results show there is a significant negative relationship between match play coupons and cash drop. For every \$1 increase in match play coupons redeemed there is a decline in blackjack cash drop of \$8.99. Although there is a significant relationship it is opposite of what management believes. Due to the limited amount of research on this area a direction of the effect could not be hypothesized and would require more research.

Proposed Hypotheses.

P₅: Match play coupons affect cash drop in table games.

In addition to marketing promotions that management can use to try and drive business, they are able to make decisions at a gaming unit level such as how much a slot machine can hold or the location of the machine. A high level of hold, or par level, means the slot machine has a larger house advantage and does not pay back as much to players as a lower par level machine. There are several studies looking at the effects of par level and machine location on slot coin-in.

Lucas and Roehl (2002) evaluate \$0.25 video poker machines in a Las Vegas locals' market casino over 100 days in 1999. Simultaneous multiple regression analysis at the .05 alpha level is conducted. The study is mainly concerned with slot location on the casino floor, manufacturer, pay tables, par, and physical machine configuration. In this study, machines with a higher par level produce less coin-in than those with lower par levels, the same results Lucas et al. (2005) found. Slot win is not evaluated so it is not known if coin-in decreases, but slot win stays the same due to the higher par level or if

coin-in and win both decrease. The four locations closer to the center of the casino have a significant positive relationship to coin-in. The locations on the perimeter of the casino do not produce a significant effect on coin-in. Bar-top machines, in which the screen is flat and typically located in a bar, and slant-top machines, in which the screen is angled at about 30 to 45 degrees, both produce a negative significant relationship to coin-in.

Similar to Lucas and Roehl (2002), Lucas, Dunn, Roehl and Wolcott (2004) are also concerned with slot machine location and characteristics, but only for \$1.00 reel machines at a Las Vegas Strip property. Multiple regression analysis at the .05 alpha level is employed for 250 machines over a 182 day period in 2001. Results show that an increase in slot machine hold percentage does not have a significant effect on coin-in. Since slot win is coin-in multiplied by par level, an increase in par level, with no change in coin-in, will increase win. While coin-in for this study does not significantly change, win will increase with an increase in par level, although Lucas et al. (2004) do not study the effect on win to see if the increase is significant. These results are opposite of what Lucas and Roehl (2002) and Lucas et al. (2005) find. Compared to the Lucas and Roehl (2002) study, Lucas et al. (2004) evaluate a different type of slot machine. In addition, there is a belief among casino management and players that video poker players are more sophisticated and can notice a change in par more than a customer playing reel machines, which are luck-based and include no strategy. Lucas and Roehl (2002) study also considers a locals' market in Las Vegas, whereas this study is concerned with the tourist market. The level of sophistication in reel slot players may be a factor with local market players being more sophisticated because they gamble more often and are able to tell if there is a par change. Lucas et al. (2004) and Lucas et al. (2005) both evaluate a Las Vegas Strip property, but in Lucas et al. (2005) the type of slot machine played is not known which could contribute to the conflicting results. This contradiction may also be due to the fact that the customers included in the Lucas et al. (2005) study have an additional coin-in of over \$950 for the \$50 group and \$1,700 for the \$100 group as compared to those customers who did not receive the direct mail offer so these players may be more sophisticated because they play more often. In terms of the location variables, Lucas et al. (2004) find that machines located closer to the table games area produce significant positive effects on coin-in. Similar to Lucas and Roehl's (2002) study, slant-top machines have a significant negative relationship to coin-in.

Another study on par level changes is concerned with the effect of par changes on theoretical win instead of coin-in for a U.S.-based destination casino (Lucas & Brandmeir, 2005). The dependent variable is theoretical win per unit per day (TWPU) and is used instead of actual win due to short term fluctuations in actual win. There are two different par levels, 5.0% and 7.5%; a dummy variable is used to represent this change, which occurred in 2003. There are 38 \$5.00 reel games evaluated over a period of 153 to 245 days, depending on the machine. The only change in these machines is their par. The location, game type, cabinet, etc. is not changed. This study uses an alpha of .10 due to its exploratory nature. Results of the study find an increase in par does not have a significant effect on TWPU. The authors note this may support management's theory that reel slot players cannot notice a change in the par level from 5.0% to 7.5% but this may also support the idea that players at a destination resort may have a set spending limit and they are not playing beyond that. The study found that players are losing their bankroll faster due to the higher par level, but are not necessarily spending more.

Changes in a slot machine's par level have differing effects on coin-in and win depending on the type of machine (video poker or reel), denomination and potentially which market the casino is in. Video poker players are typically considered more sophisticated players and can notice a change in par level so when par levels are increased, coin-in will decrease. Whether the decrease in coin-in causes win to significantly change is unknown. Additional research with two models, one for coin-in and one for win, on the same dataset would test this effect.

Proposed Hypotheses.

P₆: For video poker machines, an increase (decrease) in par level will decrease (increase) coin-in.

Reel machine players are considered less sophisticated than video poker players and casino management believes they do not notice a change in par level. Previous studies show that an increase in par decreases coin-in but win remains unchanged since customers are only playing their bankroll and not more. More research should be done to further modify these propositions to hypothesize if different customers such as low-end or high-end or different markets such as local or destination will generalize support different results.

Proposed Hypotheses.

P₇: For reel machines, an increase in par level will decrease coin-in but win will remain unchanged.

As an extension of the Lucas and Roehl (2002) and Lucas et al. (2004) studies, Lucas and Dunn (2005) study variables specific to slot machines. Location is evaluated as in previous studies but instead of evaluating the entire area of machines, Lucas and Dunn (2005) evaluate the location of the specific machine, such as on an aisle or located on the end of a bank of machines. Other location descriptive variables, such as ceiling height and presence of signage are also included. Individual game specifics, such as the top awards, game platform, standard deviation, maximum allowable coins and if the machine is a slant-top or not are also evaluated. Lucas and Dunn (2005) evaluate coin-in for 166 \$0.25 reel slot machines from a Las Vegas Strip casino for 91 days in 2002. Results from the multiple regression analysis show that coin-in significantly increases when the ceiling height is higher, the machine is located on the end of a bank and the machine is on a major aisle. Coin-in significantly decreases when standard deviation increases, when the top award on the machine increases and with higher maximum allowable coins. These results should help casino management when determining the layout of the slot floor.

Using the same dataset as Lucas and Dunn (2005), Lucas, Singh, Gewali, and Singh (2009) further analyze the data by including numerous new variables including those concerned with distance from a location. Distance variables include distance from a casino entrance and number of banks between the particular game and an aisle. The 19 independent variables have high correlation so principal component regression is utilized with 12 principal components in the final model. Utilizing the additional variables and principal component regression, the R² was increased from 64.0% in the Lucas and Dunn (2005) model to 81.5%. This study also gives casino management a visual representation of the slot floor in which they can analyze overperforming games in low coin-in per unit areas.

In terms of slot machine locations, two proposed hypotheses are presented. Results for slot machines on an end-unit or on a major aisle have shown an increase in coin-in. This increase may be attributable to the fact that these machines are easier for customers to get to so they are played more often. Another explanation may be that customers do not feel as confined at these machines since they only have a neighboring machine on one side or they have no machines directly behind them and they may be playing longer. This could also be the reason high ceiling height also leads to an increase in coin-in. Slot machines that are located closer to the center of a casino or near the table games area generally produce more coin-in. The reason for this may be the fact that the higher energy makes customer stay longer.

Proposed Hypotheses.

P₈: Slot machines that are end-units or on a major aisle have higher coin-in.

P₉: Slot machines that are closer to “the action” produce higher coin-in.

Prior research hypothesized, based on retail research, that the more comfortable a customer, is the more money they will spend. This is the belief and reason why casino management typically put in slant-top slot machines. While there have only been three known studies on this slot machine setup, two of those studies indicate a significant negative relationship, while the third does not indicate a significant relationship. A potential reason for this may be if customers are too comfortable, they spend more time socializing and less time gaming. Observations will help answer this question. While one study shows that bar-top machines produce a significant decrease in coin-in, this is what management expects and they put bar-top machines in to generate some play while customers are at the bar.

Proposed Hypotheses.

P₁₀: Slant-top slot machines have decreased coin-in.

A slot machine's standard deviation is the volatility in the game's outcome. A higher standard deviation means the machine has a wider range of outcomes from the expected par level. A greater standard deviation means that customers will lose their bankroll faster than a machine with a smaller standard deviation. The only studies on standard deviation are concerned with coin-in and not win. A further analysis could be done to see if the decrease in coin-in still increases win or left win unchanged.

Proposed Hypotheses.

P₁₁: As a machine's standard deviation increases, coin-in decreases.

One of the largest expenses for a casino after payroll and gaming taxes is promotional allowances, or comps, which are the free gaming and non-gaming items given to players. Promotional allowances are granted at management's discretion or on play, which is based on a predetermined pay schedule which management sets up and can revise. McGowan and Brown (2009) analyze whether promotional allowances increase gross revenue. The study looks at annual data for five casino companies - Boyd Gaming Corporation, Las Vegas Sands Corporation, MGM Mirage, Pinnacle Entertainment, Inc. and Harrah's Entertainment - from 1999 to 2008. Companies are evaluated using linear regression with gross revenue as the dependent variable in one model and gross gaming revenue in the second model. The study finds promotional allowances are highly correlated with gross revenue and gross gaming revenue for all five companies.

Casino accounting rules require promotional allowances to be included in gross gaming revenue. An increase of \$1 in promotional allowances must have an increase of \$1 in gross gaming revenue with everything else being equal. Additional research should be conducted to analyze what effect promotional allowances have on a casino firm's performance such as net revenue or net income and not just gross gaming revenue.

Proposed Hypotheses.

P₁₂: An increase in promotional allowances will increase gross gaming revenue.

Bingo and sports books are not the only amenities researchers have evaluated for their effect on casino performance. Food and beverage outlets, showrooms, and new amenity offerings have also been studied. Tanford and Lucas (2011) analyze the effect of casual restaurant patrons on slot coin-in from \$0.25 machines or less and cash drop. Two casinos with differing types of gaming customers over 182 days in 2009 are evaluated using simultaneous multiple regression. For the destination casino, results show that a one unit increase in restaurant covers produces a significant increase in slot coin-in of \$84.32 and a significant increase in cash drop of \$6.19. For the locals casino, results show that a one unit increase in restaurant covers produces a significant increase in slot coin-in of \$875.29 and a significant increase in cash drop of \$39.66. The effect on coin-

in is similar to the results from Lucas and Santos (2003). The authors estimate the annual gaming profit from this increase in volume to be over \$2.8 million for the destination casino and \$19.2 million for the local casino over the 182 days. Following a drop during the recession, gaming volumes started to pick back up in 2009, and some of the effects attributed to the casual restaurant may have been due to increase in people gambling more and spending more in restaurants. The time period is important in this study and should be analyzed in more detail.

Suh and West (2010) conduct multiple regression to determine if showroom headcount affects daily food and beverage revenue for casino-operated restaurants at a Las Vegas Strip property. Results show showroom headcount is significant and positively related to food and beverage revenue. Each additional showroom customer increases food and beverage revenue \$6.96. The key to this study is revenue may increase, but it is not known if casino profits also increase. Casino restaurants typically have a very low profit margin so a significant but small increase in revenue may not equate to a significant change in profit. The converse may also be true; the restaurants may have room for the additional food and beverage covers without increasing additional expenses besides food cost. Additional research should be conducted to understand the restaurant operations in this casino and if the increase in revenue also increases profits.

Suh and Lucas (2011) also study two Las Vegas Strip properties in 2004 and 2005 using time series multiple regression analysis at the .10 alpha level to see if showroom headcount affects slot coin-in or cash drop. Each is run as a separate model with an independent variable of paid showroom headcounts in addition to day of week and holiday dummy variables. Complimentary tickets are excluded from the headcount variable. Casino 1 produces a positive and significant relationship between showroom counts and cash drop and coin-in. Casino 2 does not have a significant relationship between showroom counts and coin-in, but does have a significant and positive relationship to cash drop. This study could be further analyzed excluding complimentary tickets, since complimentary tickets typically represent gaming players and they would increase the gaming volume for the day. The researchers could also exclude the tracked gaming play from any of the players who had complimentary tickets to make the showroom tickets sold and gaming play more comparable.

Lucas and Tanford (2010) analyzed the effect of a new amenity on both slot coin-in and table games drop. Using time series analysis, the authors evaluate the addition of an indoor pool complex that converts to a nightclub at an Atlantic City casino. Results show slot coin-in is not significantly affected by the opening of the new venue. Table games drop is significant and positive, with the casino producing an additional \$150,550 in table games drop on days the pool is open. The authors do not convert this volume to casino profit, but using the percentages from the destination market casino in the Tanford and Lucas (2011) study, this \$150,550 in table games drop converts to \$5,829 in table games profit every day the pool is open.

In all studies, except those concerning bingo and sports books, results consistently indicate that adding a new venue or increasing volume in a venue or outlet will increase revenue in the casino or other outlets. Depending on the amenity or outlet the gaming effect may increase table games but not slots, slots but not table games, or both. The most important thing for management to understand is the market they are in and their customer base, when attempting to determine if slots or table games will significantly increase. Just adding a new venue or outlet will not increase revenue if this is not taken into account. This validates casino management belief that generating foot traffic will generate more revenue, but goes further and says increasing foot traffic alone may not accomplish increased revenue, but increasing sales from that foot traffic will.

Proposed Hypotheses.

P₁₃: An increase in volume at a property outlet will increase revenue in the casino or other outlets.

Table 2 contains a summary of the studies concerned with operational changes in casinos.

Table 2
Studies Concerning Casino Operations Changes

Author(s)/ Year	Focus	Method used	Sample	Results
Lucas & Brewer (2001)	The effect of different marketing offers/promotions and amenities on coin-in	Multiple regression	Las Vegas casino from January 1 to June 30, 1998	Food covers are not significant but bingo headcount, direct mail offers and free slot tournaments are significant and positively related to coin-in
Lucas & Bowen (2002)	The effect of different marketing offers/promotions on coin-in	Multiple regression	Las Vegas casino from January 1 to June 30, 1998	Bingo headcount, direct mail offers, and cash promotion giveaways days are significant and positively related to coin-in but promotion earning days are not significant
Lucas & Roehl (2002)	The effect of a machine's par level, location and physical configuration on coin-in	Simultaneous multiple regression	\$0.25 video poker machines at a Las Vegas local's casino for 100 days in 1999	Par level, bar-top, and slant-top machines have a negative and significant relationship to coin-in while machines located closer to the center of the casino have a positive significant relationship with coin-in
Lucas & Santos (2003)	The effect of food covers and direct mail offers on coin-in	Multiple regression	A Las Vegas property and 2 Midwest riverboat properties over a 200 day period	Food covers and direct mails offers are significant and positively related to coin-in
Lucas (2004)	The effect of match-play coupons on blackjack cash drop	Multiple regression	Las Vegas Strip property from February to September, 2001	Match-play coupons have a significant and negative effect on cash drop
Lucas et al. (2004)	The effect of a machine's par level, location and physical	Multiple regression	250 \$1.00 reel machines at a Las Vegas Strip property for 182	There is no significant effect on coin-in with an increase in par levels

Author(s)/ Year	Focus	Method used	Sample	Results
	configuration on coin-in		days in 2001	but machines closer to table games produce a significant increase in coin-in and slant-top machines produce a significant decrease
Lucas & Brandmeir (2005)	The effect of an increase in a machine's par level on theoretical win	Multiple regression	38 \$5.00 reel machines at a US casino over 153 to 245 days in 2002 and 2003	There is no significant effect on win per unit per day with an increase in par levels
Lucas & Dunn (2005)	The effect of micro-location variables on slot machine coin-in	Multiple regression	166 \$0.25 reel slot machines at a Las Vegas Strip casino in 2002	There is a significant positive relationship to coin-in for the three machine location variables and those games considered popular, while there is a significant negative relationship to coin-in for the standard deviation, top award and maximum coin variables
Lucas et al. (2005)	The effect of direct mail offers on a players trip volume	Simultaneous multiple regression	Slot players at a Las Vegas Strip property who redeemed \$50 or \$100 offers	For players who receive a \$50 coupon there is a significant and negative relationship to coin-in but not for players who receive \$100 and both models produce a significant negative relationship between par level and coin-in
Lucas et al. (2006)	The effect of bingo headcounts, direct mail offers, and lottery promotions on slot coin-in	Multiple regression	1 Las Vegas local's casino and 1 Southern California casino for 2002 to 2003	Bingo headcount is not significant and at the California property, direct mail is also not significant, but the lottery promotion is significant and positive
Abarbanel et al. (2011, in press)	The effect of sports book write and race book wagers on slot coin-in	ARIMA	1 Las Vegas local's casino in 2009	Neither sports book write nor race book wagers is significantly related to sot coin-in

Author(s)/ Year	Focus	Method used	Sample	Results
Lucas, Singh, Gewali, & Singh (2009)	To improve the Lucas and Dunn (2005) model and to map the slot floor analyzed	Principal Component Regression, Partitioning, and Voronoi Diagrams	166 \$0.25 reel slot machines at a Las Vegas Strip casino in 2002	Improve the R ² on the Lucas and Dunn (2005) model from 64% to 81.5% and produce a slot floor map with the overperforming and underperforming machines labeled
McGowan & Brown (2009)	The effect of promotional allowances on gross revenue and gross gaming revenue	Multiple regression	5 gaming companies from 1999-2008	Promotional allowances are highly correlated to both gross revenue and gross gaming revenue
Lucas & Tanford (2010)	The effect of opening new a pool complex on slot coin-in and table games drop	Time series multiple regression	Atlantic City casino over 495 days in 2006 and 2007	The pool complex did not have a significant effect on slot coin-in but did have a significant and positive effect on table games drop
Suh & West (2010)	The effect of showrooms headcounts on food and beverage revenue	Multiple regression	Las Vegas Strip property for 226 days in 2005	Paid showroom headcounts are significant and positively related to casino-operated food and beverage
Suh & Lucas (2011)	The effect of paid showrooms headcounts on slot coin-in and cash drop	Time series multiple regression	2 Las Vegas Strip properties from 2004 and 2005	One casino showed a positive and significant relationship between paid headcounts and coin-in and drop, but the second casino only showed a significant and positive relationship with cash drop
Tanford & Lucas (2011)	The effect of casual restaurant covers on low-end slot coin-in and cash drop	Simultaneous multiple regression	2 casinos over 182 in 2009	Both casinos have a positive and significant effect on low-end slot coin-in and cash drop from casual restaurant covers

Most operational research is based on one to three property samples so the results

may not be generalizable. Also, the biggest concern with operational analysis is access to data, which is probably why there are not more studies in this area. In 2010, there were 342 casinos in Nevada and 939 land-based, riverboat, racetrack and tribal casinos in the United States, so there is plenty of data as long as researchers can obtain access (American Gaming Association, 2011a; Nevada State Gaming Control Board, 2011). Also, the large number of casinos shows the importance of this type of research on casino profits. Gaming companies in the past have been reluctant to release proprietary information but some are becoming more amenable to the idea, and this will only bridge the gap in the literature and perhaps make the studies more generalizable as they are replicated in more jurisdictions and markets.

There are also minimally publicly traded gaming companies as compared to hotels and restaurants, so the amount of public financial data available is limited, which limits the amount of research that can be conducted. In addition, there is a lot of turnover in terms of whether a company is public or private which decreases the already small sample even smaller. For instance, between 2007 and 2008, Station Casinos, Inc. and Caesars Entertainment, formally Harrah's Entertainment, both went private. In 2010, both companies considered going public again, but neither did. Mergers, acquisitions and sales affect the gaming industry frequently, which makes comparison over years a little more difficult. For example, MGM Resorts International in the last 10 years bought two of the largest publicly traded companies, Mirage Resorts in 2000 and Mandalay Bay in 2005, but they also sold off individual properties such as the Golden Nugget and Treasure Island.

Conclusion and Recommendations

There has been a steady increase in gaming policy changes and operational studies over the last fifteen years, with most occurring in the last ten, but the amount of gaming research still lacks compared to other hospitality sectors. The studies described above that affect a casino's revenue or profit have been analyzed to get an understanding of what has occurred and where the gaps are in the research. Throughout this paper there have been recommendations of how some of these studies could be modified and reexamined. Propositions based on previous research results have also been given to aid additional research in the future. These propositions are listed in summary in Table 3. In addition to these recommendations, there are a few areas in which more studies could be done to further bridge the gap.

Table 3
Proposed Hypotheses

P	Proposed Hypothesis
1	An increase (decrease) in government imposed gaming limitations will decrease (increase) casino gaming win.
2	An increase (decrease) in competitors will decrease (increase) an individual casino's gaming win.
3	An implementation of a ban on what customers can do while gaming will decrease casino volume and win. As these bans are lifted, casino win will increase.
4	In U.S. casinos that cater to a locals' market, direct mail slot offers will increase slot volume and win.
5	Match play coupons affect cash drop in table games.
6	For video poker machines, an increase (decrease) in par level will decrease (increase) coin-in.
7	For reel machines, an increase in par level will decrease coin-in but win will remain unchanged.
8	Slot machines that are end-units or on a major aisle have higher coin-in.
9	Slot machines that are closer to "the action" produce higher coin-in.
10	Slant-top slot machines have decreased coin-in.
11	As a machine's standard deviation increases, coin-in decreases.
12	An increase in promotional allowances will increase gross gaming revenue.
13	An increase in volume at a property outlet will increase revenue in the casino or other outlets.

One important and neglected area for future inquiry is mixed methods research, with a focus on consumer behavior in the gaming industry. While there has been similar research done on what customers believe this has not been mixed with what they actually do. Qualitative studies, such as observations, added to quantitative analysis would add tremendous value to the research. Observing what customers do and how they move around the casino floor and through amenities while also tracking their spending would allow casino management to better understand their customers and how to increase revenue from them.

One important and neglected area for future inquiry is mixed methods research, with a focus on consumer behavior in the gaming industry.

A second area for future research is analyzing financial ratios from an empirical standpoint. There are numerous studies concerning financial analysis in gaming but these have no hypotheses and are case study format. While this is informative, broadening this to an empirical study would decrease the literature gap. Analyzing how casino ratios affect the success of the firm would help management and investors evaluate management's effectiveness.

A third area for future research is to increase the amount of research in operational changes. While this area has progressed there is still not enough to make generalized statements. The studies evaluated could be replicated in new jurisdictions and across more casinos. Additional research areas could analyze, for example, the effect of changing restaurant hours, adding entertainment, changing policies in how customers earn complimentary and where they can redeem them, and changing the layout of the casino floor. Many casino managers believe they should do things the way they have always been done because it has always worked. By increasing the empirical studies that look at these areas, academia could offer support to management's beliefs or debunk them and offer answers to what may really be happening.

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