

Estimating the Impact of California Tribal Gaming on Demand for Casino Gaming in Nevada

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ABSTRACT

Since 1990, the California tribal casino industry has grown from a very small and insignificant industry to one with annual gross gaming revenues of about \$7.5 billion per annum by 2009. Over this same period, Nevada's gaming revenues grew from approximately \$5.0 billion in 1990 to \$10.4 billion in 2009, having declined from a peak of \$12.8 billion in 2007. Much of the recent decline in Nevada and especially Las Vegas can be attributed to the severity of the economic recession of 2007-2009. However, the major Northern Nevada destination resorts of Reno and South Lake Tahoe had experienced substantial slowdowns or contraction of their gaming industries since the advent of California tribal gaming in the early 1990s, as measured in a number of ways, including number of gaming devices, employment, and gross gaming revenues adjusted for inflation. Las Vegas, on the other hand, had experienced substantial real growth over this same period, until the Great Recession of 2007-2009, at which point it experienced a dramatic reversal of fortune.

This analysis estimates demand relationships for gaming activity in the major tourism markets in Northern and Southern Nevada, by specifying a number of variables that relate to the demand for gambling in these markets as well as noting monthly seasonal shifts. It also examines the competitive links between the expansion of California tribal gaming and the Nevada casino industry's economic performance. Regression analysis is utilized to establish the relationship between the growth and expansion of tribal casinos in California and the expansion or contraction of gaming in Nevada's major regions of Reno, Lake Tahoe, and the Las Vegas Strip.

Keywords: California tribal gaming, Nevada gaming demand, regression analysis, economic downturn

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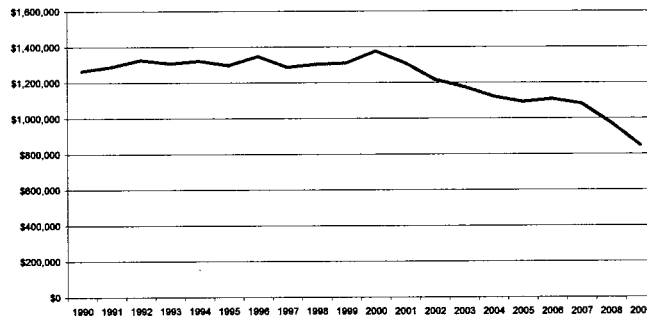
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I. GENERAL DESCRIPTION OF NEVADA'S GAMING MARKETS, 1990 TO 2007

Between 1990 and 2007, gaming revenues in Northern Nevada experienced flat or negative growth, whereas those in Las Vegas experienced robust growth throughout the 1990s, followed by slower positive growth since the turn of the century.¹ Beginning in late 2007, the negative growth of Northern Nevada gaming revenues accelerated, largely as a result of the 2007-2009 Great Recession along with openings or expansions of key major tribal casinos in Northern California.² When corrected for inflation, both of the major Northern Nevada gaming markets—Reno and South Lake Tahoe—experienced negative real growth, in terms of gaming revenues corrected for inflation, employment, and the number of stations available (positions at table games plus the number of gaming devices) for possible customers. These declines are documented in Charts 1-4.

CHART 1

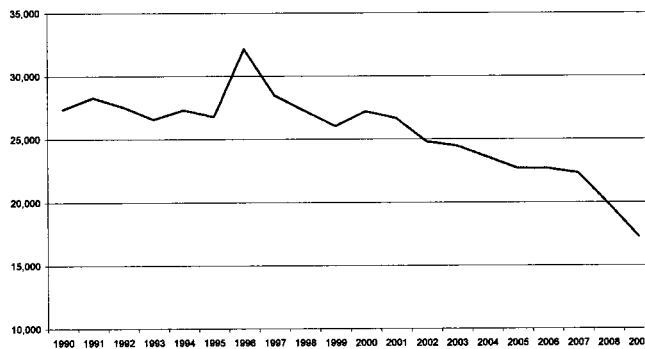
WASHOE COUNTY (RENO) REAL GROSS GAMING REVENUES 1990-2009 (2009 dollars)



Source: Nevada Gaming Control Board, *Monthly Revenue Report* (monthly, 1990-2009)

CHART 2

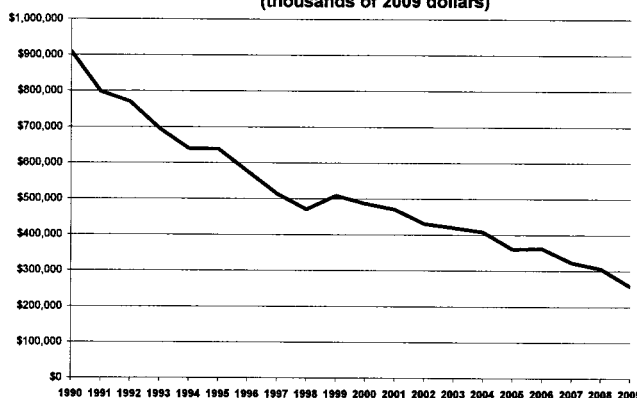
WASHOE COUNTY (RENO) CASINO EMPLOYMENT 1990-2009



Source: Nevada Gaming Control Board, *Nevada Gaming Abstract* (1990-2009)

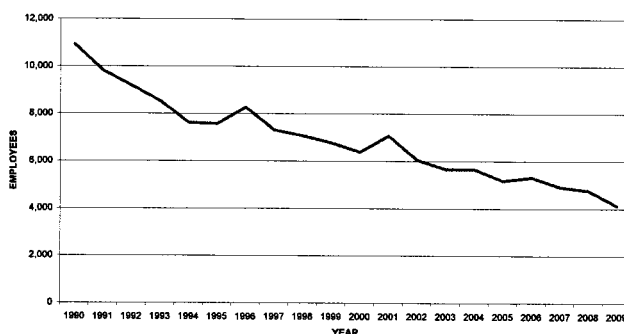
1. Nevada Gaming Control Board, *Nevada Gaming Abstracts* (annual), 1990 to 2009.
 2. Red Hawk Casino opened in Shingle Springs, on the main highway between Sacramento and South Lake Tahoe, in December 2008. Thunder Valley Casino, which had opened in Lincoln, about 10 miles from the main highway between Sacramento and Reno in 2003, completed a \$1 billion expansion with hotel and other amenities in June 2010.

CHART 3
SOUTH LAKE TAHOE
REAL GAMING REVENUES, 1990-2009
(thousands of 2009 dollars)



Source: Nevada Gaming Control Board, *Monthly Revenue Report* (monthly, 1990-2009)

CHART 4
EMPLOYMENT TRENDS,
SOUTH LAKE TAHOE CASINOS 1990-2009



Source: Nevada Gaming Control Board, *Nevada Gaming Abstract* (1990-2009)

By 2009, a number of major tribal casinos had opened in the Northern California market, competing directly for regional customers with the casinos in Reno and Lake Tahoe.

There are three factors that explain much of the stagnation and decline in the Northern Nevada casino markets. First, Lake Tahoe casinos were effectively constrained from expansions dating back to the passage of the Amended Tahoe Regional Planning Compact of 1980.³ This eliminated the construction of new casinos at South Lake Tahoe and put considerable constraints on the ability of existing properties to alter their physical facilities. Second and more importantly, Congress passed the Indian Gaming Regulatory Act in 1988⁴, and this eventually led to the creation of substantial tribal casino

industries in California, Oregon and Washington, as states signed compacts and tribes took advantage of their economic opportunities. By 2009, a number of major tribal casinos had opened in the Northern California market, competing directly for regional customers with the casinos in Reno and Lake Tahoe. Third, the period from 1989 until 2007 marked a wave of unprecedented growth and expansion of the gaming-based tourist industry in Las Vegas. The expansion of Las Vegas' mega-casinos, coupled with increasingly affordable

3. Public Law 96-551, December 19, 1980

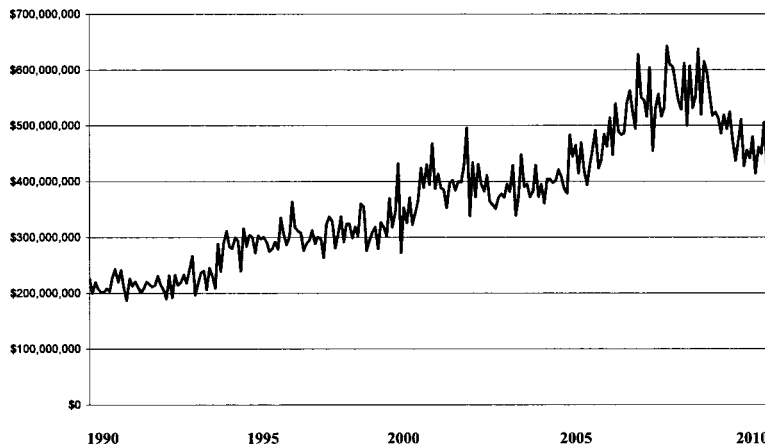
4. Public Law 100-497, October 18, 1988

air travel to Las Vegas, especially from major cities in the Western United States and Western Canada, made Las Vegas a reasonable alternative for traditional Northern Nevada gaming customers.⁵

The economic performance of the gaming market on the Las Vegas Strip, which makes up roughly half of the gaming revenues for the entire state of Nevada, had a considerably different history. From 1990 to 2007, the Strip was characterized by moderate to rapid growth in gaming revenues, with even more rapid growth in spending in non-gaming activities. In effect, Las Vegas Strip casinos expanded their non-gaming entertainment, convention, and leisure offerings in this period as a strategy to counter the emerging competition from California tribal gaming as well as the proliferation of casinos throughout the United States and Canada. Indeed, the ratio of gaming revenues to total revenues for Las Vegas Strip casino complexes with annual gaming revenues in excess of \$72 million declined from 56.9% in 1990 to 38.3% in 2009, reflecting a considerable broadening of the product offerings of the new generation of mega-casinos on the Strip. The multi-billion dollar casino resort complexes built since 1989 (including, for example, the Mirage, MGM, Bellagio, the Venetian, Wynn Las Vegas, etc.) substantially increased non-gaming spending for hotel rooms, restaurants, entertainment, retail shopping, and convention services, essentially diversifying Las Vegas Strip tourism away from a heavy dependence on gaming.⁶

However, from 2007 through 2009, the Las Vegas Strip experienced a pronounced reversal of trend with respect to both gaming revenues and non-gaming spending by visitors. In retrospect, consumers were far more income sensitive to the non-gaming offerings than had been expected prior to the Great Recession. This reversal can be seen in Chart 5, and is discussed in the following section.

**CHART 5
LAS VEGAS STRIP MONTHLY GROSS
GAMING REVENUES, 1990-2010**



Source: Nevada Gaming Control Board, *Monthly Revenue Report* (monthly, 1990-2009)

5. In contrast to Las Vegas, there were very few new casinos or casino expansions in Reno from 1990 to 2007, primarily because of the anticipated competition from California tribal gaming and the subsequently lower Expected Return on Invested Capital (EROIC). The only significant new project in this period, the Silver Legacy, opened in 1995 but did not grow the market in any significant way.

6. For a description of the major companies and developments during this period, see Christina Binkley (2008), *Winner Takes All*, New York: Hyperion Press.

II. THE GREAT RECESSION AND ITS IMPACTS ON NEVADA GAMING

With the Great Recession of 2007-2009, the economic performance of the casino gaming industry in each of Nevada's main tourist destinations—the Las Vegas Strip, Reno, and South Lake Tahoe—was dramatically and negatively affected.

With the Great Recession of 2007-2009, the economic performance of the casino gaming industry in each of Nevada's main tourist destinations—the Las Vegas Strip, Reno, and South Lake Tahoe—was dramatically and negatively affected. Furthermore, in the early period of recovery for the U.S. economy from the second half of 2009 through mid-2010, there was not much relief in the downward trends for Nevada's major tourist gaming markets. Over the thirty month period ending in June 2010, gaming revenues (in current dollars) fell 17.7%, 25.2%, and 32.8% in the Strip, Reno and Tahoe markets respectively. The secondary southern Nevada tourist destinations of Downtown Las Vegas and Laughlin declined by 20.4% and 23.9% over the same period.⁷

Other tourism indicators showed many of the same trends. For all of Las Vegas, average daily room rates fell 29.6% between 2007 and 2009, and occupancy rates declined from 90.4% in 2007 to 81.5% in 2009. Visitation fell 7.4% over that period, from 39.2 million visitors in 2007 to 36.3 million visitors in 2009, and visitors were spending less per capita on both gaming and non-gaming activities.⁸ For an industry that had seen multiple multi-billion dollar mega-casino resort properties developed over the past two decades, the decline in hotel room revenues was arguably more devastating on profitability and solvency than was the decline in gaming revenues. Indeed, this period saw significant bankruptcies (Station Casinos, Cosmopolitan, Riviera, Terrible Herbst, etc.), and postponed, bankrupt, or cancelled multi-billion dollar projects (Fontainebleau, Echelon Place, the Plaza, Crown, MGM-Kerzner, etc.), with all of the major Las Vegas Strip casino companies (Harrah's, MGM, Las Vegas Sands, Wynn, Boyd Gaming, Riviera, etc.) enduring severe financial turmoil from 2008 onward.

For an industry that many analysts and pundits had classified as "recession-resilient", if not "recession-proof", such dramatic declines surprised and shocked the major casino companies, the banks and other financial institutions that had financed much of the decade's expansion. Furthermore, the Nevada state government was disproportionately dependent on taxes on gaming revenues and retail sales to tourists for funding the state budget, and the decline in gaming revenues and visitor spending created a substantial fiscal crisis for the state.

In retrospect, spending on casino gaming and related activities proved to be far more sensitive to (substantial) economic downturns than had previously been believed. Furthermore, the ability of Nevada-style gaming-based tourism to bounce back has been painfully slow, and has lagged the recovery of the national U.S. economy. For the 12 months ended June 2010, statewide gaming revenues in Nevada were down by 4.3% over the comparable period in 2009, a period when the U.S. economy was expanding at about a 3.0% rate.⁹

The distinctions between Northern Nevada and Southern Nevada gaming industries can be seen by tracking the level of gaming activity against a broad index of economic activity. Handle¹⁰ for the Reno and Las Vegas gaming markets (using a 12 month moving average) was charted against a national Index of Weekly Leading Indicators (WLI)¹¹ with

7. *Monthly Revenue Reports*, *op. cit.*

8. Las Vegas Convention and Visitors Authority, Visitor Statistics, retrieved from <http://www.lvcva.com/press/statistics-facts/visitor-stats.jsp>

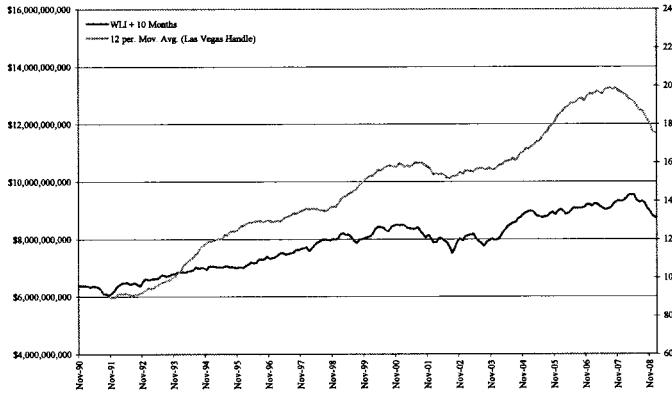
9. Estimate based on Bureau of Economic Analysis, estimated real GDP growth rates, 2009-III to 2010-II.

10. "Handle" is defined as the total amount of money wagered at gaming opportunities (i.e. tables and slot machines). It can be used as the total *quantity* of gaming services sold (standardized to a \$1 unit), whereas "House Advantage", which represents the percentage of each dollar wagered retained by the casino, is the equivalent of *price*. Gross gaming revenues, reflecting total winnings for the casino, are therefore the aggregate of House Advantage times Handle (*price times quantity*), added up over all gaming options within the casino.

11. The Weekly Leading Index (WLI) is published by the Economic Cycle Research Institute and is constructed of seven weekly economic series for the U.S.: money supply, Journal of Commerce-ECRI industrial materials price index, initial unemployment insurance claims, mortgage applications, the S&P 500 index, 10-year Treasury bond yield, and bond quality spread. More information on the WLI can be found at <http://www.businesscycle.com/>.

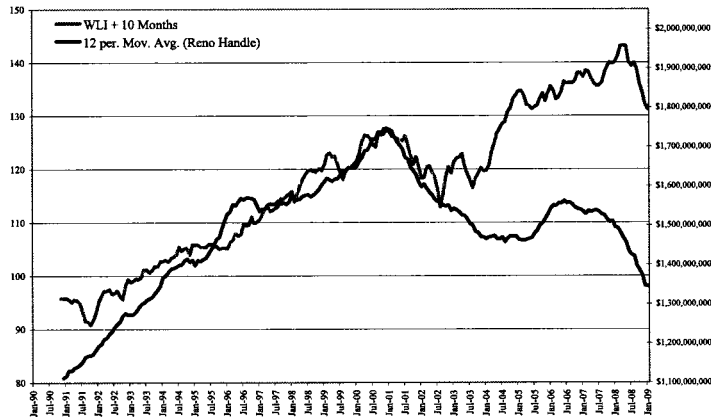
a 10-month lag, and the results are presented in Charts 6 and 7. Clearly, the Las Vegas experience correlates with the WLI series, but consistently outperforms it for most of the period, at least until the end of 2007. On the other hand, the Reno handle numbers show a strong correlation over the first portion of the period under study, but beginning in around 2002, Reno handle diverges dramatically from the direction of the Index, experiencing a general downward trend which then accelerates downward in 2007.

CHART 6
Las Vegas Handle Vs. WLI + 10 Months
 Jan 1990 - Jan 2009



Source: Nevada Gaming Control Board, *Monthly Revenue Report* (monthly, 1990-2009), and Economic Cycle Research Institute

CHART 7
Reno Handle Vs. WLI + 10 Months
 Jan 1990 - Jan 2009



Source: Nevada Gaming Control Board, *Monthly Revenue Report* (monthly, 1990-2009), and Economic Cycle Research Institute

III. PREVIOUS STUDIES

Over the years, there have only been a handful of demand and revenue studies that have looked specifically at the casino industry, or even more generally at other gaming and wagering industries. A number of early studies concentrated on estimating price elasticities for pari-mutuel wagering at horse race tracks, with the objective of estimating an optimal take-out rate (“house advantage”, or price) that would optimize total revenues accruing to the operator and to the government in taxes (Suits, (1979), Morgan and Vache

Estimating the Impact of California Tribal Gaming on Demand for Casino Gaming in Nevada (1979), Morgan and Vache (1982), Thalheimer and Ali (2003)). Cargill and Eadington (1978) looked at the time-series behavior of Nevada gaming revenues to evaluate forecasting outside the realm of causal models, and Levitsky et al (2000) examined the relationship of social attitudes toward gambling and gaming revenues.

Another group of studies, which looked specifically at the casino industry in various jurisdictions, estimated the effect of changing regulations, technologies, or other factors on the demand for gaming (Nichols (1998a), Nichols (1998b), Thalheimer and Ali (1992, 1995a, 1995b, and 2008)). Findings of these studies generally determined that relaxation of artificial regulatory constraints (i.e. casino floor space minimums per game) and introduction of new product delivery systems (i.e. telephone wagering) increases gaming revenues and the demand for gambling, whereas smoking bans have pronounced negative effects on the demand for casino gaming. Other studies have looked at competitive and cross-elasticity issues, examining the effect on demand of newly authorized cross-border competition with identical or similar forms of gambling, from the legalization of different forms of gambling (i.e. casinos) on existing gaming or wagering industries, or based on the “newness” of gaming facilities or their ability to differentiate product based on non-gaming amenities (Hunsaker (2001), Przybylski et al (1998), Thalheimer and Ali (2003), Thalheimer (1998), Lauve (2007)). This particular study most closely follows the approach of the last group of studies.

IV. MODELLING THE DEMAND FOR NEVADA GAMING

In general, the economic performance of casinos in a particular geographic market can be monitored by measuring the demand for gaming services. The quantity of gaming services sold can be measured by the metric of Handle (computed as Gross Gaming Revenues divided by House Advantage, which serves as a measure of the average price of gambling).

The demand for gaming services is a function of a number of factors, including:

- proximity to the customer base (both local and tourist);
- the level of income and wealth of the potential visitor population;
- price of gaming and complementary non-gaming offerings;
- competition from other venues that offer identical or similar gaming options;
- competition from other venues that offer alternative tourism options which are not related to gaming;
- transportation costs, such as airfares and price of gasoline, and
- other factors that affect the relative attractiveness or convenience of the location in question relative to other locations.

Other factors that influence demand for a tourist based casino industry include prices and costs that confront consumers in the casino market as well as in competing tourist (gaming and non-gaming) markets; prices of complementary and substitute goods (i.e. accommodation costs, such as hotel room and restaurant prices in the particular geographic market and in competing gaming and non-gaming locales); attractiveness factors, such as the general ambience to be found in specific casinos in the neighborhoods or business districts where such facilities are offered; the quantity, quality and variety of non-gaming amenities that are made available to attract customers; and “external shock” factors, such as the changes in consumer behavior that followed the events of September 11, 2001.

The causal factors that influence tourism behavior and spending can be roughly translated into short term and long term components. Changes in prices of substitutes and complements can be categorized as short term influences, whereas changes in supply factors (such as the legal status of gaming elsewhere, the number, vintage and quality of casinos in the marketplace and in competing markets, and important infrastructure characteristics in the markets under study as well as in competing markets) are more long term in nature. This study looks at both short term and long term factors and utilizes available data to determine if causality can be assigned to specific potential contributors to a market’s performance.

Since the early 1990s, the quantity and quality of casinos in gaming jurisdictions that effectively compete for Reno and South Lake Tahoe tourist customers have increased dramatically. Las Vegas became an increasingly important competitor for Northern Nevada, because of its substantial supply-side growth and evolution as it became an increasingly important national and global destination resort venue, with “state of the art” mega-casino complexes and a wide variety of entertainment, conference, and recreation offerings unmatched anywhere else in the world. Commercial casinos were authorized in more than fifteen states between 1988 and 2009, mainly east of the Mississippi, but also in Colorado, South Dakota, Missouri, Louisiana, and Iowa. Tribal gaming industries became well established in the states of Oregon, Washington, Arizona, and elsewhere in the United States, but most importantly for Nevada, in California.

The competitive response by Northern Nevada gaming jurisdictions was limited. Casinos in Northern Nevada did relatively little to reinvest in and grow their properties in light of increased regional and national competition, due primarily to the pessimistic outlook with respect to Expected Returns on Invested Capital (EROIC) in new casino ventures. There were some notable capital improvements made to various Northern Nevada casino properties over the past two decades, such as Atlantis, Peppermill, Harrah’s, John Ascuaga’s Nugget, Montbleu, and the Grand Sierra (formerly the Reno Hilton) but, in comparison to investments in Las Vegas and California tribal gaming facilities, these were very modest. Furthermore, the number of new tourist-oriented casinos developed in the Reno/Tahoe markets was limited to only a handful: the Silver Legacy (1995) and the Siena (2001) were the only major new tourist-oriented casino resorts to come on the scene in Northern Nevada for the past two decades.

In light of the deterioration in the tourist market for Reno/Tahoe casinos, many Reno area casinos repositioned themselves to take advantage of the locals’ market in the first decade of the millennium. In this regard, some casinos found themselves in more favorable positions than others, because of location, access, amenities, and increased marketing efforts toward locals. Some small casinos such as Gold Dust West and Tamarack opened specifically to cater to local clientele, and many others, including the Peppermill and Atlantis, geared their marketing strategies to be attractive to both local and tourist customers.

V. REGRESSION ANALYSIS RESULTS

One specific question of interest in this analysis is to see if the particular impacts of expanded California tribal gaming on the demand for Nevada casino gaming services can be quantified and verified. The following general model was developed for the Northern Nevada markets of Reno-Sparks and South Lake Tahoe.

Quantity = F(Price, Price of substitutes, Income, Availability of substitutes, Transport costs, General economic performance, Seasonality)

The individual variables were defined and measured as follows:

Quantity = Handle = Gross Gaming Revenues divided by Win Percentage

Price = Win percentage (house advantage) on slot machines for that gaming market

Income = Northern California Aggregate Personal Income

Availability of Substitutes = Number of slot machines offered in Northern California tribal casinos¹²

Transport costs = price index for airfares¹³ and price index for gasoline¹⁴

General Economic Performance = WLI Index¹⁵

Seasonality is measured with a series of dummy variables (one dummy variable for each of the first 11 months), with December serving as the base for comparison

12. Northern California casinos include all those north of 37 degrees latitude, which is an east-west delineation approximately 25 miles south of San Jose. This includes a total of 28 tribal casinos.

13. Passenger Origin and Destination (O&D) Survey, Bureau of Transportation Statistics.

14. Motor Gasoline Price Survey, US Energy Information Administration

15. c.f. footnote 11

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The time series observations for Reno-Sparks and South Lake Tahoe are based on monthly data from December 1994 to January 2009. All regressions are estimated as log-linear equations. Thus, for numerical independent variables, the resulting estimated coefficients are *BLUE* (Best Linear Unbiased Estimates) of demand elasticities.¹⁶ For the seasonal dummy variables, the interpretation of the coefficients is the average percentage change from the December base. Thus, the seasonal dummy coefficients estimate the typical shift relative to December that occurs in that month, after correcting for all other causal factors.

Significance of the individual coefficients is noted by asterisks. Coefficients significant at the 1% level are noted with (***). Coefficients significant at the 5% level are noted with (**), and coefficients significant at the 10% level are noted with (*).

The functional form used in the following regressions was the following:

$$\text{Log(Handle)} = \alpha + \beta_1 \cdot \text{log (Price)} + \beta_2 \cdot \text{log (Income)} + \dots$$

In such a model, the coefficients of independent variables can be interpreted as elasticities, and the coefficients for dummy variables can be interpreted as (adjusted) percentage shifts from the base condition.

The following tables present the log-log regression results for the Northern Nevada gaming markets.

TABLE 1
REGRESSION ANALYSIS FOR RENO-SPARKS AND SOUTH LAKE TAHOE

CASINO MARKET	RENO-SPARKS	SOUTH LAKE TAHOE
SAMPLE SIZE	170	169
ADJUSTED R ²	.8924	.6770
F-VALUE	83.47***	21.71***
VARIABLES (t-values)		
House advantage	-.7104 (-3.9317)***	-.0333 (-1.5609)
Gasoline Prices	-.0714 (-1.7485)*	.0964 (.2158)
Tribal Northern California Slots	-.2329 (-14.4726)***	-.1049 (-2.5621)***
Northern California Aggregate Personal Income	.6101 (6.0505)***	.4271 (1.7040)*
Airfares index	-0.5540 (-4.5083)***	-1.0458 (-3.3919)***
Lead Econ Indicator (WLI)	.3869 (3.4541)***	.1734 (0.6380)
Jan	-.0203 (-2.3513)***	-.0333 (-1.5609)
Feb	-.0068 (-0.7421)	.0087 (-0.3997)
Mar	.0620 (5.8830)***	-.0124 (-0.5631)
Apr	.0527 (4.7546)***	.0219 (1.1024)
May	.0805 (7.2280)***	.0396 (1.7319)*
Jun	.0598 (5.6307)***	.1760 (7.7223)***
Jul	.0863 (8.1406)***	.1591 (6.9847)***
Aug	.0950 (8.6704)***	.1052 (4.6159)***
Sep	.0861 (8.0240)***	.0356 (1.5640)
Oct	.0749 (7.1011)***	-.0361 (-1.6027)
Nov	.0280 (2.9117)***	-.0010 (-0.0458)
Durbin Watson Statistic (one period lag)	1.5558	1.9574
Durbin Watson Statistic (twelve period lag)	1.8726	1.9309

16. Demand elasticity measures the ratio of percentage change in the dependent variable to a percentage change in an independent variable, ceteris paribus.

GAMING MARKETS V. CALIFORNIA TRIBAL GAMING LOG-LOG RESULTS, 1994 TO 2009 (MONTHLY DATA)

VI. DISCUSSION

For the Reno-Sparks market, the signs of the independent variables are all consistent with the specified demand model. The relationship with handle and house advantage (price) is negative and slightly inelastic. Demand is also negatively related, *ceteris paribus*, to Northern California gasoline prices and airline fares. Northern California aggregate personal income and the index of leading economic indicators exert a positive influence on demand (handle), as expected. The number of slot machines at Northern California tribal casinos, serving as a proxy for the availability of tribal gaming as a substitute for gaming in the Reno market, has a negative impact with an estimated elasticity of -0.23, suggesting that a 10% increase in the capacity of tribal casinos in Northern California leads to a reduction in demand of about 2.3% in the Reno-Sparks market.

All of the independent variables are significant at the 1% level (except for gasoline prices, significant at the 10% level), as are the seasonal dummy variables (with the exception of February) suggesting a high degree of predictable seasonality in the data series, even after accounting for the causal factors. The adjusted R² value of .8924 and F-value of 83.47 imply a strong overall fit. The Durbin-Watson statistic is at 1.5558, suggesting some degree of auto-correlation in the data. However, when the Durbin-Watson statistic was computed using a 12 period lag (for the 12 months), the value of 1.8726 suggested no auto-correlation issue.

For South Lake Tahoe, the results are similar, but not nearly so robust. All causal variables except for gasoline prices are properly signed, though house advantage, gasoline prices and leading economic indicators are not significantly different than zero. Seasonality factors are generally not significant except for the summer months, perhaps suggesting less consistency due to such factors as winter weather and road conditions. The expansion of California tribal gaming, as measured by the number of Northern California tribal slot machines, has had a significant negative impact on South Lake Tahoe handle, with an estimated elasticity of -0.1047. The Durbin Watson lagged one period at 1.9574 and lagged 12 periods at 1.9309 suggests no presence of auto-correlation.

The expansion of California tribal gaming, as measured by the number of Northern California tribal slot machines, has had a significant negative impact on South Lake Tahoe handle.

VII. RESULTS FOR THE LAS VEGAS STRIP

The experience of the casino industry on the Las Vegas Strip was markedly different from the Northern Nevada casinos, largely because of the continuing evolution and development of ever-larger and more expensive casino resort complexes. Until 2007, these had the effect of broadening the attractiveness of the Las Vegas Strip as a national and international destination resort, and of encouraging even further capital investments in new and existing resorts.

There was also a belief that the expansions of casino gaming into new jurisdictions, including California tribal gaming, was having only negligible impacts on demand for Las Vegas Strip-style tourism. Since 1990, in spite of the fact that casino gaming had proliferated throughout the United States and many foreign countries, the belief was that the Strip and its major properties had stayed ahead of the curve and offered a unique tourism product with not only gaming but a wide variety of complementary non-gaming offerings. It was not until the Great Recession that these beliefs came under serious questioning.

Regression analysis for the demand for gaming on the Las Vegas Strip is presented in Table 2. As with the other demand models, the dependent variable is handle (Gross Gaming Revenues divided by house advantage).

TABLE 2
REGRESSION ANALYSIS FOR LAS VEGAS STRIP GAMING MARKET
V. CALIFORNIA TRIBAL GAMING
LOG-LOG RESULTS, 1995 TO 2009 (MONTHLY DATA)

CASINO MARKET	LAS VEGAS STRIP
SAMPLE SIZE	170
ADJUSTED R ²	.5757
F-VALUE	14.49***
VARIABLES (t-values)	
House advantage	-.7589 (-8.0439)***
Gasoline Prices	.1251 (3.2393)***
Airfares	.0749 (0.3679)
Tribal Slots in California	-.0507 (-1.2651)
California Aggregate Personal Income	.4523 (2.1506)**
Lead Economic Indicator	2.8214 (2.8990)***
Jan	-.0111 (-.7810)
Feb	-.0362 (-2.9124)***
Mar	-.0282 (-2.1418)**
Apr	-.0583 (-4.3906)***
May	-.0229 (-1.7208)*
Jun	-.0713 (-5.3161)***
Jul	-.0451 (-3.3668)***
Aug	-.0312 (-2.3836)***
Sep	-.0383 (-2.8391)***
Oct	-.0263 (-1.9524)*
Nov	-.0416 (-3.2212)***
Durbin Watson Statistic (one period lag)	1.6025
Durbin Watson Statistic (twelve period lag)	1.7290

VIII. DISCUSSION

As with the earlier regressions for Reno-Sparks and South Lake Tahoe, the overall results are significant and, for the most part, consistent with a traditional model of demand. Four of the causal variables were significant (house advantage, California tribal slot machines, gasoline prices, and the leading economic indicator index), and three were properly signed, whereas gasoline prices were significant but opposite what the model would predict. (Interestingly, airfares were not significant in the analysis of Las Vegas Strip demand, and were incorrectly signed.) The seasonal dummy variables were almost all significant, indicating predictable and consistent seasonal trends in the dependent variable after adjustment for the causal variables. The Durbin-Watson statistic for one-period and 12-period lags (1.60 and 1.73) suggests a moderate presence of autocorrelation in the error terms.

Of note to this analysis is the estimate associated with California tribal slots. Elasticity is estimated at $-.051$, indicating, for example, that a 10% increase in slot machines among tribal casinos in California would have a 0.5% negative impact on handle in Las Vegas Strip casinos. This is markedly less than the estimated elasticities for Reno (-0.233) and South Lake Tahoe (-0.116), suggesting that the impact of California tribal gaming on demand for gaming on the Las Vegas Strip is indeed weaker than on other regions in the State.

IX. CONCLUSIONS

This analysis has demonstrated that demand for gaming in Nevada's major tourism areas can be analyzed using traditional micro-economic analysis coupled with empirical analysis. For the most part, results presented here are consistent with *a priori* expectations, with some markets being far more robust than others.

The primary finding of this analysis is that the expansion of California tribal gaming since 1990 has had significant negative impacts on the demand for gaming in each of the three destination resort gaming markets studied here, with the strongest impacts on Reno and South Lake Tahoe, and smaller (but not measurably significant) negative impacts on demand for gaming on the Las Vegas Strip.

The impact of California tribal gaming on demand for gaming on the Las Vegas Strip is indeed weaker than on other regions in the State.

REFERENCES

- Binkley, C. (2008). *Winner takes all*. New York: Hyperion Press.
- Cargill, T. F., & Eadington, W. R. (1978). Nevada's gaming revenues: Time characteristics and forecasting. *Management Science*, 24, 1221-30.
- Economic Cycle Research Institute, at <http://www.businesscycle.com/>.
- Hunsaker, J. (2001). The impact of riverboat casinos on the demand for gambling at casino resorts: A theoretical and empirical investigation. *Managerial and Decision Economics*, 22, 97-111.
- Las Vegas Convention and Visitors Authority, Visitor Statistics, at <http://www.lvcva.com/press/statistics-facts/visitor-stats.jsp>
- Lauve, M. (2007). Demand estimation and policy implications in markets for casino gaming and electricity. Ph.D. dissertation, Rutgers University.
- Levitzy, I., Assane, D., & Robinson, W. (2000). Determinants of gaming revenue: Extent of changing attitudes in the gaming industry. *Applied Economics Letters*, 7, 155-158.
- Morgan, W. D., & Vasche, J. D. (1979). Horseracing demand, parimutuel taxation and state revenue potential. *National Tax Journal*, 32(2), 185-194.
- Morgan, W. D., & Vasche, J. D. (1982). A note on the elasticity of demand for wagering. *Applied Economics*, 14, 469-74.

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- Nevada Gaming Control Board. Monthly Revenue Reports (monthly, 1990-2009).
- Nevada Gaming Control Board. Nevada Gaming Abstracts (annual, 1990-2009).
- Nichols, M. W. (1998a). Deregulation and cross-border substitution in Iowa's riverboat gaming industry. *Journal of Gambling Studies*, 14, 151-72.
- Nichols, M. W. (1998b). The impact of deregulation on casino win in Atlantic City, *Review of Industrial Organization*, 13, 713-26.
- Przybylski, M., Felsenstein, D., Freeman, D., & Littlepage, L. (1998). Does gambling complement the tourist industry? Some empirical evidence of import substitution and demand displacement. *Tourism Economics*, 1998(4), 213-31.
- Suits, D. B. (1979). The elasticity of demand for gambling. *Quarterly Journal of Economics*, 9, 155-62.
- Thalheimer, R. (1998). Parimutuel wagering and video gaming: A racetrack portfolio. *Applied Economics*, 30, 531-543.
- Thalheimer, R., & Ali, M. M. (1992). The demand for pari-mutuel horse race wagering with special reference to telephone betting. *Applied Economics*, 24, 137-42.
- Thalheimer, R., & Ali, M. M. (1995a). Exotic betting opportunities, pricing policies and the demand for pari-mutuel horse race wagering. *Applied Economics*, 27, 689-703.
- Thalheimer, R., & Ali, M. M. (1995b). The demand for pari-mutuel horse race wagering and attendance. *Management Science*, 41(1), 129-43.
- Thalheimer, R., & Ali, M. M. (2003). The demand for casino gaming. *Applied Economics*, 35, 907-918.
- Thalheimer, R., & Ali, M. M. (2008). The demand for slot machine gaming with special reference to the effect of a smoking ban. *Economic Inquiry*, 46 (2), 273-282.

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