The Impact of Local
Economic Conditions on Casinos Revenues

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ABSTRACT

While gaming as an industry like most other industries was negatively affected by the severe economic downturn in 2007 and 2008 it has continued to suffer during the anemic recovery. However different gaming destinations have suffered at different rates. This paper reviews the fall and rise of gaming revenues in the three major destination gaming areas of the United States. We look at the relationships of local GDP, Unemployment Rates, and Housing Values Continually to gaming revenues.. Over the last 5 to 6 years the belief that gaming revenues at destination gaming sites were immune to local economic distortions has come into question. The truth may very well just the opposite and that the economic magnification effect of local conditions has just been hidden under the pre- recession long term increase in gaming tourists. Hence during boom times local economies within gaming destination areas preform much better that the national average while during recessions local economies relying on casinos as economic drivers preform much worse that the national average.

This follows the findings (Flanegin et. al. 2009 and), of significant impact of national GDP, unemployment rate, inflation rate, Misery Index and stock market returns on the gaming revenues of the major U.S. casino destinations: Atlantic City, the Las Vegas Strip, Downtown Las Vegas, Laughli/Reno and Boulder City

INTRODUCTION

The Business Cycle Dating Committee of National Bureau of Economic Research (NBER) is generally accepted as the authority for dating US recessions. The NBER defines an economic recession as "*a significant decline in [the] economic activity spread across the country, lasting more than a few months, normally visible in real GDP growth, real personal income, employment (non-farm payrolls), industrial production, and wholesale-retail sales.*" (www.nber.org/cycles/recessions.html) According to NBER, after WWII US economy has gone through eleven business cycles, with average recession lasting eleven months. However, the latest recession started in December of 2007 and ended in June of 2009, spanning eighteen months. While this follows the academically accepted terminology of recessions and recoveries the current "recovery" has been the most anemic on record and the only one in more than 100 years, which the unemployment rate has remained above 7%. In addition the 2006/2007 correction in housing market, (*According to David Lereah, chief economist for National Association of Realtors, housing prices peaked and real estate market boom ended in August of 2005*) and the collapse of the subprime mortgage industry in March of 2007, in December of 2007 the US economy entered the longest lasting recession since the stock market and economic crash of 1929-1933. (*www.nber.org/cycles.html*) The fact that most all major US trading partners simultaneously went through their own recession introduced additional problems which have slowed down the recovery despite aggressive and government intervention.

Until the most recent recession the widespread belief, based on continuously increasing revenues generated in ever larger and more opulent casinos, was that gaming revenues in general, and especially those on the Las Vegas Strip, were recession proof. Although odds of casinos' win vary, with every game and machine, they are always on the side of the house and over the long term the statistics of gaming guaranty hefty profits for casinos.

Recently several articles in the popular press reported the significant decline in casino revenues even after the recession officially ended in June of 2009. The gaming revenues of Atlantic City have never recovered, as seen by in fact they have continued to decline to the point
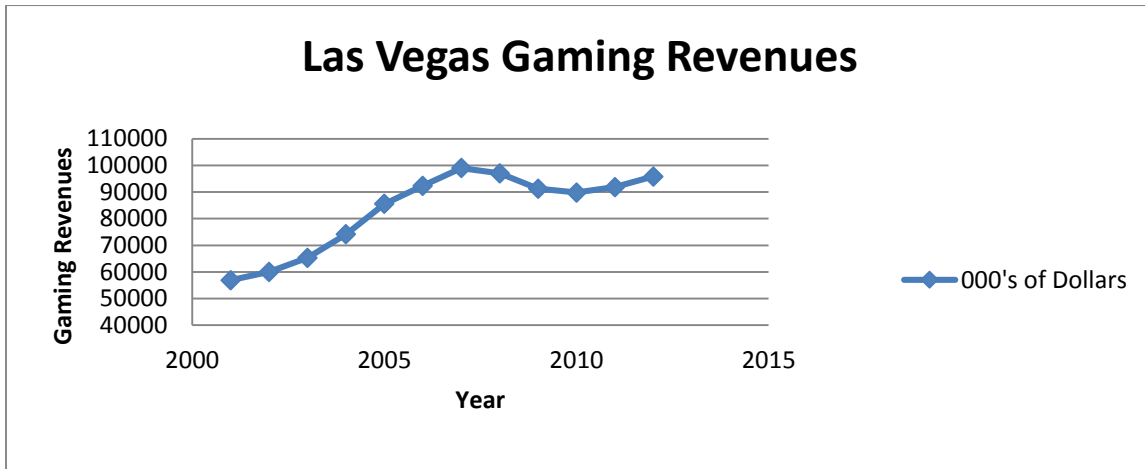
Graph # 1 Atlantic City Gaming Revenues
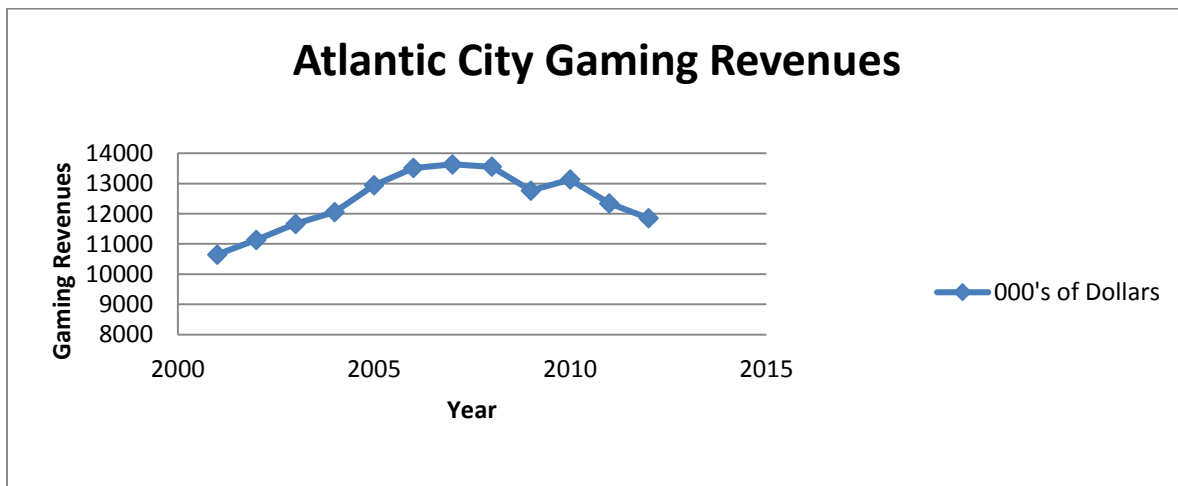
that according to Brian Pempus of CardPlayer.com " Pennsylvania last year overtook New Jersey as the second most lucrative gambling market in the United States. The top spot still belongs to Nevada, which took in $10.8 billion last year in gaming revenue, and that should increase slightly in 2013". As seen

below, Graph # 2, and also reported by Brain Pempus the fortunes of Las Vegas over this recovery period have far outpaced those of Atlantic City with a 7% increase in 2011 and a 4% increase in 2012.

Graph # 2 Las Vegas Gaming Revenues

Lastly we look at Reno, Graph 3 below and as we compare the three graphs we realize this is really a tale of three cities. Atlantic City's decline not only in gaming revenues as shown on Graph# 1, but in every area of economic vitality. While in Las Vegas gaming revenues have regained some of their sparkle with yearly increases over the past three years. Finally Reno, just holding on with an increase in gaming revenues of only 1.1% last year which in truth does not even make up for inflation.

Graph # 3 Reno Gaming Revenues
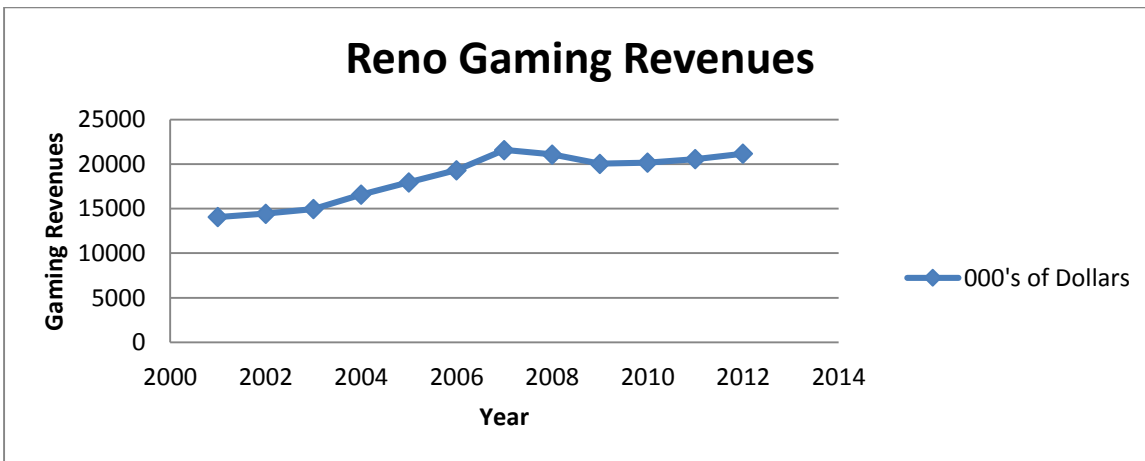
Because of scaling issues, Las Vegas has far greater gaming revenues than Reno or Atlantic City we have provided the three graphs above, however a clearer picture may be obtained by converting the dollar revenues into a rate of change percentage. With all three gaming areas now "normalized" they can be combined onto one graph. Graph 4 below shows that while all three gaming markets had negative growth

during the recession years of 2007 to 2010, both Las Vegas and Reno had crossed over to positive growth by 2011. Only in Atlantic City has growth remained negative. In fact Atlantic City has had a decrease in gaming revenues every year since 2006.

Graph 4 Gaming Market Revenues Annual Rate of Change
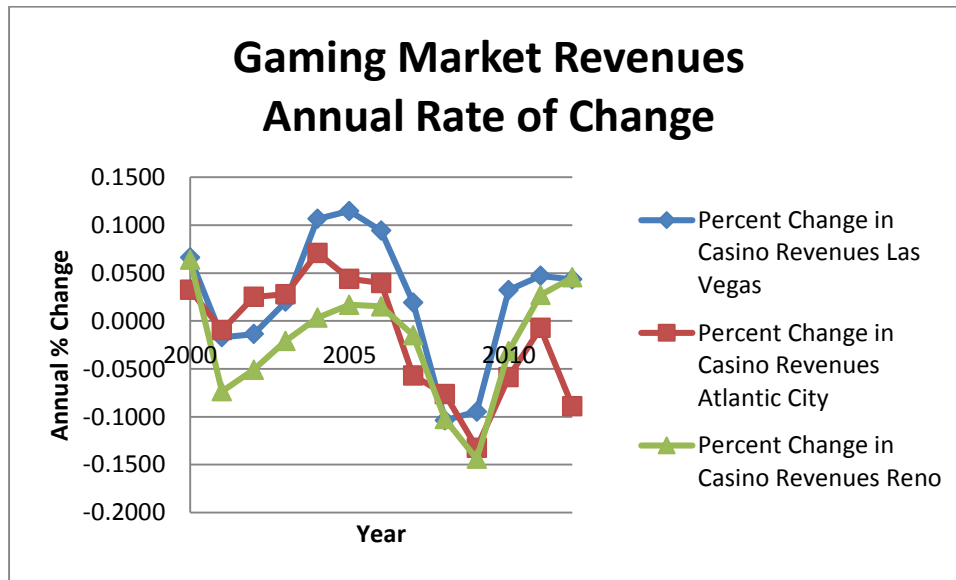
We believe the three cities shown above provide best case, worst case and average case examples of gaming revenue changes since the beginning of the last recession. To ascertain the extent of influence local economic conditions on casino revenues we analyzed the relationship between revenues for the major gaming centers listed above and nominal local Gross Domestic Product (GDP), (*www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=5&Freq=Qtr&FirstYear=2007&LastYe ar=2009*) local unemployment, and local housing market. We considered MSA (Metroplolatin Statistical Area) to be the best available measure of local economic conditions.

THE MODEL

Simple (ordinary least squares) univariate linear regression produces the slope and the intercept of a line that best fits data points, in our case the relationship between microeconomic factors and casino revenues, by reducing the sum of the squared differences between each data point and the forecasted line.

We analyze the proportion of variation in casino revenue, our dependent or Y variable, explained by the variation in macro-economic factors (our independent or X_i variables) in the following model:

$$Y_t = \beta_0 + \beta_1 X_{it} + \varepsilon$$

Y_t = The Dependent Variable (Casino win) in period t
X_{it} = The Individual Independent Variable (each of macro-economic factors) i in period t
$$\varepsilon = Error\ Term\ (\ assumed\ to\ be\ close\ to\ 0)$$
$$\beta_0 = the\ Y\ Axis\ \ Intercept$$
$$\beta_1 = The\ Slope\ of\ the\ Line$$

By assuming that the expected value of the error term (ε) is very close to zero, this then becomes the equation for a straight line. In addition to a contemporaneous comparison we believe there may very well be a lag period between the change in macro-economic factors and the change in casino win. This lag may be as little as three months, but is expected to be closer to one year as many casino visitors, especially for the Las Vegas Strip, plan vacations a year or more in advance.

The success of our model is measured by "Coefficient of Determination" r^2 also known as the "goodness of fit" statistic. The Coefficient of Determination reports the proportion of the variation in the dependent variable Y as a result of the introduction of the independent variable X. The range of r^2 is from 0 to 1.Thus, the closer r^2 is to 1 the larger proportion of the total variation of the dependent variable Y is explained by the independent variable X.

Another statistic, the correlation coefficient (r), is data sets easier to understand. It represents a much broader relationship and indicates how the two time series move together. If the correlation coefficient is +1 then they move exactly the same, a 10% increase in X is mirrored by a positive movement of 10% in Y. If the coefficient is -1 then the exact opposite is true, and if the coefficient is 0 then there is no relationship at all. Although it appears that the easiest way to calculate (r) is to take the square root of (r^2) that is not the case. Since the square root of any number can be positive or negative, reflecting the -1 to +1 range of (r) discussed above. To determine the correlation between two time series data sets, their co-variance must be standardized by the product of standard deviation (σ) of variables Y and X:

$$Correlation\ Coefficient\ r = Cov(Y,\ X) / (SD_Y * SD_X) = \sigma_{YX} / (\sigma_{Y*}\sigma_X).$$

As can be seen from the above equation, the Covariance can be negative or positive and hence the correlation coefficient can range from -1 to +1. The plus or minus sign is attached to the coefficient according to the relationship between two time series, illustrated by the slope of the fitted regression line. Based on economic theory we would expect casino revenues to have a positive relationship with GDP and housing values and a negative relationship to unemployment.

DATA

Due to the seasonal nature in both monthly and quarterly data especially in both local unemployment, and local housing markets we annualized all data. In addition we did not utilize just the annualized raw numbers, but calculated the change between years. By calculating the percentage change between years we the could compare the percentage change from year to year in GDP, Unemployment, and Housing values. The correlations coefficients of annual percentage changes, presented in Table 1, support our expectations.

Correlations of Revenue; Revenues from different gaming centers exhibit positive correlation among themselves. The correlations of both Reno and Atlantic city are relatively high and represent the overall gaming market. The correlation of Atlantic City with Reno is much smaller indicating these markets are much more local and have very little effect on each other.

Table 1: Correlations of Annual Percentage Changes in Casino Revenues and Local Economic Factors

	LV REV	AC REV	Reno REV	LV Unemplo	AC Unempl	Reno unempl	Lv Housing	AC Housing	Reno Housing	LV GDP	AC GDP	Reno GDP
LV REV	1.00											
AC REV	0.73	1.00										
Reno REV	0.87	0.53	1.00									
LV Unemployment	0.80	0.62	0.82	1.00								
AC Unemployment	0.74	0.38	0.82	0.87	1.00							
Reno Unemployment	0.82	0.56	0.81	0.99	0.88	1.00						
Lv Housing	0.83	0.86	0.61	0.69	0.58	0.65	1.00					
AC Housing	0.68	0.90	0.41	0.51	0.31	0.46	0.94	1.00				
Reno Housing	0.73	0.84	0.51	0.60	0.40	0.54	0.96	0.96	1.00			
LV GDP	0.79	0.88	0.59	0.56	0.41	0.51	0.93	0.92	0.91	1.00		
AC GDP	0.44	0.63	0.40	0.21	0.12	0.17	0.58	0.61	0.56	0.67	1.00	
Reno GDP	0.80	0.78	0.66	0.56	0.54	0.52	0.85	0.79	0.76	0.93	0.56	1.00

THE RESULTS

Results from contemporaneous regressions of annual percentage changes, presented in Table 2, indicate that only GDP and unemployment had statistically significant effects on casino revenues, but just in Boulder City and along the Las Vegas Strip. The impact of GDP was also statistically significant on casino winnings in Atlantic City. Consistent with theoretical predictions and correlation coefficients reported in Table 1, GDP had a positive and unemployment a negative relationship with casino revenues.

Table 2: Annual Percentage Change in Casino Revenues vs. Contemporaneous Local-Economic Factors

Local Economic Factor	Statistical Results	Las Vegas	Atlantic City	Reno	Combined
	R^2	.6283	.4027	.04343	.4896
GDP	t-stat	3.9001	2.4632	2.628	5.4538
	Prob	.00361***	.0359**	.02741**	.00005***
	R^2	.4147	.1526	.4624	.3101
Unemployment	t-stat	-3.7654	-1.898	-4.148	-5.3746
	Prob	.00121***	.0722*	.000497***	.000001***
	R^2	.3318	.3484	.1702	.2390
Housing Values	t-stat	3.1513	3.2701	2.0258	4.483
	Prob	.00502***	.00383***	.05632*	.00003* **

Level of significance 10%=*, 5%=**, 1%=***

It appears that all three economic factors, GDP, Unemployment, and Housing, have a significant relationship with Casino Revenues on an individual market basis.

- GDP is significant at the 1% level in both Las Vegas and at the 5% level in Reno and Atlantic City
- Unemployment is significant at the 1% level for both Las Vegas and Reno, and at the 10% level for Atlantic city
- Housing Values are significant at the 1% for Las Vegas and Atlantic city and at the 10% for Reno.

As shown above there appears to be a strong relationship between a majority of the variables within each individual market when all three markets are aggragated , i.e. GDP for all three markets compared to Revenues for all three markets, there is even a stronger relationship. Agragated GDP, Unemployement, and Housing are all significant at well beyond the 1% level.

While the contemporaneous results above show strong results we would be amiss if we did not take into account the possibility of a lagged effect. Many economic variables require a period of time to work through the economy. To test if there is a lag effect we employed a one period lag (1 year) of the economic variables which were then regressed against gaming revenues and presented in Table 3.

Table 3: Annual Percentage Change in Casino Revenues vs. 1 Period Lagged Local-Economic Factors

Local (Lagged) Economic Factor	Statistical Results	Las Vegas	Atlantic City	Reno	All Locations
GDP	R^2	.1726	.0005	.0469	.0927
	t-stat	1.2920	.0645	.6238	1.7216
	Prob	.2324	.9501	.5501	.09578*
Unemployment	R^2	.3814	.2201	..6110	.4392
	t-stat	-3.423	-2.3156	-5.462	-4.7659
	Prob	.0029***	.0319**	.00003***	.00004***
Housing Values	R^2	.1969	.1649	.0950	.2316
	t-stat	2.158	1.9376	1.4125	2.9571
	Prob	.0438**	.0677*	.1739	.00612***

Level of significance 10%=*, 5%=**, 1%=***

Lagging the economic variables by one year provides us with a slightly different picture with unemployment remaining the most significant variable.

- GDP is not significant at the individual level for any destination and only significant at the 10% level for the combination of locations.
- Unemployment remains significant at the 1% level for both Las Vegas, Reno and the combination, but increases to the 5% level for Atlantic city.
- Housing Values drop in significance for all three areas and the combination, but remain significant for the combination.

THE CONCLUSIONS

The above information indicates that the three economic variables are significant on a contemporaneous comparison both individually and on a combined basis. On an individual comparison basis 5 of the 9 pairwise comparisons are significant at the 1% while all three combined comparisons are significant at the 1% level. The significance of our relationships deteriorate when a 1 year lag period is added with only unemployment truly remaining significant with Vegas and Reno at the 1% and Atlantic City at the 5%. While when combined variables also remain significant with Unemployment and Housing Values at the 1% level and GDP at the 5% level, the probabilities of all variables increased.
Consistent with our predictions, unemployment has a negative relationship while the other two have positive relationships.

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