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The Effects of gaming on residential real estate prices and sales: A case study of Las Vegas: 1990--2008

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THE EFFECTS OF GAMING ON RESIDENTIAL REAL ESTATE PRICES AND SALES: A CASE STUDY OF LAS VEGAS, NEVADA 1990 - 2008

by

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ABSTRACT

**The Effects of Gaming on Residential Real Estate Prices and Sales:
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This dissertation empirically investigates the effects of the gaming industry on a local economy, specifically housing prices and sales in the city and surrounding areas of Las Vegas. This study explores many of the economic effects that Las Vegas' relatively unrestricted gaming industry has on surrounding home prices and sales and analyzes the specific forces and the issues they involve. As of this writing, little to no research has used seminal economic theories to analyze the effects of the performance of a locale's gaming industry on the surrounding residential real estate market. This study addresses this gap by examining the relationship of gaming performance to employment, employment to income, and income to housing. The analysis provides evidence of a significant positive correlation between gaming revenues and casino employment, and between casino employment and residential sales and pricing. The study brings new perspective to the relationship between gaming and the local economy, providing a possible glimpse into the future for other maturing gaming markets.

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CHAPTER 1

INTRODUCTION

In the centuries of investigation into the domino effects linking economic production to consumption (Friedman, 1957, 1962; Holt, Modigliani, & Simon, 1955; Keynes, 1936; Smith, 1776), one of the strongest examples of economic consumption has been residential real estate sales (Hoyer & Holden, 2001; Muth & Goodman, 2001). As one might expect, production has been shown to be positively and significantly related to employment (Borjas, 1991, 2005), employment positively and significantly related to income (Peterson & Estenson, 1996), income positively and significantly related to consumption (Mankiw, 2007), and residential real estate sales (Leung, 2004). Given the relatively recent and rapid development of the gaming industry, however, these economic relationships must be revisited and empirically reevaluated to determine the continued worth of theories previously used to forecast business, industry, and consumption in a modern capitalist economy.

From the beginning, the Las Vegas MSA has been a dynamic and unique regional economy. The regional economy of Las Vegas is different from any other previously seen in the U.S., in that its development has been driven almost entirely by the gaming industry. Economic models over the years have built our knowledge based on empirically tested data in many industries, but the scientific study of gaming-influenced economies is in its infancy. To date, the few studies that have been completed are purported to have extreme bias (Rose, 1999), at the expense of our knowledge of regional economic development.

It has been said that “the ultimate test of an economic model comes when it is confronted with data from the economy itself” (Varian, 2002, p. 2). This case study

attempts to test a Keynesianesque industrial model while including the gaming industry in the overall economic development of one metropolitan statistical area (MSA). More specifically, the author attempts here to isolate the effect of the gaming industry on housing, used previously as a general proxy for consumption spending (Case, Quigley, & Shiller, 2005). If we can better understand what relationship the gaming industry has to the local real estate market and to overall economic development, we may add to our knowledge of the initiation of this particular industry in other locations.

Statement of the Problem

As noted above, despite an apparent link to employment and real estate values**,** the connection between casino industry performance and real estate values remains unexplored. Similarly, no empirical research appears to have been completed that incorporates the operational performance of a casino with that of its surrounding community. The purpose of this dissertation is to address this gap by analyzing the relationships among a city's casino industry performance, employment, and real estate values, and in turn, to measure the influence of casino activities on the surrounding community.

The primary function of this dissertation is to empirically test the relationship between the performance of local casino industries and local real estate values, and to observe in turn the association with regional employment and incomes. The links proposed by present research between employment**,** income**,** and home values have not been empirically tested in a casino based city setting in a way that incorporates the casinos' operational performance and staffing. It is therefore believed that this study will be the first of its kind in gaming industry literature, and will add to the body of literature

on industry and its economic impacts on the immediate economic environment (Littlejohn, 1999; Parker, 2000).

Objectives of the Study

The research objectives of this study are derived from the income and employment theories made popular by economists John Maynard Keynes (1883-1946) and Milton Friedman (1957-2006), both of whose work stressed the relationship between output, income, and expenditure. Building on their original theories, economists influenced by both Keynes and Friedman believe that industry output drives employment (Boianovsky, 1996; Stigler, 1983), that employment is the creator of income in the aggregate (Kalecki, 1990), and that aggregate income is the supporter of consumption (Pischke, 1995). This study analyzes these relationships in a city where casino gaming is prominent. Gaming revenue is used as the industry's production variable, annual employment data to represent its labor variable, and housing as a proxy for consumption.

The first objective of this study is to empirically test for a relationship between gaming industry performance and employment. The second is to establish a correlation between employment and aggregate income, and the third is to test the seminal researchon aggregate income and housing prices by measuring the correlation between the two variables. The final objective is to measure by summation the correlation between gaming industry performance and local housing prices and sales. The research methodology that will be used to accomplish these four objectives will be described in detail in Chapter 3. The four hypotheses derived from the above objectives are stated below.

Hypotheses

The hypotheses to be tested in this dissertation are as follows:

H1: Gaming revenue is positively correlated with casino employment

$H1_0$: r (correlation coefficient) ≤ 0

$H1_a$: $r > 0$

H2: Casino employment is positively correlated with aggregate personal income

$H2_0$: r (correlation coefficient) ≤ 0

$H2_a$: $r > 0$

H3a: Aggregate personal income is positively correlated with the number of home sales

$H3b_0$: r (correlation coefficient) ≤ 0

$H3b_a$: $r > 0$

H3b: Aggregate personal income is positively correlated with home prices

$H3_0$: r (correlation coefficient) ≤ 0

$H3_a$: $r > 0$

H3c: Average payroll per casino employee is positively correlated with the number of home sales.

$H3c_0$: r (correlation coefficient) ≤ 0

$H3c_a$: $r > 0$

H3d: Average payroll per casino employee is positively correlated with the prices of home sales.

$H3d_0$: r (correlation coefficient) ≤ 0

$H3d_a$: $r > 0$

H4a: Gaming revenue is positively correlated to residential real estate sales

$H4a_0$: r (correlation coefficient) ≤ 0

$H4a_a$: $r > 0$

H4b: Gaming revenue is positively correlated to residential real estate prices

$H4b_0$: r (correlation coefficient) ≤ 0

$H4b_a$: $r > 0$

The statistical methods that will be used to test the above hypotheses are covered in Chapter 3.

Justifications

The goal of this study is to further define the relationships among industrial output, employment, income, and consumption. The gaming relationship will be tested by empirically analyzing the separate components of the relationship within a gaming based city. The information obtained by this research into these relationships will be of use to municipalities considering gaming and those who have already accepted gaming into their economies. In addition, this study will examine the link between employment and the consumption of real estate, adding useful knowledge to both the gaming and economic literature. At the same time, the results of the study should be of interest to representatives of the gaming industry when making their statements on the possible economic impacts of gaming on communities, to real estate investors, and to residential home owners.

Assumptions

Very few, if any, models will explain reality in its entirety. What is examined in this study is whether the simple models hold true by testing it in a real world situation.

For purposes of this study we will assume that casino firms located in Las Vegas, on average, want to achieve profit maximization (PM). Other conjectures within this PM assumption include that the casino industry has sufficient information about the nature of the market and its costs in order to make profit maximizing choices, and that the profit-maximization techniques in place are made by the firms for sustainability into perpetuity. It is further assumed that differences between the Las Vegas-Paradise Metropolitan Statistical Area (MSA), Clark County, and Las Vegas are negligible.

Delimitations of the Study

1. Only one city will be tested and it is the primary casino destination in the world based on total revenue produced by casino establishments (State Gaming Control Board, 1991).
2. Gaming revenues from companies and individuals with restricted gaming licenses will not be incorporated.
3. Annual data will be used for the years 1990 to 2008.
4. The full effects of the 2005 – 2008 economic downturn will be reflected in the data.
5. At the time of writing, data on mortgage standards was not yet available, though average mortgage rates were
6. Differentiation will not be made between residential real estate purchased for residency and that purchased for investment purposes.
7. Data on specific home structure, such as number of bedrooms and baths or square footage, is not included.

8. No differentiation of location within the Vegas Valley will be made for either casinos or homes. This is based on the assumption that the casino location do not have an effect on the employees' choice of housing location.

Definitions

The following are definitions of terms that will be used in the remainder of this dissertation as they apply to the study:

1. Non-Restricted gaming – gaming which takes place at an operation where the owner/ operator maintains a non-restricted gaming license. This license is issued for the operation of games and/or tables only; or for the operation of 16 or more slot machines only; or for the operation of games and/or tables in conjunction with slot machines (Nevada Gaming Control Act, 1959a).

2. Restricted Gaming – gaming which takes place at an operation where the owner/ operator maintains a restricted gaming license. This license is issued for operations of not more than 15 slot machines and no other games (Nevada Gaming Control Act, 1959b).

3. Gaming Revenue – is synonymous with gross gambling revenue, the amount wagered minus the winnings returned to players. It is considered the "true measure of the economic value of gaming" (American Gaming Association, 2009).

4. Aggregate Income – for the purposes of this study aggregate income and total personal income are synonymous pertaining to the data collected and presented by the United States Bureau of Economic Analysis (2009).

Organization of the Dissertation

This dissertation is arranged into five chapters. Chapter One includes the basis for the problem stated, the problem statement itself, justification of the study, hypotheses,

limitations of the dissertation, and definitions used throughout. Chapter 2 provides a review of relevant literature and explains the cerebral research approach. The third chapter will describe the research methodologies used to test the hypotheses, including research design, data, data collection, and statistical analysis. Chapter 4 will discuss the results of the analysis and testing of the hypotheses. The last chapter will summarize the findings and provide recommendations for further studies and the practical applications of the findings.

CHAPTER 2

REVIEW OF LITERATURE

Introduction

This chapter reviews the seminal economic literature pertaining to this study and prior attempts to measure the economic impact of the gaming industry. The first section analyzes the economic literature pertaining to relationships between the key economic variables. In this section the proposed steps of the economic analysis are found and given syntax. The second section of the chapter reviews prior attempts to analyze the effects of the gaming industry on the surrounding economic environment. This section will also include a review of the literature concerning the effects of non – residential commercial cites on surrounding housing values. The third section will summarize the nearly eighty year history of Las Vegas and its relationship with gaming. Finally, the findings of the chapter will be summarized as a lead in to the methodology discussed in Chapter Three.

Economic Analysis

Economics is the study of the allocation of scarce resources among people, places, and time. The study of economics includes the material aspects necessary for survival in our society. These aspects include, but are not limited to, production, employment, income, and consumption (McAfee, 2006). The heart of economics is the analysis of social phenomena and the creation of models, derived from various theories and concepts, to explain them (Varian, 2002). When these models are combined or used in a new way, new model creation becomes possible (Solow, 1975). The following section will describe the some of the theories and concepts to be tested.

Economic Theories of this Study

This literature review begins with the relationship between the production of an industry and its economic connection with its employees. John Maynard Keynes (1936), in his magnum opus, *The General Theory of Employment, Interest, and Money*, described the interrelationships between industrial production, employment, income, and consumption. Keynes (1936) claimed that there could be positive correlation that flowed from production to employment, employment to income, income to consumption, and back to production.

Production to Employment

John Bates Clark (1886) theorized the concept of marginal utility could be applied to labor. A company would hire as many employees as it could until the last person hired no longer contributed to the overall benefit of the company (Clark, 1928). Because hospitality is a labor intensive industry and much of its revenue is produced in labor intensive activities (Kusluvan, 2003), there should be a strong correlation between the gaming industry's proxy for production, gaming revenue, and number of employees. Because even today's rapidly improving technologies cannot offer the expected level of service that many customers demand (Hayes & Ninemeier, 2008), a researcher has the opportunity not to include or account for changes in technology when measuring for correlation between hospitality industry production and employment.

Employment to Income: Labor Economics

Though it may seem obvious, employment and aggregate income are positively correlated. The more people employed, the greater the aggregate income (Bowles & Boyer, 1995; Atesoglu, 2000). Many studies have investigated ways of increasing employment, or more specifically of reducing unemployment (Cotton & Tuttle, 1986;

Fallick, 1996). While the literature tends to converge on the idea that low unemployment is better than higher unemployment due to the distribution of income (Chang, 1997), studies also recognize some concerns in the event that unemployment becomes extremely low. The excess income could drive overall prices higher too quickly, causing significant inflation (Phelps, 1973). Inflation in this instance would be caused by an excess of consumer demand and consumption (Fuhrer & Moore, 1995).

Income and Consumption

The literature concerning the interaction between income and consumption is vast and varied (Zeldes, 1989), but two seminal theories predominate. Keynes (1936) theorized that individuals consume as a result of their disposable income in the present and near future, which is positively related to their marginal propensity to consume. Over two decades, later, Friedman (1957) proposed that consumption was primarily driven by permanent income, or what an individual expects to receive in the present and future. Transitory changes in income have less effect on consumption in Friedman's economic theory than in that of Keynes (Ehrenberg & Smith, 2005). These two perspectives differ in how much they believe individuals extrapolate their current income to their future circumstances, and how this micro-level conceptualization of income can drive macro-level economic consumption (Deaton, 1992; Friedman, 1962). This study makes no definite stance on either a Friedman-based or Keynesian perspective, but draws on both approaches to explain how income, however it is defined, drives consumption in regional economies.

Income, Housing, and the Economy

An abundance of economic literature identifies income as a strong driver of residential home prices (Ortalo-Magne & Rady, 2006). Some of the more current and influential studies include Poterba (1991), Abraham and Hendershott (1993, 1994), Englund and Ioannides (1997), Malpezzi (1999), Sutton (2002), and Muellbauer and Murphy (2008),.

Residential real estate, referred to here as housing, represents more than half of U.S. fixed capital stock (Baffoe-Bonnie, 1998) and accounts for a significant portion of many individuals' personal consumption expenditures. The performance of the housing market has been shown to have major impact on local economies (Muth & Goodman, 2001), and the economic variables of employment and income have been shown to change real estate metrics in terms of units sold and housing purchase prices (Baffoe-Bonnie, 1998; Winger, 1968). In a gaming economy, however, the strength of these metrics is not clear, because nearly all real estate research to date in regional gaming economies contradicts the principles established by both Friedman and Keynes (Rose, 1999).

Gaming Literature

In response to the rapid spread of gaming in the 1990s, Congress created the National Gambling Impact Study Commission (NGISC) in 1996 to measure the impact of gaming in the United States. The NGISC's final report was released in 1999 with few definite conclusions beyond the need for further research due to the wide variance in opinions and results in many areas. The effects of gaming on the local economy are still widely debated, in large part because the results from many studies are heavily influenced

by the organization that funds the study (Rose, 1999). Rose was able to conclude that a new casino in a non-saturated market might yield positive economic payback to its host economy.

Academic literature on the economic impact of gaming was scarce before the late 1990s, when studies appeared along with the NGISC study. Much of the present research is focused on accessing the impacts of a casino based on a cost-benefit analysis (Grinols & Mustard, 2001). A cost-benefit analysis attempts to find a net gain or loss by weighing the value of an arbitrary number of perceived costs against a subjectively determined number of benefits. For their analysis, Mustard and Grinols use limited benefits and numerous costs, with little reference to the success of cities like Las Vegas or Tunica, Mississippi. Grinols and Mustard also tend to omit the problems preexisting gaming in observed locations, such as the history of alcohol and drug problems in the state of South Dakota.

Walker and Barnett (1999) note that much of the literature dealing with assessing the social costs of gaming is "more likely to obscure relevant issues than to inform the policy debate . . .In this literature, real and redistribution effects have been confused, incorrectly estimated and inappropriately merged. The concept of externality has been misunderstood and incorrectly applied" (p. 208).

The Arthur Anderson (1996) study, performed as a consulting project for the American Gaming Association, described the number of employees, average wages paid, taxes paid to states, and many other variables, but did not mention its effects on the local economy from these variables.

Eadington (2003) expressed concern regarding the inadequacies of cost – benefit analyses and the importance of greater "understanding of the nature of social and personal costs associated with such expansions [of gaming], and develop[ing] meaningful strategies that can best deal with those costs in a responsible and efficient manner" (p.211).

Of the 806 pieces reviewed in Smith and Wynne's (2000) *Review of Gambling Literature* in the Economic and Policy Domains for the Alberta Gaming Research Institute, no articles attempted to answer with empirical data the question of the effects of the casino industry on housing prices.

Gaming Revenue and Employment of Casinos

Grinols (1995) and Blevins and Jensen (1998) characterized casino work as low skill, low paying, and unsuited for the U.S. economy. Global Insight, formerly known as WEFA agreed, citing as evidence that 12% of the jobs at the Foxwoods Resort and Casino were considered executive and/or managerial (Rose, 1999, p. 21). The latter authors fail to mention that this is a higher percentage than the national management average of approximately 10.5% of the workforce (U.S. Census Bureau, 2002). In another study, Hill (1994) remarked that over seventy percent of casino personnel in Mississippi received an hourly wage of $7.40, but did not account for the tips and gratuities that often amount to the majority of employees' income (Fernandez, 2004).

Gaming Employment and Income

The Adam Rose study prepared for the NGISC in 1999 assessed the literature pertaining to the economic impacts of casino gaming. On the topic of the effects of casinos on the distribution of personal income, Rose (1999) claims "Not a single study to

date has come close to providing a convincing answer to this question" (p. 22). While George, Ambrose, and Linneman's (1998) study claimed that counties with casinos had unemployment rates two times the national average, Las Vegas until recently has maintained an unemployment rate at or below the national average for 14 years between 1990 and 2008 (Nevada Workforce Informer, 2009).

Garrett (2004) analyzed six different counties in four different states that had opened their first casinos. Due to the variability of results across the six counties, the researcher had a difficult time quantifying the employment effects, but the results did show a decrease in unemployment rates in five of the six locations. He was able to conclude that the rural counties that adopted casino gaming experienced increased household and payroll employment.

In a separate study, Cotti (2008) found positive overall results in employment for the time immediately following the opening of a casino. However, the study pooled casino locations with varying gaming laws and capabilities. One must question the validity of the results from such a diverse group of gaming businesses.

Grinols (2004) argued when a city is at full employment, casino jobs would simply displace other jobs, as would any introduction of a new industry into a full employment situation. The questions in this scenario are 1) whether the casino workers would be making more income in the new casino jobs, considering both wages and tips, and 2) whether the displaced jobs would be filled with those moving into the area. If both cases were true, both aggregate income and the aggregate necessity for housing would increase.

Walker and Jackson (2007) claimed there is no causal relationship between real casino revenues and real per capita income at the state level. This researcher questions the usefulness of measuring the relationship at a state level, which tends to introduce external factors that may skew findings. Not all gaming communities are large enough to affect the entire state.

Casinos and Housing

In 1996, a dissertation by Chad Jeffery examined the urban neighborhood impacts of a casino. The study examined housing prices from the announcement of the casino in January of 1993, as well as 658 residential sales between 1981 and 1995. The casino wasn't finished until May 17, 1994. The Jeffery study, an extension of a previous study done by J.P. Lowrie (1994), only examined a relatively small neighborhood close to the casino site. There was no mention of the new purchasers of the homes sold, or of the impact of other economic factors such as revenues and employment. As of this writing neither Jeffrey nor Lowrie has published a follow up article addressing the housing prices since the casino has opened, the impact on other neighborhoods, or the impact on the overall local residential real estate market. The revenue produced by the casino in the Jeffrey study during its 11 months of operation in 1995 was 418.9 million Canadian dollars and the overall employment effect was an increase of 471 full-time equivalent jobs and an induced income of $7.3 million (Marfels, 1997).

Wenz (2007) examined the effects of casinos on housing prices. The study used 358 Class III casinos operating in 28 states. The state of Nevada was excluded due to its "uniqueness" (p. 106). The study does not consider the number of employees or the amount of income produced by the employees. Again, because the study evaluated so

many casinos together, Native American and non-Native American, from differing states and jurisdictions and with different gaming makeup one has to question the external validity of the results and whether they would apply to Las Vegas, any other Nevada gaming city, or any individual town worldwide. In addition, housing and other data were collected from the 1990 and 2000 U.S. Census of Population Microdata 5 Percent Sample (PUMS). Wenz's article fails to mention the recession of 1990 and the onset of another recession in 2001. Though he is willing to exclude Nevada due to its "uniqueness," Wenz did not mention or attempt to accommodate the two recessions. In excluding Nevada, Wenz also neglected the impact of the growth of Las Vegas gaming on the rest of the nation. The study concluded that the net benefit of casino gambling to a neighborhood was $2,000 - $3,000 per household close to a casino, or about 2% of household value.

Land Use and Housing

Due to the amount of conflicting research, this study reviewed literature on the effects of building a non-residential site on nearby housing values. Li and Brown (1980) and Colwell, Gurjral, and Coley (1985) give supporting evidence that a non-residential site can have both positive and negative effects on residential property values. Accessibility, for example, often has a positive effect on values, while traffic, pollution and noise can have a negative effect.

Thibodeau (1990) studied the effects of a nonconforming office building on nearby housing values. Though his findings justified the concerns for homeowners with properties within 1,000 meters of the office building, they also show a rise in property values for homes located between 1,000 and 2,500 meters from the building, and on residential properties greater than 2,500 meters away there were no significant effects.

His findings also show a net increase in property values in the aggregate: More homes increased in value than lost value. He concluded it was "therefore inappropriate for local governments to prohibit this type of economic activity on the grounds that it reduces aggregate homeowner wealth" (page 408).

McMillen and McDonald (2004) examined the effects of the Chicago Midway Transit line on nearby housing prices. The study found evidence that after a decrease in home values upon announcement of the construction of the line, home values rebounded and appreciated at a greater rate than homes farther away. This study did not show the effects of the employment created by the Midway Line or any changes to the aggregate level of income.

History of Gaming in Las Vegas, Nevada

As the first state to legalize gambling in 1931, the state of Nevada held a geographic monopoly on casino gaming in America for over 65 years (Eadington, 1984). The relevant legislation, Assembly Bill 98, was authored by freshman Nevada State Assemblyman Phil Tobin, a Northern Nevadan rancher whose goal was to create tax revenue for public schools (Kilby, Fox, & Lucas, 2004). The businessmen who favored and supported the act were not reacting to the depression but as a way of diversifying into the tourism industry (Bernhard, Green, & Lucas, 2008).

In the 1930's Las Vegas was a haven from the financial downturn wreaking havoc on the rest of the country. Employment, revenue, and income were prevalent due to the construction of Hoover Dam, gaming, and the presence of Union Pacific Railroad. The first four licensed gaming establishments, The Boulder Club, Las Vegas Club, Exchange Club, and the Northern Club, were all located in Las Vegas. The growth of gaming in Las

Vegas was slow due to the economic depression and the onset of World War II (Judd & Fainstein, 1999).

By 1950, Clark County's population was just under 50,000 (Small Business Development Center, 2009), and in1952, the gaming industry became the largest revenue generating business in Nevada. As the state became more dependent on the gaming industry, regulation became imperative. In 1955, the Gaming Control Board was created to oversee the licensing and the operation of the industry. In 1959, the Nevada Gaming Commission was formed to act "on the recommendations of the State Gaming Control Board in licensing matters and ruling in work permit appeal cases" (Nevada Gaming Commission and Control Board, 2008). The gaming regulatory system of Nevada is now the standard for gaming jurisdictions in other states and countries (Cabot, 1996).

In 1967, the Nevada State Legislature made it legal for public companies to own and operate gaming operations without every stockholder being licensed. This law was instrumental in helping Las Vegas become what it is today. In 1973, Harrah's Entertainment used a law passed in 1967 to become the first gaming company listed on the New York Stock Exchange (Binkley, 2008). Publicly owned casino companies now worked to make sustainable profits for their shareholders and not just a few partners. By the mid-seventies the state of Nevada and the city of Las Vegas had become one of the fastest growing states and cities in the United States, respectively (Moehring & Green, 2005). This was congruent with a 150% rise in gaming revenues (Cargill & Eadington, 1978).

As the end of the decade approached, however, there was a sense of stagnation throughout the gaming industry. This would soon end with the combination and

integration of the luxury resort with gaming. Steve Wynn created what would be later known as the "Megaresort" when he opened The Mirage in 1989 (Gottdiener, Collins, & Dickens, 1999). The Mirage set a new standard for size, luxury, service, and employment (Kilby et al., 2004) and its opening sparked a construction and population boom that would last for more than 10 years. Over a dozen megaresorts would open in the Las Vegas Valley during the nineties, bringing with them growth in population and construction not seen in the southwest United States since the Gold Rush of the 1840s and 1850s (Gottdiener et al., 1999).

By 2000, over 4,000 people were moving to Las Vegas on a monthly basis. Jobs were plentiful, generated by the gaming industry and the industries supported by the related tourism. World–class restaurants, mega-nightclubs, and ultra lounges needed to be staffed with young and attractive employees. The Mirage, as shown in Table 1, still employs between 5,500 and 5,999. As of today, eighteen individual casinos are in Clark County's top twenty five employers (Nevada Workforce Informer, 2009). The Clark County School District is number one and Clark County Government and the City of Henderson are in second and last place respectively.

Table 1.

Top Clark County Employers for Fiscal Year 2008

Organization – Company	Percent of County Employment	Number of Employees
Clark County School District	3.47%	31500 to 31999
Clark County	1.10%	10000 to 10499
Bellagio LLC (casino)	0.99%	9000 to 9499
Wynn Las Vegas LLC (casino)	0.96%	8500 to 8999
MGM Grand Hotel/Casino	0.95%	8500 to 8999
Mandalay Bay Resort and Casino	0.79%	7000 to 7499
Caesars Palace (casino)	0.65%	5500 to 5999
The Venetian Casino Resort	0.62%	5500 to 5999
Mirage Casino-Hotel, the	0.60%	5500 to 5999
University of NV-Las Vegas	0.59%	5000 to 5499
Las Vegas Metropolitan Police	0.59%	5000 to 5499
Rio Suite Hotel & Casino	0.48%	4000 to 4499
University Medical Ctr of S NV	0.45%	4000 to 4499
Flamingo Hilton Corporation (casino)	0.43%	3500 to 3999
Paris Casino/Hotel	0.43%	3500 to 3999
Luxor (casino)	0.41%	3500 to 3999
Harrahs Las Vegas Inc (casino)	0.39%	3500 to 3999
Treasure Island at the Mirage (casino)	0.38%	3500 to 3999
City of Las Vegas	0.37%	3000 to 3499
Bally's Casino/Hotel	0.36%	3000 to 3499
Excalibur Hotel & Casino	0.36%	3000 to 3499
Circus Circus Casinos Inc.-LV	0.34%	3000 to 3499
Red Rock Station Resort & Casino	0.33%	3000 to 3499
Las Vegas Hilton (casino)	0.33%	3000 to 3499
City of Henderson	0.32%	2500 to 2999
Total	16.69%	

The construction industry too has been fed by the fortunes of the casinos. As casinos at capacity needed to expand, more casinos or extensions to existing ones were built. With a growing population and aggregate personal income due to employment, the need for housing was difficult to satisfy (Gottdeiner et al., 1999), and commercial construction increased along with residential.

Summary

A careful review of the existing literature reveals an inconsistency in the research pertaining to economic effects of an industry on its local environment and the methods used to evaluate those effects. Much of the literature on gaming conflicts with the explanations offered by seminal economic literature of the relationships and correlations between production, employment, income, and consumption. In addition, despite the long history of gambling in Las Vegas and the availability of data, the literature concerning the economic ramifications of the casino industry on its local environment has tended to exclude Las Vegas. It is evident from this review that there are important gaps to be filled in the research concerning economic analysis of the gaming industry and the economic impact of gaming on the world's top gaming destination.

This chapter reviewed the seminal research of the basic economic production-consumption chain, the gaming literature concerning the economic effects of gaming on their surrounding locales, and a history of gaming in Las Vegas. The next chapter will discuss the proposed methods that will be used to test the hypotheses stated in Chapter One.

CHAPTER 3

METHODOLOGY

The preceding chapters defined the research question and developed a general method of analyzing the production-consumption chain in terms of gaming and housing. This chapter identifies the methodology that will be used to examine the individual links of the relationship from gaming production to the consumption of housing. Both correlation and regression will be used to test each link in the production–consumption chain.

Therefore, this study will test some of the most widely used economic models. These economic models have limitations, but are nonetheless useful in that they help portray how firms make their choices and how consumers behave. Many of the models help describe the interactions between these two groups and the results of these interactions.

There are typically two ways of verifying an economic model: 1) the direct approach, which attempts to validate the assumptions on which the model is based, and 2) an indirect approach that attempts to validate the models by showing how well the model fits or predicts real world events. This study uses the indirect approach in that it will attempt to show how the prior 19 years of the casino industry in Las Vegas fits the economic model concerning company production, employment, income, and consumption based on seminal theories.

Data

The main data sets used in the proposed study include the Nevada Gaming Abstract (State Gaming Control Board, 1991-2009), the United States Bureau of Economic Analysis (2009), and Standard & Poor's Case-Shiller Home Price History (2009a) and Sales Pair Counts Indices (2009b).

Nevada Gaming Data

Nevada Gaming Abstract Reports are annual financial analyses of non-restricted gaming licensees producing $1 million or more in gaming revenue. Their fiscal year runs from July 1st to June 30th. The reports are released to the public in mid-February for the prior fiscal year. Casino employee counts are averages for the year. Gaming Abstracts are available for the years from 1990 to 2008 and will be utilized for this study. Data included in the abstracts include combined balance sheets, income statements for combined casino, rooms, beverage, food, and other departments. Also included in the abstracts are the average employee counts for the fiscal year. The employee numbers include casino wide and departmental staffing levels.

U. S. Bureau of Economic Analysis Data

Reports on local area personal income are published annually in May. Personal income is defined as the sum of wage and salary disbursements, their supplements, proprietors' income, dividends, interest, and rent and personal current transfer receipts, less contributions for government social insurance (U. S. Bureau of Economic Analysis, 2009).

The Standard & Poor's (S&P)/ Case-Shiller Indices (2009a) are based on the pricing levels of January 2000 (i.e. January 2000 = 100). Values are based on the

respective metropolitan statistical area (MSA). The S&P/ Case-Shiller Housing Indices are created to follow the prices and sales of typical single-family residences located in 20 MSAs. The indices use the repeat sales pricing technique to investigate housing markets. Indices are calculated monthly and published with a sixty day delay.

Case and Shiller (1987) developed their repeat sales method in the 1980s. It is used by government agencies such as the Office of Federal Housing Enterprise Oversight (OFHEO) and is recognized as the most reliable in measuring housing price movements (Standard & Poor's, 2009a). The repeat sales method uses pricing data collected from local public records offices on residential properties that have been sold at least twice. This allows for the calculation of the appreciated price based on a consistent level of quality. Pricing data is collected once it becomes available at the local public recording offices. Because of the need for at least two arms-length transactions, new homes are not included.

Research Objectives

Chapter One identified four research objectives. The first objective of this research is to test John Bates Clark's theory on the marginal utility of labor against claims made against the existence of a positive relationship between gaming revenues and employment. The second is to ascertain the reality of a positive relationship between employment and aggregate income. This will involve testing a sample of the employed citizens (casino employees) in Clark County with the aggregate income data provided by the United States Bureau of Economic Analysis.

The third objective is to test the seminal research on the effect of income, both in the aggregate and pertaining to casino employees, on housing prices and sales against

research done by Jeffery (1996), Grinols (2004), and Grinols and Mustard (2001, 2006), and Wenz (2007, 2008). Finally, this study will attempt to ascertain the existence of an overall relationship between gaming performance and housing, and to measure the relationship if one exists.

As demonstrated in Chapter Two, there is no clear consensus in the gaming literature about the influence of casinos on the surrounding residential real estate market. Thus, this study will add a valuable perspective on these unresolved issues. The research hypotheses stemming from these four objectives are reviewed next.

Restatement of Research Hypotheses

In order to meet the above research objectives, four groups of research hypotheses will be tested for this study:

H1: Gaming revenue is positively correlated with casino employment.

H2: Casino employment is positively correlated with aggregate personal income.

H3a: Aggregate personal income is positively correlated with the number of home sales.

H3b: Aggregate personal income is positively correlated with home prices.

H3c: Average payroll per casino employee is positively correlated with the number of home sales.

H3d: Average payroll per casino employee is positively correlated with the prices of home sales.

H4a: Gaming revenue is positively correlated to residential real estate sales.

H4b: Gaming revenue is positively correlated to residential real estate prices.

Since the hypotheses indicate a direction, the tests of significance will be one–tailed. The hypotheses will be tested to a significance of two and one half percent in all cases unless otherwise specified.

Statistical Techniques

Hypothesis 1 Tests

In order to test John Bates Clark's marginal utility of labor theory against claims of insignificant employment changes (Anders, Siegel & Yacoub, 1998; Przybylski, Felsenstein, Freeman & Littlepage, 1998; Siegel & Anders, 1999), Hypothesis 1 will be analyzed using correlation and regression analysis. Annual gaming revenue data for Clark County's casinos will be compared to total casino employees for the time period of 1990 – 2008.

Hypothesis 2 Tests

Due to the heavy influence of the casino industry on Clark County, casino employment will be compared to the aggregate income of the Las Vegas area. Correlation and regression analyses will be used to measure what impact those employed by and because of casinos have on the total personal income levels for the Las Vegas area.

Hypothesis 3 Tests

Using data from the Nevada Gaming Abstracts, total personal income of the Las Vegas MSA from the U.S. Bureau of Economic Analysis, and housing data provided by Standard & Poor's Case-Shiller databases, tests of correlation and regression will be performed to ascertain any relationship between casino employee income and housing sales and sales prices. In order to test the effects of the broader economy's income level

on housing, test of correlation and regression will be performed comparing the aggregate income of the county with housing sales and prices.

Hypothesis 4 Tests

To ascertain the overall effects of the casino industry on housing, comparative analyses will be performed to weigh the effects of casino revenues on local residential real estate sales and prices. Gaming revenue data will be tested for correlation and regression with residential real estate sales and prices.

Summary

This chapter presented the research methodology of this study. Because the research process involved the acquisition of data from various sources, their uses and origins were discussed. Research objectives and the groups of hypotheses to be tested were discussed and restated. Finally, the statistical methods and techniques used to test the hypotheses were addressed. The results of the application of these techniques are discussed in the next chapter.

CHAPTER 4

ANALYSIS AND RESULTS

Introduction

This chapter will discuss the results of the analyses and the hypotheses testing for the data that was collected as outlined in Chapter 3. The first section of this chapter examines the structure of the data, describing how the data was formatted in the original source and any adjustments made to make analysis possible. The next section presents the results of the initial testing of the hypotheses. Adjustments were made to the testing to accommodate the effects of national economic circumstances which occurred in September of 2001. Results of testing the adjusted and unadjusted data will be presented, followed by the output of the correlation and regression analyses. Finally, the findings of the data analysis will be compared to the corresponding hypotheses.

Data Formatting

The Nevada Gaming Abstract collects financial information from non-restricted Nevada gaming licensees grossing one million dollars or more in gaming revenue for the fiscal year ending June 30. The gaming revenue, average employment, and labor data provided by the Nevada Gaming Abstract are presented annually based on their fiscal year of July 1st to June 30th (State Gaming Control Board, 1991-2009).

The real estate data source used was the Standard & Poor's (S&P) Case-Shiller Home Price Indices (2009a). This source provides housing data by tracking changes in the value of residential real estate transactions. Because the S&P Case-Shiller reports are calculated and published on a monthly basis, some transformation was needed to match the annual form of the gaming data.

The aggregate personal income data provided by the United States Bureau of Economic Analysis (U. S. Bureau of Economic Analysis, 2009) is based on a calendar year annual basis. Without monthly data sources, this study will proceed using the data in its given form, and data analyses will be run based on the given fiscal year of each data source.

Testing of Hypotheses

Hypothesis I

H1: Gaming revenue has a positive correlation with casino employment

$H1_0$: r (correlation coefficient) ≤ 0

$H1_a$: $r > 0$

Correlation and regression analyses were performed for the nineteen years of 1990 through 2008, inclusive. The two variables compared were annual gaming revenue and total casino employees, with gaming revenue the independent variable. The correlation coefficient was 0.9272. The Pearson's correlation critical value at the .025 significance level is .456. Based on these values we reject the null hypothesis. The coefficient of determination measured 0.8598. The F – Value was 104.2472 ($p < .001$). The results for testing the coefficient of the independent variable provided evidence of significant value with a t – Statistic of 10.210 ($p < .001$). As one would expect with testing one variable with another for linear regression, the t – Statistic value is equal to the square root of the F- statistic value (Fisher, 1925).

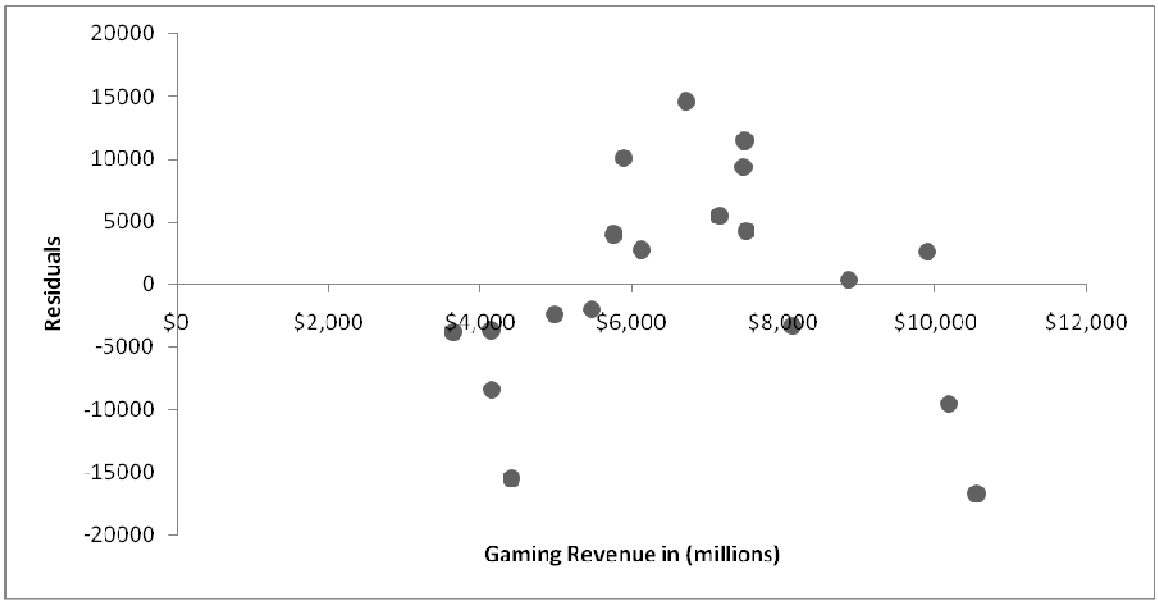

Figure 1. Residual plot of gaming revenue (1990-2008) in millions of dollars when dependent variable is employment.

When analyzing the residual plot (see Figure 1) and considering the Durbin-Watson value of .892, there seemed to exist a pattern starting with the data coinciding with the years 2002-2008 that might cause one to believe the residuals were correlated. Tests were rerun using data points for 1990 through 2001, inclusive. The statistical results provide evidence of a higher correlation (see Table 2). Correlation coefficient was .9728, coefficient of determination equaled .9463. The critical value for the correlation coefficient equaled .576. We also reject the null hypothesis using the updated data. The F-value was 176.0821 ($p < .001$) and the t-statistic value of 13.270 ($p < .001$) was also significant. The resulting residual plot (see Figure 2) appears to be more random. The corresponding Durbin- Watson value was 2.437. The results seem to support the hypothesis of a positive relationship between regional gaming revenue and casino employment.

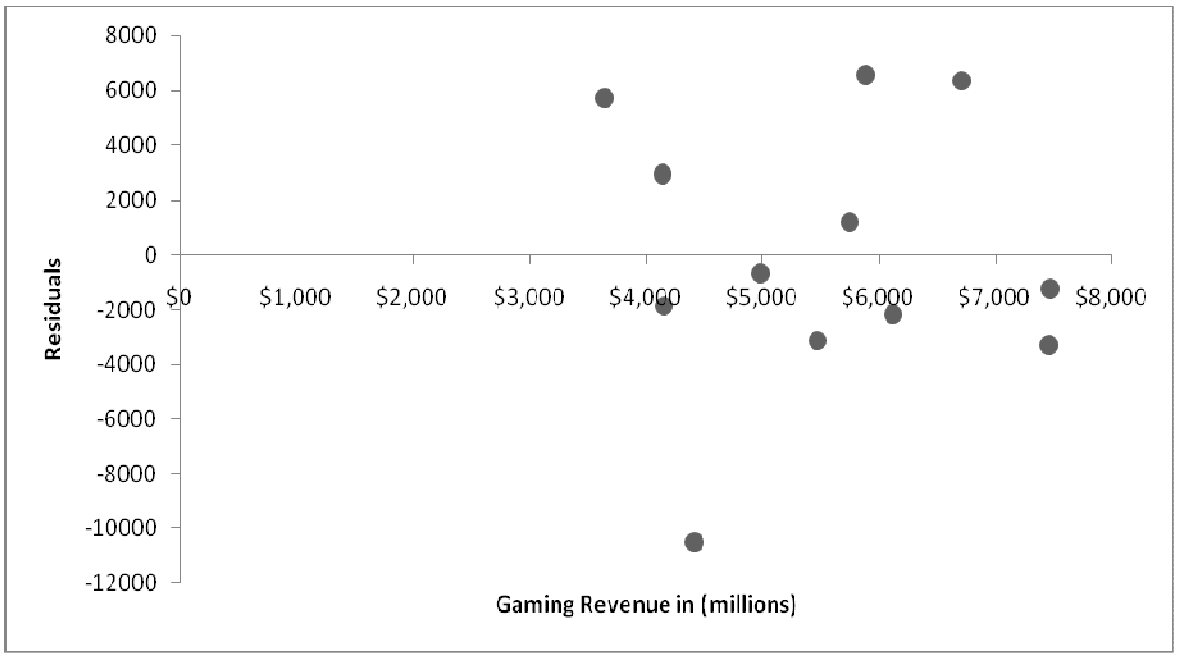

Figure 2. Residual plot of gaming revenue (1990-2001) in millions of dollars when dependent variable is employment.

Table 2

Summary of Hypothesis 1 Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.9272	0.8598	104.2472	0.001
1990 - 2001	0.9728	0.9463	176.0821	0.001

Hypothesis 2

H2: Casino employment is positively correlated with aggregate personal income

$H2_0$: r (correlation coefficient) ≤ 0

$H2_a$: $r > 0$

Correlation and regression analyses were performed for the nineteen years of 1990 through 2008. The two variables compared were the number of casino employees and Clark County Nevada's aggregate personal income, with the independent variable the number of casino employees. The correlation coefficient was 0.8945. The Pearson's correlation critical value at the .025 significance level is .456. Based on these values we reject the null hypothesis. The coefficient of determination measured 0.8001. The F-value was 68.0429 ($p < .001$). The results for testing the coefficient provided statistics that would lead to assuming it was significant. The t-statistic value was 8.2488 ($p < .001$) for the coefficient of the independent variable.

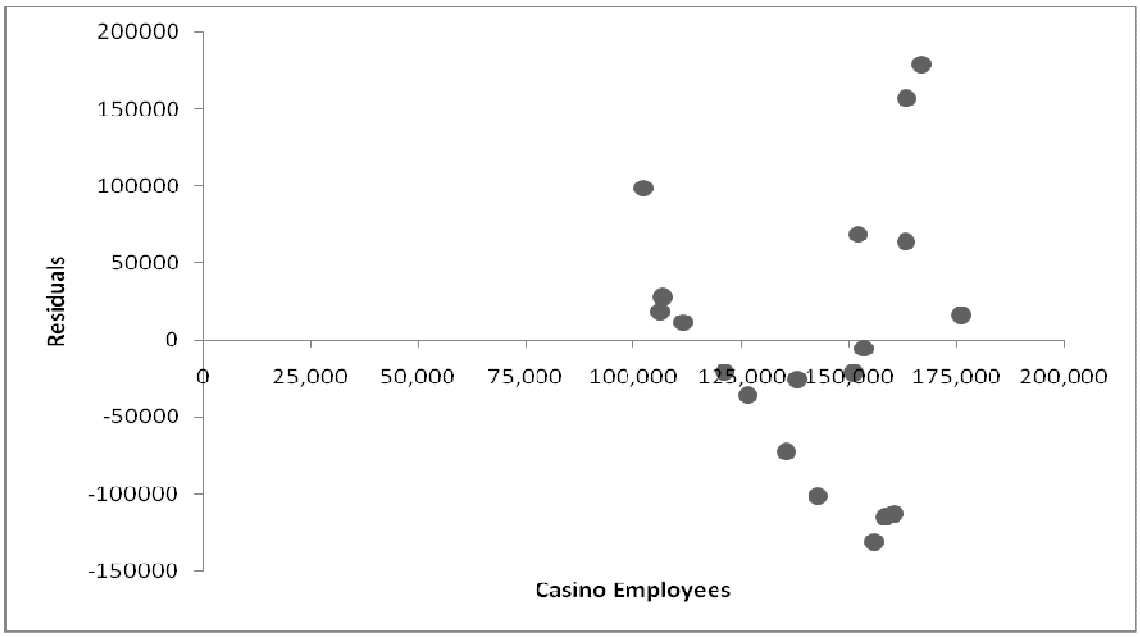

Figure 3. Residual plot of casino employees (1990-2008) when dependent variable is aggregate income.

When analyzing the residual plot (see Figure 3) and considering the Durbin-Watson value of .567, there seemed to be a pattern starting with the data coinciding with the years 2002- 2008 that might cause one to believe the residuals were correlated. Tests were rerun using data points for 1990 through 2001, inclusive. The statistical results gave evidence to a higher correlation (see Table 3). Correlation coefficient was .9709; coefficient of determination equaled .9426. The critical value for the correlation coefficient equaled .576. We therefore also reject the null hypothesis using the updated data. The F-value was 164.2767 ($p < .001$) and the t-statistic value of 12.8171 ($p < .001$) was also significant. The resulting residual plot (see Figure 4) appears to be more random. The corresponding Durbin-Watson value was 2.323. These results seem to

support the existence of a positive relationship between casino employment and aggregate personal income within the Las Vegas MSA.

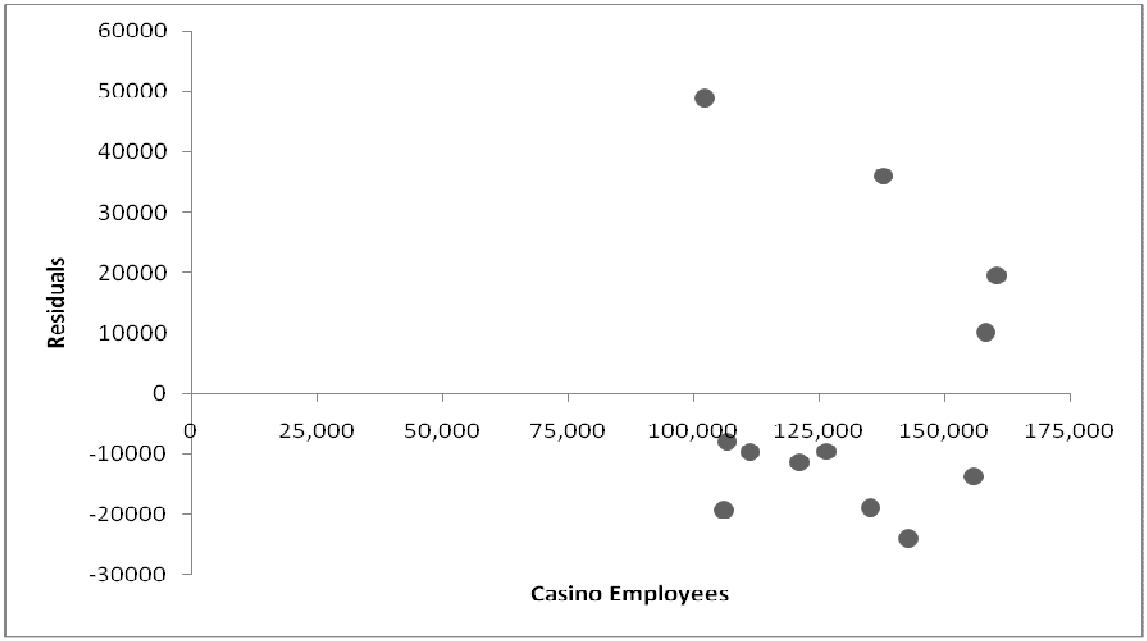

Figure 4. Residual plot of casino employees (1990-2001) when dependent variable is aggregate income.

Table 3

Summary of Hypothesis 2 Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F – Value	Significance of F ($p <$ ___)
1990 - 2008	0.8945	0.8001	68.0429	0.001
1990 - 2000	0.9709	0.9426	164.2767	0.001

Hypothesis 3

H3a: Aggregate personal income is positively correlated with the number of home sales

$H3a_0$: r (correlation coefficient) ≤ 0

$H3a_a$: $r > 0$

Correlation and regression analyses were performed for the nineteen years of 1990 through 2008. The two variables compared were total aggregate personal income for Clark County Nevada and the number of home sales pairs provided by Standard & Poor's Case Shiller housing database for the Las Vegas MSA. The aggregate income variable was the independent variable. The correlation coefficient was 0.6432. The Pearson's correlation critical value at the .025 significance level is .456. Based on these values we reject the null hypothesis. The coefficient of determination measured 0.4137. The F-value was 11.9952 ($p < .005$). The results of testing both the intercept and coefficient provided statistics that would lead us to assume the coefficient of the independent variable was significant. The t-statistic value was 3.4634 ($p < .005$) for the coefficient of the independent variable. These results seem to support a positive relationship between aggregate income and the number of home sales.

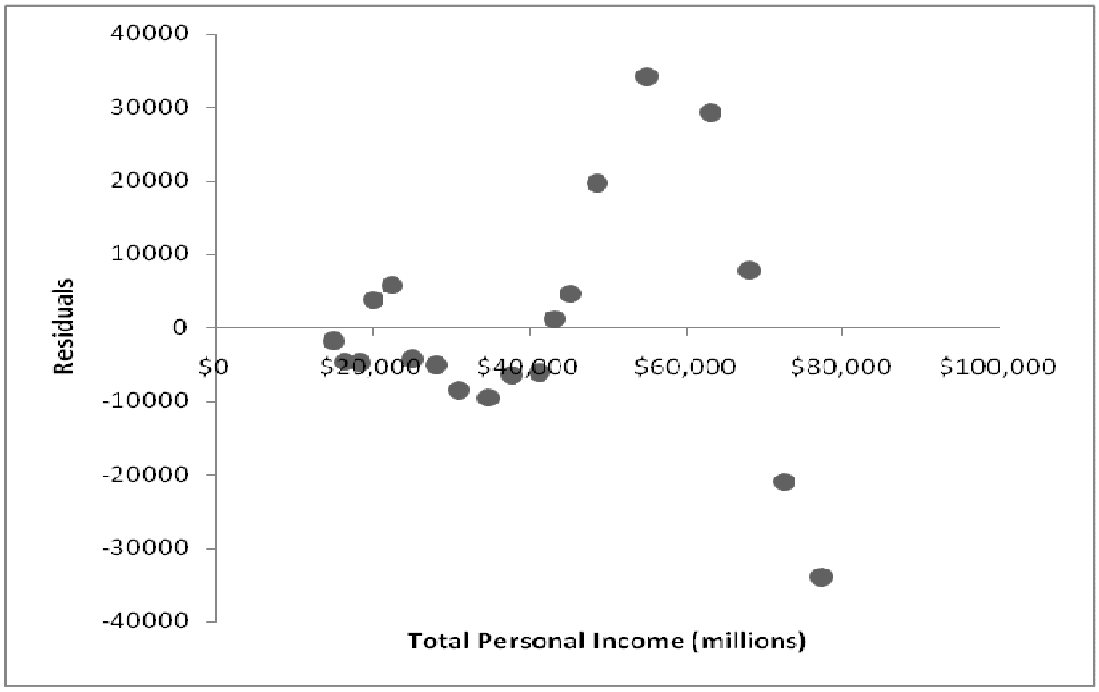

Figure 5. Residual plot of total personal income (1990-2008) when dependent variable is the number of home sales.

When analyzing the residual plot (see Figure 5) and considering the Durbin-Watson value of .491, there appeared to be a pattern coinciding with the years 2001-2008 that might suggest that the residuals were correlated. Tests were rerun using data points for 1990 through 2000, inclusive. The statistical results gave evidence to a higher correlation. Correlation coefficient was .6582; coefficient of determination equaled .4332. The critical value for the correlation coefficient equaled .602. Therefore, we also reject the null hypothesis using the updated data (see Table 4). The F-value was 6.879 ($p < .05$) and the t-statistic value of 2.6228 ($p < .05$) was also significant. The resulting residual plot (see Figure 6) appears to be more random. The resulting residual plot (see Figure 6) appears to be more random. The corresponding Durbin-Watson value was

1.2932. The results seem to further support the hypothesis of a positive relationship between aggregate income and home sales.

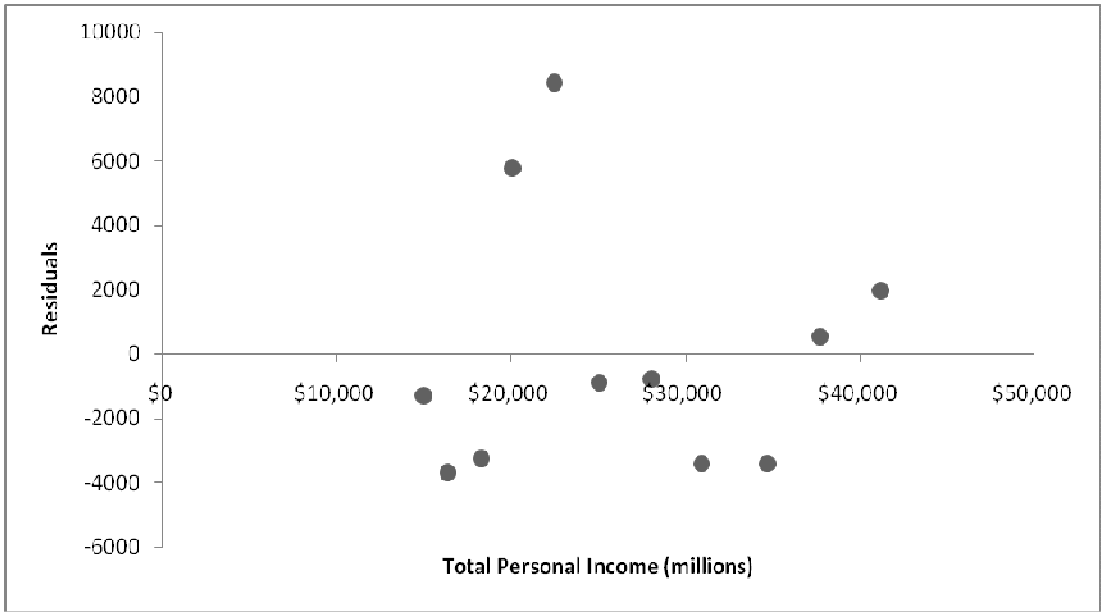

Figure 6. Residual plot of total personal income (1990-2000) when dependent variable is the number of home sales.

Table 4

Summary of Hypothesis 3a Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.6432	0.4137	11.9952	0.005
1990 - 2000	0.6582	0.4332	6.879	0.05

H3b: Aggregate personal income levels have a positive relationship with home prices.

$H3b_0$: r (correlation coefficient) ≤ 0

$H3b_a$: $r > 0$

Correlation and regression analyses were performed for the nineteen years of 1990 through 2008. The two variables compared were total aggregate personal income for Clark County Nevada (January through December) and the annual home price index value provided by Standard & Poor's Case-Shiller housing database for the Las Vegas MSA. The respective weighted average prices were used to compare with the aggregate personal income data. The aggregate income variable was the independent variable. The correlation coefficient was 0.8816 and the Pearson's correlation critical value at the .025 significance level was .456. Based on these values, we reject the null hypothesis. The coefficient of determination measured 0.7773. The F-Value was 59.3538 ($p < .001$). The results of testing the coefficient provided statistics that lead us to assume the coefficient was significant. The t-statistic values were 7.7041 ($p < .001$) for the coefficient of the independent variable. These results seem to support the hypothesis of a positive relationship between aggregate income and home sales prices.

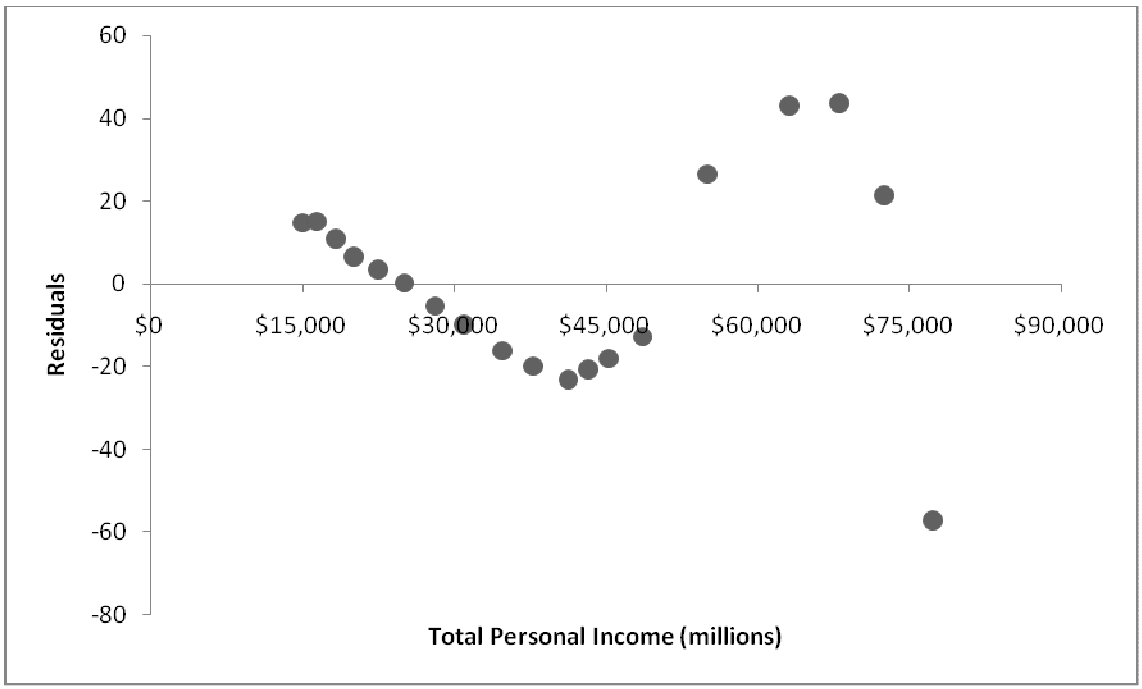

Figure 7. Residual plot of total personal income (1990-2008) when dependent variable is home sale prices.

An analysis of the residual plot (see Figure 7), considering the Durbin-Watson value of .788, seemed to reveal a pattern, beginning with the data coinciding with the years 2001- 2008 that might indicate the residuals were correlated. Tests were rerun using data points for 1990 through 2000 inclusive. The statistical results showed evidence of a higher correlation. Correlation coefficient was .9897; coefficient of determination equaled .9796, and the critical value for the correlation coefficient equaled .602 (see Table 5). We therefore also reject the null hypothesis using the updated data. The F-value was 431.8844 ($p < .001$) and the t-statistic value of 20.7818 ($p < .001$) was also significant. The resulting residual plot (see Figure 8) appears to be more random. The corresponding Durbin-Watson value was 1.629. These results seem to further support the hypothesis of a positive relationship between aggregate income and home sales prices.

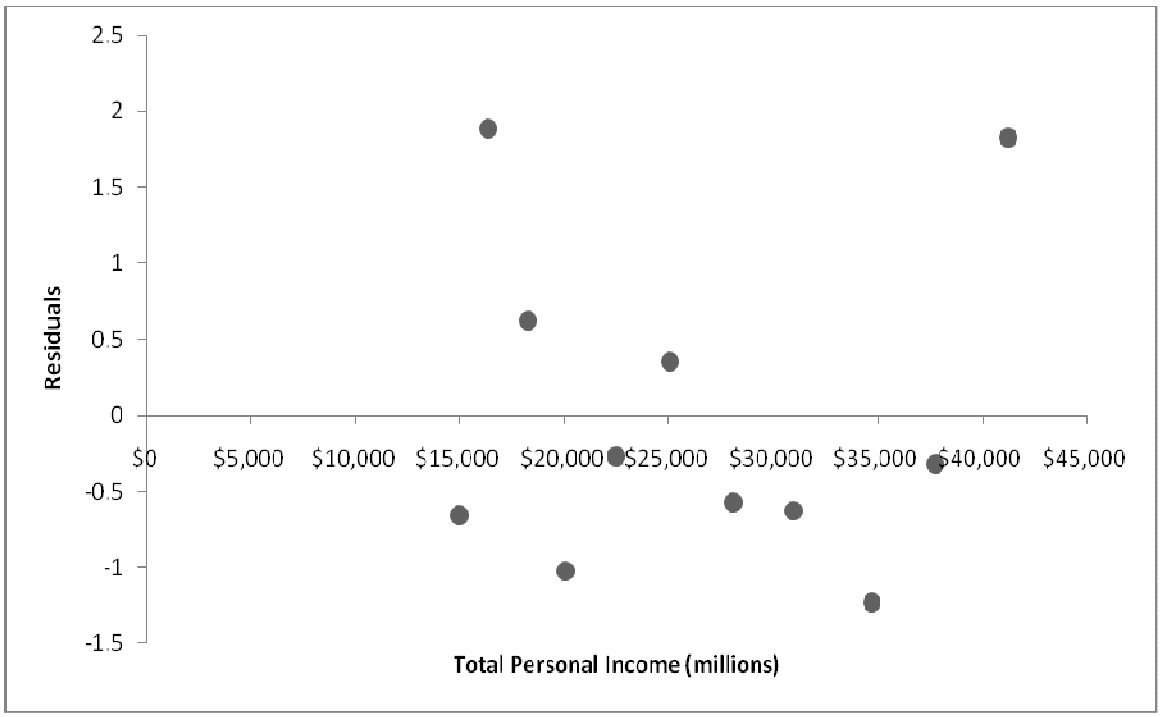

Figure 8. Residual plot of total personal income (1990-2000) when dependent variable is home sale prices.

Table 5

Summary of Hypothesis 3b Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.8816	0.7773	59.3538	0.001
1990 - 2000	0.9897	0.9796	431.8844	0.001

H3c: Average payroll per casino employee is positively correlated with the number of home sales.

$H3c_0$: r (correlation coefficient) ≤ 0

$H3c_a$: $r > 0$

Correlation and regression analyses were performed for the years 1990 through 2008. The two variables compared were average payroll per casino employee and the number of home sales pairs provided by Standard & Poor's Case-Shiller housing database for the Las Vegas MSA. The average employee payroll variable was the independent variable. The correlation coefficient was 0.7122 and the Pearson's correlation critical value at the .025 significance level is .456. Based on these values, we reject the null hypothesis. The coefficient of determination measured 0.5072. The F-Value was 17.4973 ($p < .005$). The statistics provided by testing the coefficient lead us to assume that the coefficient of the independent variable was significant. The t-statistic value was 4.1829 ($p < .005$) for the coefficient of the independent variable. The results seem to support the hypothesis of a positive relationship between aggregate income and the number of home sales.

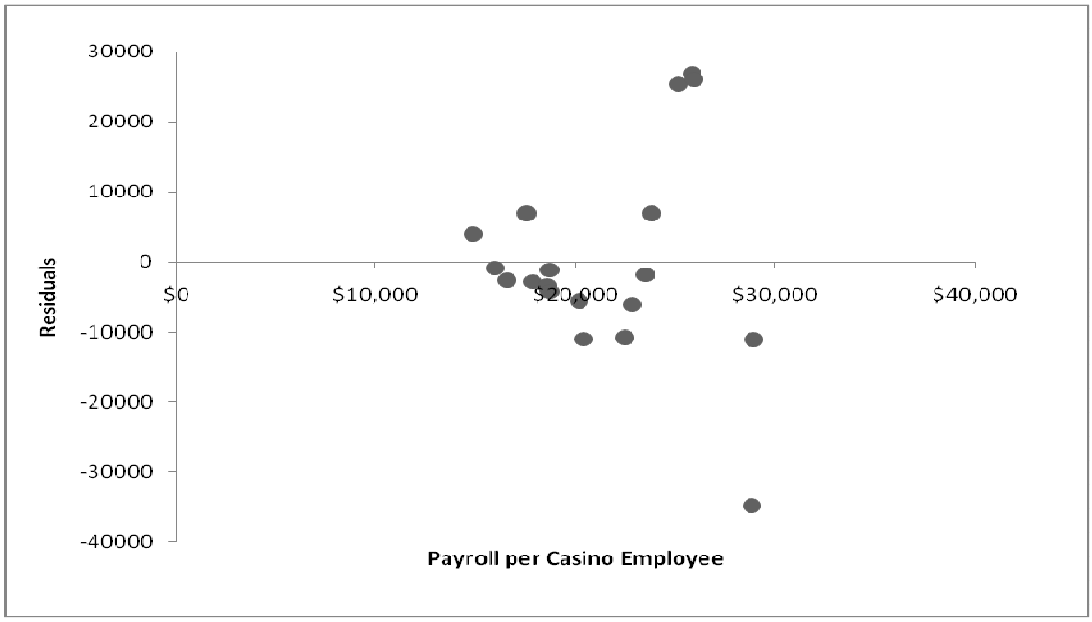

Figure 9. Residual plot of payroll per casino employee (1990-2008) when dependent variable is the number of home sales.

Analyzing the residual plot (see Figure 9) and considering the Durbin-Watson value of .707, seemed to reveal a pattern, starting with the data coinciding with the years 2002–2008, that might indicate that the residuals were correlated. Tests were rerun using data points for 1990 through 2001, inclusive. The statistical results provided evidence of a higher correlation. Correlation coefficient was .7999; coefficient of determination equaled .6398. The critical value for the correlation coefficient equaled .576. We therefore reject the null hypothesis using the updated data (see Table 6). The F-Value was 17.7615 ($p < .005$) and the t-statistic value of 4.2144 ($p < .05$) was also significant. The resulting residual plot (see Figure 10) appears to be more random. The corresponding Durbin-Watson value was 1.699. These results seem to further support the hypothesis of a positive relationship between average payroll per casino employee and home sales.

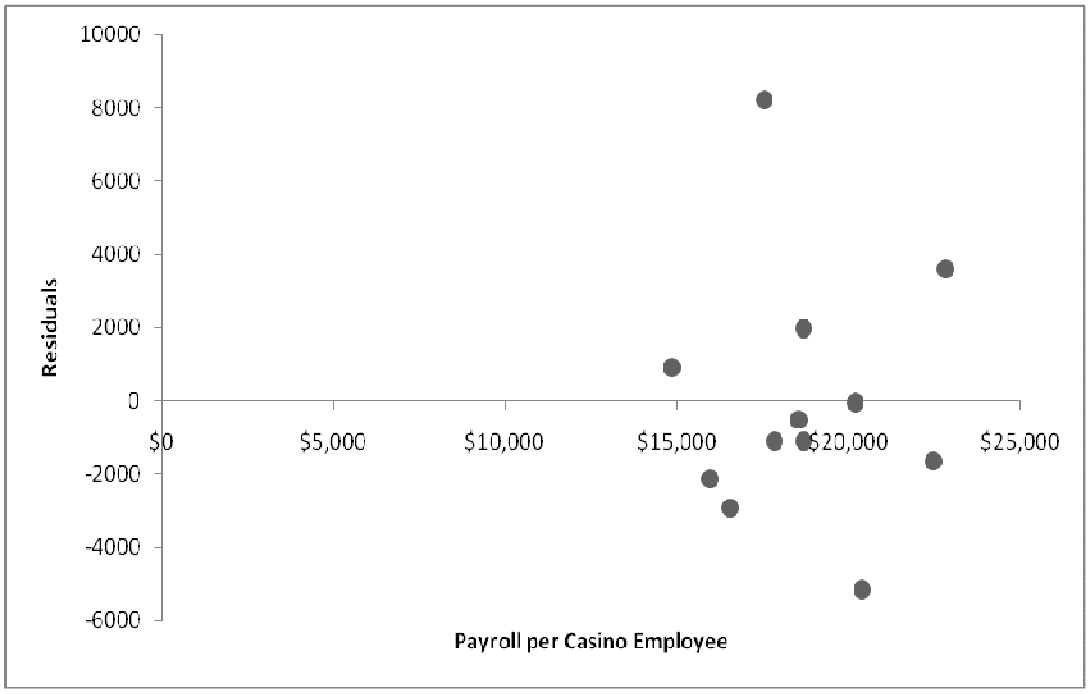

Figure 10. Residual plot of payroll per casino employee (1990-2001) when dependent variable is the number of home sales.

Table 6

Summary of Hypothesis 3c Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.7122	0.5072	17.4973	0.001
1990 - 2001	0.7999	0.6398	17.7615	0.005

H3d: Average payroll per casino employee is positively correlated with the prices of home sales.

$H3d_0$: r (correlation coefficient) ≤ 0

$H3d_a$: $r > 0$

Correlation and regression analyses were performed for the years 1990 through 2008. The two variables compared were average payroll per casino employee and the annual home price index value provided by Standard & Poor's Case- Shiller (2009a) housing database for the Las Vegas MSA. The respective weighted average prices were used to compare with the average payroll per employee income data. The average payroll per employee variable was the independent variable. The correlation coefficient was 0.8833. The Pearson's correlation critical value at the .025 significance level is .456. Based on these values, we reject the null hypothesis. The coefficient of determination measured 0.7801. The F-Value was 60.3191 ($p < .001$). Testing the coefficient provided statistics that would lead us to assume that the coefficient of the independent variable was significant. The t-statistic value was 7.7665 ($p < .001$) for the coefficient of the independent variable. The results seem to support a positive relationship between average casino employee payroll and home prices.

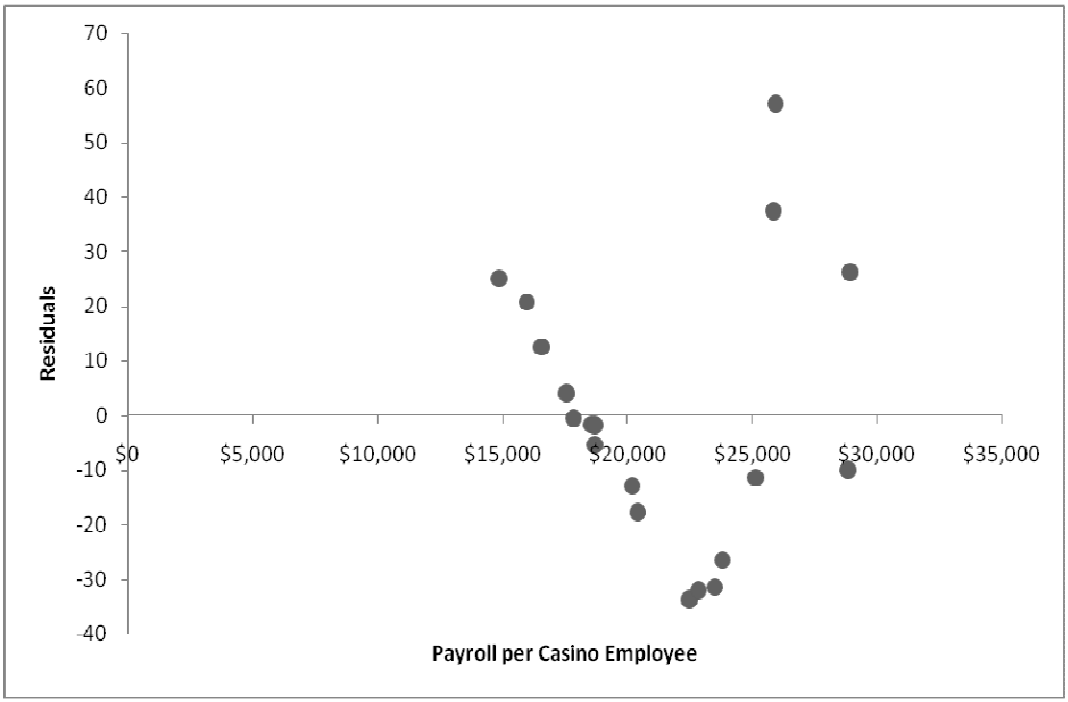

Figure 11. Residual plot of payroll per casino employee (1990-2008) when dependent variable is home sale prices.

When analyzing the residual plot (see Figure 11) and considering the Durbin-Watson value of .609, we saw what seemed to be a pattern starting with the data coinciding with the years 2002-2008 that might indicate that the residuals were correlated. Tests were rerun using data points for 1990 through 2001, inclusive, and discovered evidence of a higher correlation. Correlation coefficient was .9694; coefficient of determination equaled .9398. The critical value for the correlation coefficient equaled .576. Based on the updated data, we reject the null hypothesis (see Table 7). The F-value was 156.0504 ($p < .001$) and the t- statistic value of 12.4920 ($p < .001$) was also significant. The resulting residual plot (see Figure 12) appears to be more random. The corresponding Durbin-Watson value was 2.686. The results seem to further support a positive relationship between casino employee income and home prices.

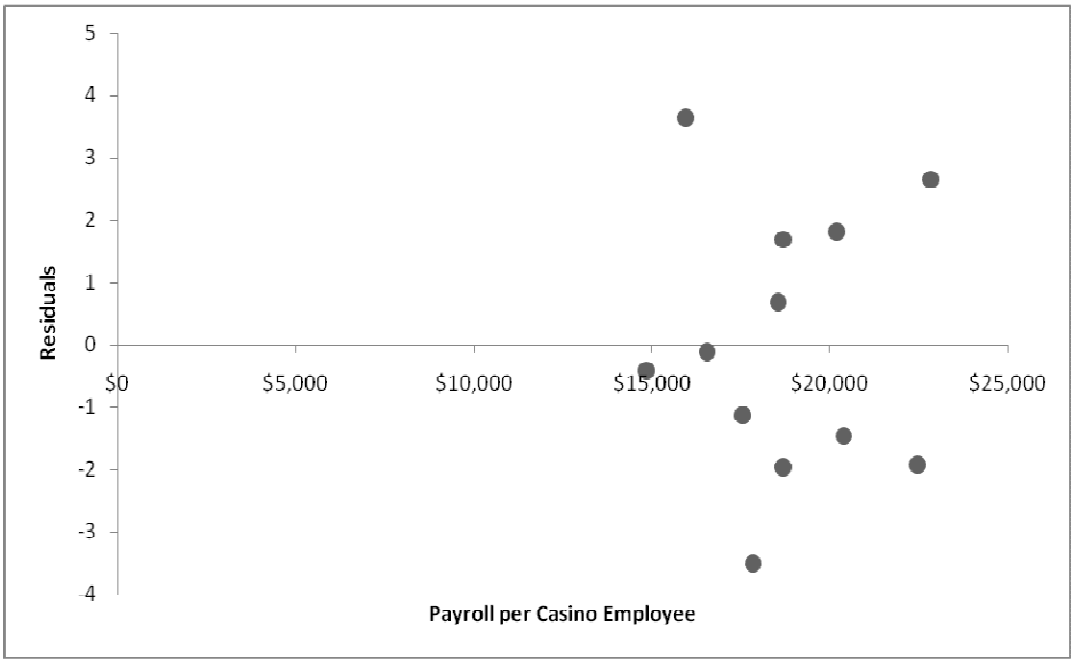

Figure 12. Residual plot of payroll per casino employee (1990-2001) when dependent variable is home sale prices.

Table 7

Summary of Hypothesis 3d Statistics

	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.8833	0.7801	60.3191	0.001
1990 - 2001	0.9694	0.9398	156.0504	0.001

Hypothesis 4

H4a: Gaming revenue is positively correlated to residential real estate sales

$H4a_0$: r (correlation coefficient) ≤ 0

$H4a_a$: $r > 0$

Correlation and regression analyses were performed for the nineteen years of 1990 through 2008. The two variables compared were gaming revenue for Clark County and the number of home sales pairs provided by Standard & Poor's Case-Shiller (2009b) housing database for the Las Vegas MSA. The average gaming revenue variable was the independent variable. The correlation coefficient was 0.7132. The Pearson's correlation critical value at the .025 significance level is .456. Based on these values we reject the null hypothesis. The coefficient of determination measured 0.5087. The F-value was 17.6036 ($p < .005$). The results for testing the coefficient provided statistics that would lead to assuming the coefficient of the independent variable was significant. The t-statistic value was 4.1957 ($p < .005$) for the coefficient of the independent variable. The results seem to support the hypothesis of a positive relationship between gaming revenue and the number of home sales.

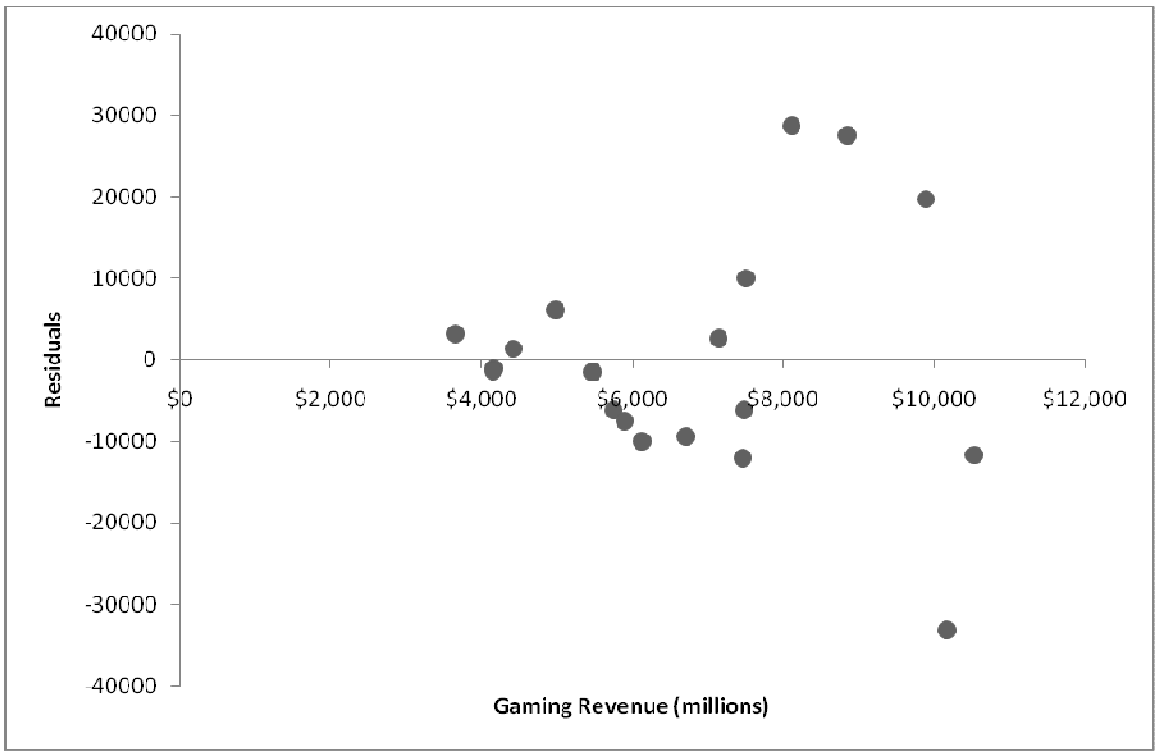

Figure 13. Residual plot of gaming revenue (1990-2008) in millions of dollars when dependent variable is the number of home sales.

When analyzing the residual plot (see Figure 13) and considering the Durbin-Watson value of .565, there seemed to exist a pattern starting with the data coinciding with the years 2002 – 2008 that might indicate the residuals were correlated. Tests were rerun using data points for 1990 through 2001, inclusive. The statistical results gave evidence to a higher correlation. Correlation coefficient was .8025; coefficient of determination equaled .6440. The critical value for the correlation coefficient equaled .576. Using the updated data, we reject the null hypothesis (see Table 8). The F-value was 18.0901 ($p < .005$) and the t-statistic value of 4.2532 ($p < .005$) was also significant. The resulting residual plot (see Figure 14) appears to be more random. The corresponding

Durbin-Watson value was 1.224. The results seem to further support the hypothesis of a positive relationship between casino revenue and home sales.

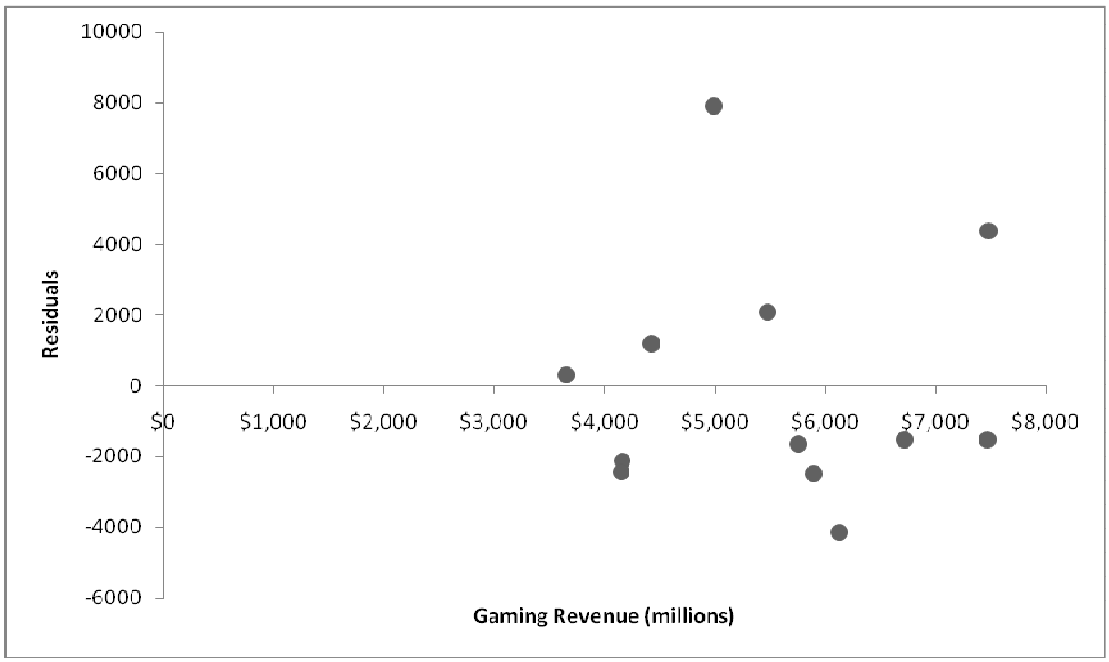

Figure 14. Residual plot of gaming revenue (1990-2001) in millions of dollars when dependent variable is the number of home sales.

Table 8

Summary of Hypothesis 4a Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.7132	0.5087	17.6036	0.005
1990 - 2001	0.8025	0.644	18.0901	0.005

H4b: Gaming revenue is positively correlated to residential real estate prices

$H4b_0$: r (correlation coefficient) ≤ 0

$H4b_a$: $r > 0$

Correlation and regression analyses were performed for the years 1990 through 2008. The two variables compared were gaming revenue and the annual home price index value provided by Standard & Poor's Case-Shiller (2009a) housing database for the Las Vegas MSA. The respective weighted average prices were used to compare with the average payroll per employee income data, with gaming revenue as the independent variable. The correlation coefficient was 0.9064. The Pearson's correlation critical value at the .025 significance level is .456. Based on these values we reject the null hypothesis. The coefficient of determination measured 0.8216. The F-Value was 78.3096 ($p < .001$). The results for testing the coefficient provided statistics that would lead to assuming the coefficient of the independent variable was significant. The t-statistic value was 8.8493 ($p < .001$) for the coefficient of the independent variable. The results seem to support the hypothesis of a positive relationship between casino gaming revenues and home prices.

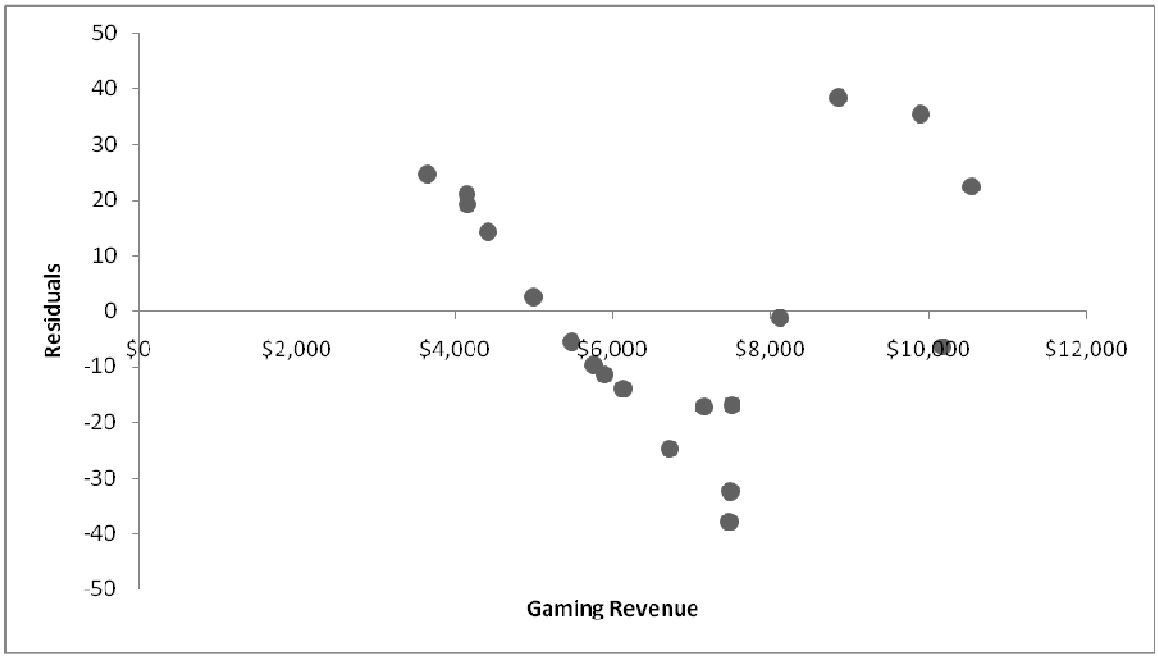

Figure 15. Residual plot of gaming revenue (1990-2008) in millions of dollars when dependent variable is home sale prices.

When analyzing the residual plot (see Figure 15) and considering the Durbin-Watson value of .408, there seemed to exist a pattern starting with the data coinciding with the years 2002 – 2008 that might indicate the residuals were correlated. Tests were rerun using data points for 1990 through 2001, inclusive, resulting in evidence of a higher correlation. Correlation coefficient was .9738; coefficient of determination equaled .9483. The critical value for the correlation coefficient equaled .576. We also reject the null hypothesis using the updated data (see Table 9). The F-Value was 183.4033 ($p < .001$) and the t-statistic value of 13.5427 ($p < .001$) was also significant. The resulting residual plot (see Figure 16) appears to be more random. The corresponding Durbin – Watson value was 1.396. The results seem to further support a positive relationship between casino gaming revenues and home prices.

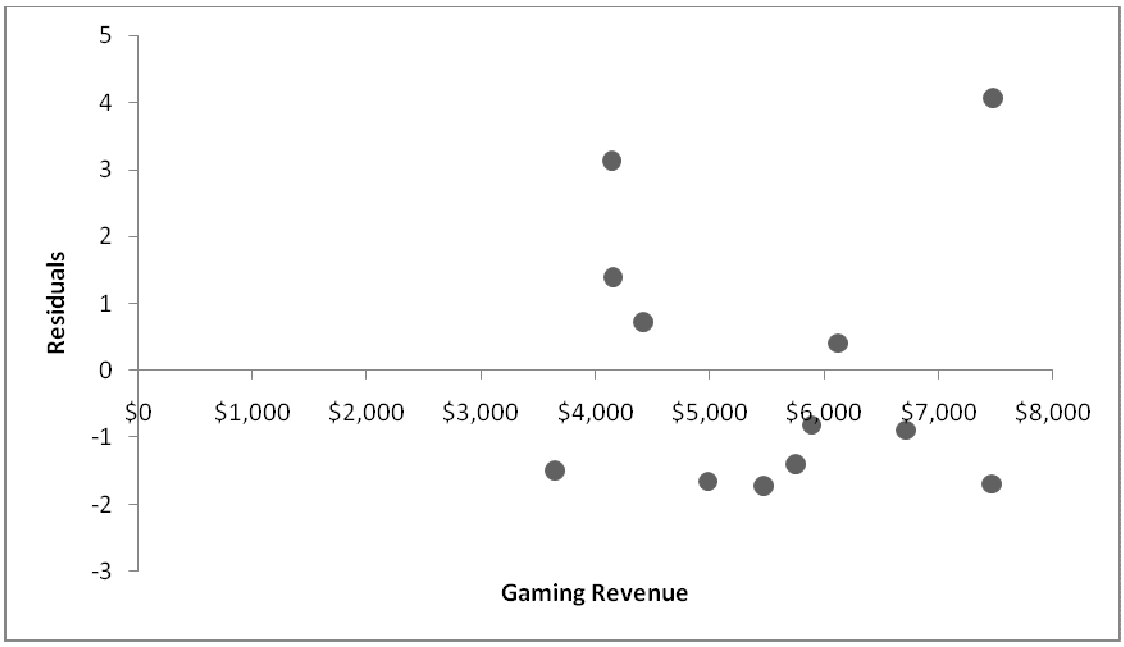

Figure 16. Residual plot of gaming revenue (1990-2001) in millions of dollars when dependent variable is home sale prices.

Table 9

Summary of Hypothesis 4b Statistics

Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
1990 - 2008	0.9064	0.8216	78.3096	0.001
1990 - 2001	0.9738	0.9483	183.4033	0.001

Summary of the Findings

A total of eight hypotheses and sub-hypotheses were tested to determine the effect of gaming on local residential real estate in the Las Vegas MSA. Hypothesis one focused on determining the presence of a relationship between gaming industry performance, measured by gaming revenue, and employment. The null hypothesis was rejected because of significant levels of positive correlation between gaming revenue and the number of casino employees. The Student's T–test results of the independent variable's coefficient further support the existence of a relationship between gaming revenue and overall casino employment.

Hypothesis two focused on determining whether there existed a positive relationship between Las Vegas' dominant industry and aggregate personal income with the Las Vegas area. The null hypothesis was rejected because the results gave evidence that the number of casino employees and aggregate Las Vegas personal income was highly correlated. The subsequent Student T-test of the employment variable provides further evidence to support a positive relationship between casino employment and aggregate personal income.

The sub- hypotheses grouped under Hypothesis 3 tested the correlation and relationship between income and local residential housing. All four null hypotheses were rejected in response to evidence that personal income, both in the aggregate and among casino employees, had a positive correlation with residential home sales and prices. Student T–tests were run and produced evidence that further support these claims, and secondary tests were run to exclude the effects of September 11, 2001. The findings of

the secondary tests further supported the initial testing of the hypotheses and sub-hypotheses.

The fourth group of hypotheses was tested to determine the overall correlation between gaming revenue and its effects on residential housing. Both null hypotheses were rejected. Between gaming revenue and local residential real estate, correlations were significantly positive and relationships expressed by the coefficient of determination gave evidence to support a strong relationship between the variables. Subsequent Student T-tests of the coefficient of the independent variables further support a relationship between casino performance and local residential housing.

CHAPTER 5

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

Although researchers from many different fields of study have analyzed the impact of varying aspects of the casino industry on their surroundings, many do not have an adequate understanding either of the gaming industry itself or of the differences between gaming jurisdictions. For this reason, much of the research is inadequate, susceptible to funders' biases, or impractical.

A serious attempt to analyze the economic effects of the casino industry will need to begin, as with any other industry, with an understanding of seminal economic principles, in particular theories of production, distribution, and consumption of goods and services. Because different legislation regulates the gaming industry in different locales, a researcher should not make the mistake of grouping data from different jurisdictions together, but should study the implications of gaming on a case by case and location by location basis. Creating, stating, or implying the external validity of findings based on a few similar locations or an inappropriate mix of varying locations is damaging to the validity of the research.

This study implemented and assessed the economic interactions between the production of the gaming industry, the labor involved in production, employee income, and consumption in terms of housing. Additionally, the study sought to fill a gap in the research by including Las Vegas in an economic impact study concerning gaming.This chapter summarizes the key findings of the results and draws conclusions from these

findings. Next, the implications of the findings are provided, followed by a list of recommendations for future research.

Summary of Key Findings

In examining the first hypothesis, it was determined that Clark County gaming revenues had a strong correlation with the number of employees hired by the same gaming establishments that produced the gaming revenue ($r = .9272$). Regression analysis produced a coefficient of determination which measured .8598 and evidence signifying a strong interaction between the variables ($F=104.2472$, $p < .001$). Testing the independent variable (revenues) coefficient for significance provided further evidence of a positive relationship between the two variables of gaming revenue and employment ($t = 10.2102$, $p < .001$).

Analysis of hypothesis two revealed evidence that the level of casino employment was positively correlated with county aggregate personal income. The correlation coefficient was .8945 and the corresponding coefficient of determination was .8001. Testing the independent variable (employment) coefficient for significance provided further evidence of a positive relationship between employment and aggregate income ($F=68.0429$, $p < .001$). Testing the independent variable provided further information leading to the conclusion that there is a positive relationship between employment and aggregate income ($t = 8.2488$, $p < .001$).

The third group of hypotheses examined the relationship between income and housing. The study tested the relationship between the aggregate personal income of Clark County and the annual weighted average home price index in the Las Vegas-Paradise Metropolitan Statistical Area (MSA). Statistical results implied a strong

interaction between the two variables with a correlation of 0.8816 and coefficient of determination measuring 0.7773. The F statistic in the regression analysis also supported a strong correlation between the two variables ($F = 59.3538$, $p < .001$). Further testing the independent variable's coefficient for significance provided additional evidence of a positive relationship between the home prices and aggregate income ($t = 7.7041$, $p < .001$).

When analyzing the results of the tests between aggregate income and home sales prices, there was evidence of positive serial correlation (Durbin- Watson = .788). Graphically the divergence appeared to occur after 2000. A second correlation and regression tests were run excluding the data points corresponding to years 2001 to 2008 inclusive. Test statistics provided evidence of an even stronger relationship between the two variables. The correlation coefficient was .9897, the coefficient of determination was .9796, and the F-value equaled 431.8844 ($p < .0001$). Testing the independent variable coefficient provided evidence of a significant and positive coefficient ($t = 20.7818$, $p < .0001$).

The analysis of the relationship between aggregate income and housing sales provided evidence of a positive relationship between the two variables but one with less strength than that of aggregate income and housing prices. Correlation coefficient equaled 0.6432 with a corresponding coefficient of determination of 0.4137. The F-value of the regression analysis was 11.9952 ($p < .005$) and the t-statistic for the coefficient of the independent variable was 3.4634 ($p < .005$). Though not as strong as the relationship between aggregate income and home prices, the relationship between aggregate income and home sales seemed significant and positive.

Once again, evidence of positive serial correlation revealed itself (Durbin-Watson = .491). Graphically the divergence occurred with data points associated with the years 2001 through 2008 inclusive. In response, regression tests were run for years 1990 through 2000, inclusive. Coefficients of correlation and determination were 0.6582 and 0.4332, respectively. The F-value was 6.8789 ($p < .05$), further showing a significant interaction, albeit not as strong as that shown between aggregate income and home prices. Evidence of positive serial correlation diminished (Durbin-Watson = 1.293).

To further investigate the relationship between income and housing, analyses were run to measure the relationship between the average income derived from casino employment per employee and housing. The first of the hypotheses to be analyzed tested the correlation between casino employee income and annual weighted average housing prices. The correlation coefficient and coefficient of determination were 0.8833 and .7801 respectively. Regression analysis provided more evidence to support a positive relationship, with an F-Value of 60.3191 ($p < .001$) and t-statistic of 7.7665 ($p < .001$) for the independent variable's coefficient.

Secondary analysis was performed in response to the Durbin- Watson statistic of 0.609 in the previous analysis. Correlation and regression analyses were re-run using data points for years 1990 to 2001 inclusive. The correlation coefficient result increased to 0.9694 and the corresponding coefficient of determination equaled 0.9398. The F-value and the corresponding t-statistic were 156.0503 ($p < .001$) and 12.4920 ($p < .001$) respectively. The Durbin-Watson value increased to 2.686. This evidence supports a strong positive relationship between the income of casino employees and housing prices.

Next, the investigator analyzed the relationship between average pay per casino employee and housing sales, with average pay as the independent variable. The correlation coefficient equaled 0.7122 with a coefficient of determination of0.5072. The regression analysis produced an F-value of 17.4973 ($p < .005$). Further evidence of a relationship was evident in the significance of the coefficient of the independent variable ($t = 4.1829$, $p < .005$). Doubt about the statistical strength of the results was brought to light by the Durbin-Watson value of 0.707. When the data was re-analyzed using pre-September 11, 2001 data, the strength of a positive relationship was reaffirmed. Coefficients of correlation and determination measured 0.7999 and .6398 respectively. The regression analysis supported the existence of a relationship ($F = 17.7615$, $p < .005$). The coefficient of the independent variable also showed significance ($t = 4.2144$, $p < .05$), and concerns about positive autocorrelation were minimized based on a Durbin-Watson value of 1.699.

The hypotheses in the fourth group were tested to measure the overall relationship between gaming and housing. The first test was to measure the relationship between gaming revenue and housing sales. For the nineteen years measured, the correlation coefficient between the two variables equaled 0.7132 with a corresponding coefficient of determination 0.5087. The F-value for the ensuing regression analysis also supported the existence of a positive relationship between the two variables ($F = 17.6036$, $p < .005$), as did the results of testing the significance of the independent variable coefficient \($t = 4.1957$, $p < .005$). There were some concerns of positive autocorrelation with a Durbin-Watson value of 0.565.

Based on the results of the testing of the other hypotheses, the low Durbin-Watson value, and the visual analysis of the residual plot, it was determined that we should also analyze the data prior to September 11, 2001. When analysis was performed on the data for the years 1990 to 2001, inclusive, the existence of a positive relationship between the two variables was reaffirmed. Correlation coefficient equaled 0.8025 and the coefficient of determination was .6440. Regression analysis was supportive ($F = 18.0901$, $p < .005$) with the coefficient of the independent variable statistically significant ($t = 4.2532$, $p < .005$). Durbin- Watson value was 1.224.

Testing for a relationship between gaming revenue and housing prices revealed a correlation coefficient of 0.9064 and a coefficient of determination of .8216. The F-value of the regression analysis was 78.3096 ($p < .001$), and the coefficient of the independent variable also displayed levels of significance ($t = 8.8492$, $p < .001$). The Durbin-Watson value equaled .408.

When a re-analysis was performed of the years 1990 to 2001 using the same variables, correlation and determination coefficients increased to 0.9738 and 0.9482 respectively. F-value increased to 183.4033 ($p < .001$) and the t- statistic to 13.5427 ($p < .001$). The Durbin-Watson value increased to 1.396.

The analysis of data gives evidence that supports rejection of all ten null hypotheses in the four areas tested (see Table 10). The overall view of the data seems to support seminal economic theory and to conflict with much of the prior research concerning the effects of casinos and the gaming industry on the local environment.

Table 10

Summary of Hypotheses Statistics

Hypothesis	Years	Correlation Coefficient (r)	Coefficient of Determination (R^2)	F - Value	Significance of F ($p <$ ___)
I	1990 - 2008	0.9272	0.8598	104.2472	0.001
	1990 - 2001	0.9728	0.9463	176.0821	0.001
II	1990 - 2008	0.8945	0.8001	68.0429	0.001
	1990 - 2000	0.9709	0.9426	164.2767	0.001
III a	1990 - 2008	0.6432	0.4137	11.9952	0.005
	1990 - 2000	0.6582	0.4332	6.879	0.05
III b	1990 - 2008	0.8816	0.7773	59.3538	0.001
	1990 - 2000	0.9897	0.9796	431.8844	0.001
III c	1990 - 2008	0.7122	0.5072	17.4973	0.001
	1990 - 2001	0.7999	0.6398	17.7615	0.005
III d	1990 - 2008	0.8833	0.7801	60.3191	0.001
	1990 - 2001	0.9694	0.9398	156.0504	0.001
IV a	1990 - 2008	0.7132	0.5087	17.6036	0.005
	1990 - 2001	0.8025	0.644	18.0901	0.005
IV b	1990 - 2008	0.9064	0.8216	78.3096	0.001
	1990 - 2001	0.9738	0.9483	183.4033	0.001

Discussion

This study provides a different method of analyzing the effects of a casino industry on the local economy. Using seminal economic principles in an established gaming market allows for researchers and practitioners alike to gain valuable and unbiased information. The availability of objective data such as that provided by the Nevada Gaming Commission and Gaming Control Board (2008), along with generally

accepted Case-Shiller real estate data (2009a, 2009b) and data from the United States Bureau of Economic Analysis (2009), reduces the need to use subjective data or to use objective data in subjective ways, as in a social cost-benefit analysis.

The techniques used in this study coincide with economic principles concerning production and employment (Holt, Modigliani & Simon, 1955), employment and aggregate income, aggregate income and consumption, and income and housing. The overall model, in truth a collection of related techniques, does not attempt to justify the usefulness or legitimacy of an industry, but to objectively measure the effects of one economic variable produced by the industry on variables representing the environment affected.

It is surprising that these well-known and tested economic theories have not been used in more studies such as this one. This may be in part related to the subjectivity of prior research and the biases resulting from its funding. One must also question the availability of data. Standard and Poor's Case -Shiller data is limited to a select number of cities and metropolitan areas, only one of which has an established gaming industry.

The most interesting results of the study were not the statistical results themselves, but how closely the correlations of this study matched correlations of studies used in the creation of the seminal theories and principles (Friedman, 1957). It may be that the absence of similar studies in the literature is due to a lack of interest in the success of a gaming industry based metropolitan area.

Correlation coefficient values decreasing as the study progressed through the production- consumption chain was seen as normal, as other variables not tested for in this study may have had some minor effects. The correlation values discovered still

provide credible evidence of the relationship between the tested variables. A similar analysis of other gaming based cities may help discover other contributing factors to the economic interaction of the tested variables. Future investigators will now have a base from which to compare the effects of differences in such variables as legislation, location, and awareness.

Conclusions

Using Deardorff's (2006) definition of an economic model— a collection of assumptions from which inferences can be derived about economic behavior and performance— this study has created a robust model that can be used to initially compare the effects of an industry on its surrounding economic environment.

The most significant outcome of this study was the discovery of evidence leading to the conclusion that the presence of gaming has a positive correlation with housing sales and prices in its local economic area. The techniques involved in analyzing such a relationship will allow researchers to compare other cities where gaming is a significant source of business. Although several previous studies exist concerning gaming and its effects on the local economy, the findings of this study support the use of seminal economic research techniques for providing objective results.

Implications of the Study

This study was undertaken because of the investigator's belief that there was a gap in the research regarding the gaming industry's effects on its local economy, and a lack of unbiased and objective research in particular. Prior to this study, the investigator was unable to find an acceptable method for evaluating the economic effects of the gaming industry on its local area. This series of tests for correlation was assembled in

order to properly seek and measure the relationships between gaming industry production, employment, income, and housing.

Undertaking a case study of Las Vegas provided this investigation with the ability to analyze a developed gaming market and its effects on an area that is dependent on the industry itself. Using one city allowed the study to focus on the key economic factors rather than attempting to account for factors such as differing gaming rules and regulations, cultures, tax laws, and demographics that would affect the results of a multi-city study.

Although this dissertation is limited in its generalizability due to the unique position of Las Vegas among gaming economies in the U.S, it does seem to suggest that an increase in gaming industry production increases employment, aggregate income, average gaming employee income, and housing prices and sales. It also provides a model for evaluating the effects of the gaming industry in a particular geographic or statistical area on its surrounding economic environment.

This technique might be applied to other gaming communities in order to increase the likelihood of creating better analyses of industry and economic performance within and among surrounding communities. It would allow gaming companies to better interact with nearby citizens as well as allowing local governments to administer their resources more efficiently. It might also be used with regard to other industries in order to help estimate the financial and economic impact of introducing the industry to or removing it from a given location. Finally, this study might also be used by individuals who, like the investigator, invest in real estate for personal financial gain. It would allow us to better estimate if, where, and when to buy, hold, or sell residential real estate.

Key Limitations of the Study

While this study has made a contribution to research in gaming and economics, it contains limitations that must be noted. First, the study was exploratory in nature and relied for the sake of convenience on secondary data. Though secondary data is common in economic studies, the data is not specifically tailored for every type of study. In addition, the study used annual data and annual averages in the computation of the statistical results. Though this is also common in economic impact studies and allows the researcher to omit the complications of calculating seasonal effects, using more frequent data may have increased validity and allowed for more accurate statistical outcomes. The minimal amounts of data collected may make it difficult to duplicate the study using another geographic location.

Next, because of the effects of September 11, 2001, many of the statistical calculations used only a portion of the data available. The number of years in calculations was reduced from nineteen years (1990-2008) to eleven (1990- 2000) or twelve (1990-2001). While a longer time period would have been preferable, many seminal economic studies exploring similar relationships have used as little as nine years (Friedman, p.132). It is hoped that further research will be conducted using longer time periods or more periodic data.

In a hospitality service based town such as Las Vegas, a significant amount of many employees' income is derived from tips or gratuities. This income is difficult to track and thus more difficult to account for in aggregate and personal income calculations. Attaining more accurate data of the presence and magnitude of tips and gratuities would enrich the study and possibly increase validity.

It should be noted that some of these limitations lead directly to suggestions for further research endeavors. That topic is discussed next in the last section of this chapter.

Recommendations for Future Research

The following recommendations are made for further study:

1. Further studies should investigate additional cities where gaming is a significant part of the locale's employment and aggregate income can be used in order to establish a comparative study.
2. In this study there seemed to be a significant change in the relationship between the variables following September 11, 2001 as compared to before this date. A comprehensive study measuring the effects of this occurrence on gaming and gaming related destinations should be done using a pre- and post- September 11, 2001 variable.
3. A similar study should be performed that measures the relationship of different items of consumption to gaming industry performance.
4. A similar study should be performed that replaces the gaming industry with another industry of similar significance to the immediate geographic or metropolitan statistical area.
5. Longer – term effects and correlations should be studied as well as how changes in other economic factors such as technology, population, and education affect the factors studied in this dissertation.
6. Using this study as a benchmark, a study should be performed to compare the effects of various gaming restrictions, such as betting limits and zoning restrictions, on the economy.

7. A comprehensive study on the effects of tips and gratuities on the local economy should be done in order to more accurately weigh the economic influence of tip-based jobs such as bartending, cocktailing, serving, and valet parking.

APPENDIX

Table 11

Production, Employment, and Income Data

Year	Gaming Revenue (in millions)	Total Casino Employees	Aggregate Personal Income (in millions)	Payroll per Casino Employee
1990	$3,644.48	106,060	$14,954.60	$14,845.34
1991	$4,154.28	106,645	$16,346.70	$16,555.47
1992	$4,147.19	111,321	$18,278.20	$15,960.18
1993	$4,416.55	102,186	$20,048.20	$17,841.45
1994	$4,984.92	121,096	$22,483.50	$17,544.36
1995	$5,471.72	126,422	$25,053.60	$18,688.43
1996	$5,752.57	135,249	$28,071.10	$18,552.68
1997	$5,890.90	142,790	$30,941.50	$18,693.56
1998	$6,122.84	137,797	$34,713.80	$20,394.64
1999	$6,711.42	155,672	$37,747.70	$20,191.64
2000	$7,467.05	158,135	$41,239.30	$22,469.33
2001	$7,478.27	160,370	$43,179.70	$22,836.06
2002	$7,149.56	150,969	$45,202.60	$23,485.31
2003	$7,503.76	153,366	$48,600.90	$23,800.29
2004	$8,114.59	152,011	$54,976.20	$25,131.39
2005	$8,852.22	163,218	$63,040.60	$25,848.43
2006	$9,888.91	176,029	$68,031.60	$25,938.17
2007	$10,538.12	163,288	$72,411.60	$28,919.74
2008	$10,172.34	166,779	$77,278.60	$28,827.34

Table 12

Real Estate Data

Year	Case-Shiller Sales Pairs (Jan. to Dec.)	Case-Shiller Sales Pairs (July to June)	Case-Shiller weighted avg. price index (Jan. to Dec.)	Case-Shiller weighted avg. price index (July to June)
1990	9,766	9,421	78.94	75.22
1991	7,907	8,800	82.63	81.46
1992	9,105	8,473	82.95	83.16
1993	18,848	13,047	82.77	82.52
1994	22,466	21,802	85.53	83.88
1995	14,137	17,702	88.27	87.01
1996	15,426	14,972	89.82	89.19
1997	13,899	14,635	92.14	90.69
1998	15,387	13,788	94.64	93.44
1999	20,533	18,517	98.05	96.01
2000	23,329	21,196	103.06	100.17
2001	31,836	27,148	110.14	106.03
2002	36,644	33,637	117.56	113.61
2003	53,965	43,546	130.84	122.10
2004	72,829	66,570	185.20	151.81
2005	73,384	70,613	220.71	208.42
2006	55,195	70,071	233.25	229.13
2007	29,404	43,303	221.15	230.98
2008	19,714	19,223	154.03	193.75

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Social/Behavioral IRB –Review
Notice of Excluded Activity

DATE: June 29, 2009

TO: **Dr. William Werner,** Hotel Management

FROM: Office for the Protection of Research Subjects

RE: Notification of IRB Action by Dr. Paul Jones, Co-Chair
Protocol Title: **The Effects of Gaming on Residential Real Estate Sales and Prices: A Case Study of Las Vegas, Nevada 1990-2008**
OPRS# 0906-3140

This memorandum is notification that the project referenced above has been reviewed by the UNLV Social/Behavioral Institutional Review Board (IRB) as indicated in Federal regulatory statutes 45CFR46.

The protocol has been reviewed and deemed excluded from IRB review. It is not in need of further review or approval by the IRB.

Any changes to the excluded activity may cause this project to require a different level of IRB review. Should any changes need to be made, please contact OPRS.

If you have questions or require any assistance, please contact the Office for the Protection of Research Subjects at OPRSHumanSubjects@unlv.edu or call 895-2794.

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