Foreign Exchange Rate Effect on International Gaming Demand: An Examination from an Upscale Las Vegas Casino

Myongjee (Michelle) Yoo
Ashok K. Singh
Kasra Ghaharian

Abstract

Las Vegas has developed into one of the world's top tourist destinations, and the international market has become a vital stream of the city's revenue. The objective of this study was to understand the foreign exchange rate as a determinant for international gaming demand in the Las Vegas gaming industry. This study applied the econometric modeling method of panel data analysis to secondary data originated from a Las Vegas Strip casino property. This study attempted to validate the foreign exchange effect through empirical investigation. Results of this study showed that foreign exchange rate has an impact on international gaming demand.

Key Words: Currency rate; Econometric modeling; Exchange rate; International gaming demand; Las Vegas; Panel Data.

Myongjee (Michelle) Yoo*
Assistant Professor
California State Polytechnic University, Pomona
The Collins College of Hospitality Management
myoo@cpp.edu

Ashok K. Singh
Professor
University of Nevada, Las Vegas
William F. Harrah College of Hotel Administration
aksingh@unlv.nevada.edu

Kasra Ghaharian
kasra.ghaharian@gmail.com

*Corresponding author

Introduction

International visitors make up a significant proportion of total visitor volume in Las Vegas. Between 2011 and 2015, international visitors comprised approximately 20% of the Las Vegas visitor profile (Las Vegas Convention and Visitors Authority (LVCVA), 2016). These visitors are of very high value to the Las Vegas economy, as they generate over 25% of the city's total gaming revenue and over 30% of non-gaming revenue. Moreover, international visitors spend twice as more than domestic visitors on average on total expense (Huddleston, 2011; LVCVA, 2016; Velotta, 2012). International visitors are known to plan their trips in advance, stay longer, and spend more than domestic visitors. For this reason, the LVCVA has been paying attention towards boosting the international market, and have been developing various global strategies by increasing marketing budgets and international offices throughout the world expecting to reach 30% in the next 10 years (Haugen, 2015; LVCVA, 2016). Casino marketers have been constantly looking for international visitors to keep the hotels and casinos occupied as well with the city's inventory adding up to more than 150,000 rooms (LVCVA, 2016).

Even during the economic downturn, visitor volume of the international market increased, while in fact, the total number of visitations actually decreased (LVCVA, 2016). Currency depreciation usually impacts the prices of foreign travel, whereas appreciating currencies usually encourage foreign travel (Raab & Scher, 2003). While there are many factors that influence international tourists to travel, the weak dollar after the financial crisis in 2008 has been one of the strong selling points for international tourism. It actually drove international travelers to the Las Vegas and encouraged their expenditures (Sayre, 2008). For example, the exchange rate of the U.S. dollar per Euro was approximately 1.6 to 1 at the highest in 2008, allowing European visitors to believe Las Vegas a good value to visit (Sayre, 2008; International Monetary Fund (IMF), 2016). Additionally, international visitor volume to Las Vegas steadily increased to 20% until 2013 when the U.S. dollar was relatively weaker and decreased to 16% in 2015 when the US dollar became relatively stronger (LVCVA, 2016).

The purpose of this study is to investigate the currency exchange rate effect as a potential determinant of the international gaming demand in the Las Vegas gaming industry. Given the incredibly competitive climate of the gaming industry in Las Vegas, casino marketers have been recognizing the importance of the international market as an additional revenue source. This study was specifically designed to explore the gaming demand of the international market to Las Vegas based on the economic circumstances. The findings of this study are expected to provide valuable insights for marketers to understand the international market behavior from an economic standpoint. It is anticipated that marketers will take the study findings to the next level and develop marketing tactics to maintain higher profit levels by saving costs and utilizing budgets more strategically.

There are numerous studies that attempted to inspect the role of the foreign exchange rate on tourism demand (Chadee & Mieczkowski, 1987; Crouch, 1994b; Loeb 1982; Qu & Or, 2006; Tse, 2001; Vanegas & Croes, 2000; Witt & Martin, 1987). However, empirical evidence on this topic within the gaming industry has been extremely scarce. While Raab and Scher (2003) investigated the short and long term impact of the Asian crisis on Las Vegas gaming revenues using fluctuations in exchange rates, only Asian high-rollers from Japan, Korea, Taiwan, and Hong Kong were observed, on a particular table game, Baccarat. Based on Raab and Scher's (2003) study and previous studies of the foreign exchange rate effect (Chadee & Mieczkowski, 1987; Loeb, 1982; Qu & Or, 2006), this study attempts to validate the effect of foreign exchange rate in the

gaming industry. This study modeled the demand for Las Vegas international gaming from the general international tourism demand model to provide a broader and more current assessment of international gaming demand to Las Vegas. It is expected that this study will contribute to the growing body and help fill the gap of gaming literature.

Literature Review

Las Vegas Gaming Demand

Las Vegas has managed to continue explosive growth, attracting customers from all over the world by constantly introducing a number of grand scale mega resorts associated with gambling, shopping, dining, and entertainment (Eadington, Wells, & Gossi, 2010; LVCVA, 2016). Despite its history of success, Las Vegas experienced a significant downturn in 2008. The sluggish economy resulted in a constriction of consumer discretionary spending, and a reduction in gaming revenue. As expected, the cocktail of oversupply mixed with lack of demand has caused competition to become extremely aggressive. Visitor volume had decreased approximately 5%, and gaming revenue of the Las Vegas Strip had decreased approximately 11% at the end of 2011 compared to that of the peak year of 2007. More importantly, spending per visitor decreased dramatically (Eadington, Wells, & Gossi, 2010; LVCVA, 2016). Although the economy slowly recovered since 2010 (LVCVA, 2016), and the visitor volume to Las Vegas reached more than 42 million in 2015, hitting a record (Jones, 2015), total gaming revenue has not regained to its peak in 2007 (LVCVA, 2016).

As of 2016, the total number of room inventory in Las Vegas exceeded 149,000, approximately a 12% increase since its peak in 2007 (LVCVA, 2016). Consequently, the international market has become essential for businesses in Las Vegas, contributing a significant proportion of revenue. According to the LVCVA, the number of international visitors to Las Vegas increased to 15% in 2008, 18% in 2010, and 20% in 2013 compared to 12% in 2005. In fact, when the total visitor count in Las Vegas dropped for the first time in 2008 ever since the 9/11 terrorist attack, the number of international travelers jumped by approximately 900,000 in 2008 (LVCVA, 2016). As of 2015, there are more repeat visitors (56%) than first time visitors (49%) among the international travelers showing an average number of 3.8 visits (LVCVA, 2016). While their primary purpose of visiting Las Vegas was vacation and pleasure, international travelers are more likely to gamble and have a higher gambling budget than domestic travelers. International travelers stay relatively longer and spend more in Las Vegas than domestic travelers. While the domestic traveler stays an average of 3.9 days, the international travelers stays and average of 5.0 days per trip. International travelers also spend significantly more on accommodation, dining, shopping, entertainment, and sightseeing (LVCVA, 2016).

Overall, international visitors have become a very attractive market for Las Vegas. Gaming is becoming more popular and common in foreign economies and cultures, resulting in an increase of average gaming expenditure and repeat visitation to Las Vegas (Velotta, 2012; Yeo, 2011). LVCVA has been making efforts in areas such as public relations and customer service issues for visa processing more than ever to increase the percentage of international traveler visitation rate. The LVCVA and casino businesses are expected to continue targeting their marketing efforts to attract a larger international crowd, hoping to capitalize on their potential and profitability (Haugen, 2015; LVCVA, 2016).

Exchange Rate Effect

Price competitiveness is a key element for a destination or a region to acquire competitive advantage because prices are one of the most important factors that tourists consider for traveling. Exchange rate is one component that reflects relative prices at home in other countries, which influences tourist's destination choice (Dwyer, Forsyth, & Rao, 2002; Dwyer & Forsyth, 2011). While some researchers argue against using exchange rates as an explanatory variable for predicting international travel volume since it is related to the inflation rates (Witt & Martin, 1987), exchange rates have been receiving increased attention for its rapid fluctuation rate in terms of evaluating its influence for international tourism (Qu & Or, 2006). All other things being equal, currency depreciation usually impacts the prices of foreign travel. In contrast, appreciating currencies usually encourage foreign travel (Anastasopoulos, 1989; Raab & Scher, 2003).

Over the years, several authors have investigated the effect of exchange rates on international travel. Webber (2001) investigated the long-run demand for Australian outbound leisure tourism for nine major tourism destinations and found that the variance of the exchange rate was a significant determinant of long-run tourism demand, and changes in the exchange rate are likely to have the same impact on the tourist's destination choice as relative price changes. Crouch (1994b) argued that exchange rate fluctuations can impact international travelers in several different ways. Unfavorable exchange rates change effects include (1) less traveling abroad, (2) travel to alternative destinations, (3) decline in expenditure or length of stay, (4) changes in travel mode or time, and (5) decline in spending by business travelers. On the contrary, favorable exchange rate change effects included (1) increase in spending on goods and services that would have never been purchased, (2) spending on additional goods and services, (3) a shift in spending from other destinations, (4) attraction of new tourists, and (5) attraction of border shoppers.

Many Asian countries, for example, experienced a significant drop in exchange rates during the Asian financial crisis compared to the U.S. dollar. Such currency fluctuations reduced the prices to travel to Asian countries by Americans, while it increased travel prices to the U.S. for Asian travelers. As a result, baccarat revenue declined significantly on the Las Vegas Strip casino properties (Raab & Scher, 2003) Tse (2001) found that an increase in Hong Kong currency exchange rate resulted in a decrease in international travel. Dwyer et al. (2002) found the impact of exchange rates to increase tourism price competitiveness for a number of tourist destinations. Qu and Or (2006) also found that an increase in the real exchange rates of the Canadian dollar to the U.S. dollar resulted in the U.S. becoming a less attractive destination for Canadian tourists.

Modeling International Gaming Demand

There is limited amount of studies on gaming demand (Thalheimer & Ali, 2003). Depending on the scope and objective of the study, explanatory variables used to predict gaming volume differed among previous studies (Ahlgren, Dalbor, & Singh, 2009; Cargill & Eadington, 1978; Eadington, Wells, & Gossi, 2010; Raab & Schwer, 2003; Thalheimer & Ali, 2003; 2008). Morever, other than Raab and Schwer's (2003) study, previous studies did not consider including exchange rate in their models. Despite of some similarities, Raab and Schwer's (2003) study purposely examined fluctuation in exchange rates for Asian high-rollers on baccarat revenues, thus their model could not be adopted. For this reason, this study modeled international gaming demand based on the general model for international tourism demand to specifically investigate the exchange rate effect.

Different variables have been used to measure tourism demand. The most popular measures of demand are (1) the total number of tourist arrivals from an origin to a destination, and (2) tourist expenditure (Li, Wong, Song & Witt, 2006; Turner & Witt, 2001; Qu & Or, 2006). Numerous studies have shown that economic determinants account for much of the demand variation for international traveling. A typical tourist will choose to consume tourism depending on preferences and income. Then, travel decisions are made according to income and the prices of tourism (Cheng, 2012). In general, classical economic theory suggests that income and price-type factors are the major determinants for international tourism (Cheng, 2012; Crouch, 1992a; Crouch, 1994b; Loeb, 1982; Song & Witt, 2006; Tan, McCahon, & Miller, 2002; Tse, 2001; Uysal & Crompton, 1984; Vanegas & Croes, 2000; Witt & Witt, 1995).

Income has been the single most important determinant for international travel. It has been known that an increase in real income provides consumers with greater spending behaviors (Crouch, 1996c; Loeb, 1982; Uysal & Crompton, 1984). National income of the origin country approximated using the gross domestic product (GDP) per capita has been used frequently to explain income in tourism demand modeling studies (Song & Witt, 2003; Song, Wong, & Chon, 2003; Song, Wong, & Li, 2003; Wong, Song, Witt, & Wu, 2007).

The tourism industry is a combination of goods and services, making it extremely difficult to define the total mix of the consumed tourism price by each tourist (Crouch, 1994b). For this reason price has been expressed as a ratio of prices in the destination to prices in the origin country as relative prices (Crouch, 1994b). On the whole, tourist generating countries could anticipate an increase in international tourism demand as relative prices decline (Loeb, 1982). It is common to use prices in the destination approximated using the consumer price index (CPI) or a ratio between the CPI of the destination and that of the visitors markets (Cheng, 2012; Han, Durbarry, & Sinclair, 2006; Li et al., 2005; Uysal & Crompton, 1984; Witt & Witt, 1995).

Currency exchange rate has been found to have a significant effect on international travel. Since exchange rates reflect relative rates of inflation to some extent, ultimately the cost of goods in the destination country would not be relatively cheaper, although the exchange rate becomes favorable. However, in the short-run, tourists find that exchange movements can offer them bargain deals (Witt & Martin, 1987). Tourists are likely to gather information on exchange rates movements and estimate the price changes in destinations. Moreover, exchange rates fluctuate more rapidly, thereby allowing tourists to take more advantage of the favorable exchange rates in the short term (Qu & Or, 2006; Vanegas & Croes, 2000; Witt & Martin, 1987).

Special events would include a wide range of factors that might have had a transitory influence on demand. Examples include economic recessions, terrorism, oil crisis, world fairs, sporting events (such as the Olympics), national celebrations, and political disturbances, to name a few. It is expected that the demand for travel services in a given country by foreigners would be positively or negatively affected by such incidents (Crouch, 1994b; Loeb, 1982). Las Vegas, for example, experienced a considerable decrease in tourist volume after the 9/11 terrorist attack (Eisendrath, Bernhard, Lucas, & Murphey, 2008), and international tourism demand to Asia decreased substantially during the SARS outbreak (Kuo, Chen, Tseng, Ju, & Huang, 2008).

Overall, the general model for international tourism demand includes income of origin country, relative prices, currency exchange rate, and special events as the major variables (Chadee & Mieczkowski, 1987; Loeb, 1982; Qu & Or, 2006), and is expressed as:

$T = f(RYPC, RPI, EX, D)$
where: T = the demand for travel services,
RYPC = real per capita income of origin country,
RPI = relative prices,
EX = currency exchange rate,
D = special event.

Based on the review of previous literature, this study attempted to investigate the effect of currency exchange rate as an economic determinant for international gaming demand in Las Vegas through the general international tourism demand model. Gaming demand was measured in both casino patron's visiting volume and gaming expenditure. Overall, the following study hypothesis was driven:

H1: Currency exchange rate will affect gaming demand.
H1a: Currency exchange rate will affect visit frequency.
H1b: Currency exchange rate will affect gaming expenditure.

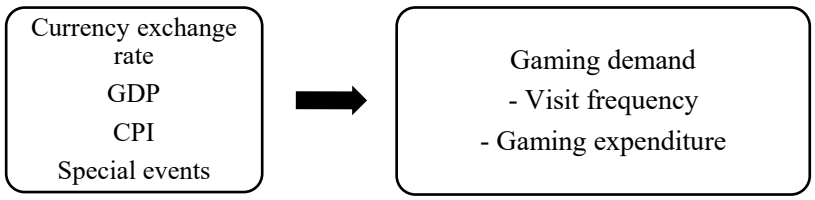


Figure 1. Research design

Methodology

Data Collection

For the measurement of demand, secondary data was retrieved from an upscale Las Vegas Strip hotel casino property. The name of the specific property cannot be stated in order to assure anonymity. The population for this study included international customers with international residence addresses in the property's casino database. The database was scanned for the top 10 international countries with the highest visit frequency: Canada, Mexico, England, Japan, Australia, Germany, China, Israel, Hong Kong, and Taiwan. The casino did not aggressively promote towards the international market unless they are a premium clientele or high rollers. Thus, that premium clientele were excluded. The data for the currency exchange rate were compiled in annual data from January, 1999 up to December, 2010. Together with the currency exchange rate data, additional explanatory variables (exchange rate, GDP, and relative CPI) were collected from the International Monetary Fund website (IMF, 2016).

Data Measurement

Dependent variables. Demand theory suggests that the ideal demand variable should be able to measure the quantity of the product demand. The number of tourist visits and expenditure have been used in previous studies to measure tourism demand (Qu & Or, 2006). Both the number of casino patron's visits and gaming expenditure were used as the dependent variable to measure gaming demand.

For tourist visits, total number of visitors was used and is represented as Visit frequency in this study. Patron's total Coin-in and Drop were used as surrogates for gaming expenditure. Coin-in represents the total dollar amount of wagers from slot machines and drop represents the total dollar amount of wagers from table games (Lucas, 2011). Coin-in and Drop is known to be the best indicator to measure gaming volume because they are relatively more stable (Lucas, 2011; 2013). Other variables such as revenue, total win amount (either slot win or table win), average daily win/loss, and average theoretical win/loss may suffer from short-term volatility and contain flaws (Eisendrath et al., 2008; Lucas, 2011; Lucas, Dunn, & Singh, 2005; Lucas & Tanford, 2010), or vary significantly due to normal fluctuations in the amount of wagers won by the casino (Lucas, 2011). Coin-in and Drop were purposely examined separately to observe whether study results would differ between the two gaming expenditure variables.

Explanatory variables. In this study, exchange rate was the primary explanatory variable; it was transformed into a categorical variable with two levels (exchange rate < 1 or weak dollar, and exchange rate > 1 referred to as strong dollar) (Hollier, 1991), because the correlations between the dependent variables and exchange rate as a continuous predictor were very small and insignificant.

Additionally, GDP of origins and CPI were included to represent income and price. CPI was converted into relative price by dividing the CPI in USA by that of the origin country, adjusted by the appropriate exchange rate. For special events, a trend component was added to account for the non-stationarity in the annual time series and reflected the long-term positive or negative changes in the dependent variable over time (Ahlgren, Dalbor, & Singh 2009). Other marketing efforts from the casino that may have direct effects on the dependent variables were not included, as they did not apply for this international market.

Method and Data Analysis

The data collected for this study is a time series of Visit frequency, Coin-in, and Drop, from 10 countries (units). Such a data set is called panel data (see, for example, Wooldridge, 2002), and the method of linear panel modeling, briefly described below, was used in this study. Panel data comprises observation of multiple phenomena obtained over multiple time periods so it has both a cross-sectional and a time series dimension. The panel model applies since data from the same countries were observed in a given period. Panel data modeling is usually known to be more efficient than pooling cross sections since the observation for several periods reduces the variance over randomly selected data. Overall, panel data modeling is more likely to suggest unbiased and consistent results (Wooldridge, 2002).

Linear panel model

The basic linear panel model for the dataset collected for this study is (Croissant & Millo, 2008):

$$y_{it} = \alpha + \beta^T x_{it} + \mu_i + e_{it}$$

where

y_{it} = the response or dependent variable (Visit frequency, Coin-in, or Drop)
β = vector of unknown parameters
X = matrix of predictors
μ_i = individual error component
and
e_{it} = idiosyncratic error, assumed to be well-behaved and independent of both the predictors X and the individual error component μ_i

Different assumptions on the individual error component u_i lead to different panel models, some of which are described below:

a) If the individual error component u_i is missing, i.e. $u_i = 0$ for each *i*, pooled ordinary least squares (OLS) gives consistent and efficient estimate of β if e_{it} is normally distributed with mean 0 and variance σ^2.
b) If the individual error component u_i is uncorrelated with the predictors X, then so is the combined error term $\mu_i + e_{it}$, and OLS estimator of β is consistent but inefficient, and a generalized least squares (GLS) estimator of β is used. The linear panel model for the case $COV(u_i, X_{it}) = 0$ is called random effects (RE) model.
c) If the individual error component u_i is correlated with X, i.e. $COV(u_i, X_{it}) \neq 0$, OLS estimator of β is inconsistent. In this case, the errors μ_i are treated as unknown parameters, which can be estimated by OLS using dummy variables for countries. The linear panel model in this case is called fixed effects (FE) model.

Model specification testing in panel models involves running (i) the F-test test of poolability, which is the standard F-test of the null hypothesis that the same coefficients apply to each entity (country), or the OLS model is sufficient, and (ii) using the Hausman test (Hausman, 1978) for testing the null hypothesis that the individual error component u_i is uncorrelated with the predictors X, i.e., the RE model provides a better fit to the data (Croissant & Millo, 2008).

The diagnostic testing in panel models involves testing for serial correlations, cross-sectional correlations, and heteroskadasticity (Wooldridge, 2002; 2009). The serial correlation in linear panel models is tested by the Breusch-Godfrey/Wooldridge test, and the Breusch-Pagan test is used for testing heteroskadasticity; for cross-sectional

dependence, the Lagrange Multiplier test of Breusch-Pagan is being used since T = 12 > N = 10 (De Hoyos & Sarafidis, 2006).

The diagnostic testing is followed by computing estimators that are controlled for serial correlations, cross-sectional correlations, and heteroskadasticity, as warranted. The package plm of the software R (R Core Team, 2015) is used for fitting various models to the data, and for selecting the best model (Croissant & Millo, 2008). The dataset was prepared so that the variable "Country" is in the first column, and "Year" is in the second column, which avoids any preprocessing of data to be used in plm.

Results

Sample Profile

Table 1 and Table 2 summarizes the sample data. Table 1 describes the demographic profile of the sample. The proportions of males and females varied widely among countries. Canada had the lowest proportion of males of 56% and the highest proportion of females of 44%. China and Taiwan had the highest proportion of males of 79% and the lowest proportion of females of 21%. Accordingly, there was a difference of 23% between the highest and lowest ratio. Overall, all countries showed a higher proportion of male customers than female customers.

There was an enormous difference between the countries in terms of average visit frequency per month as well. Canada showed the highest number of 812, for the average visit frequency per month. Mexico, England, and Japan also showed more than 100 visits on average per month, and the remaining six countries showed less than 100 visits on average per month. On the other hand, the average age of customers turned out to be rather similar among the 10 countries. Mexico showed the oldest average age of 50, and Germany showed the youngest average age of 43.

Table 1

Profile of sample

Country	Gender (%)		Avg. visit (per month)	Avg. age (yrs)
	Male	Female		
Canada	56	44	812	49
Mexico	61	39	230	50
England	65	35	171	44
Japan	73	27	129	43
Australia	62	38	54	45
Germany	73	27	42	43
China	79	21	40	45
Israel	77	23	25	46
Hong Kong	75	25	16	49
Taiwan	79	21	14	49

Table 2 shows the summary of statistics by country and weak/strong dollar. Since the data were compiled in annual data from January, 1999 to December, 2010, there were a total number of 12 data points for each country. Overall, there were a total number of 21 data points for weak dollar and 99 data points for strong dollar.

Table 2

Summary of statistics

	N	Mean	Median	SD	Min	Max
Visit frequency						
Australia	12	727	441	682	205	2,221
Canada	12	15,645	10,146	11,186	7,854	37,163
China	12	763	642	426	236	1,627
England	12	2,533	1,722	1,936	839	7,047
Germany	12	667	476	506	290	1,947
Hongkong	12	472	477	92	343	639
Israel	12	389	305	199	231	879
Japan	12	2,065	2,120	238	1,691	2,375
Mexico	12	4,277	3,944	994	3,292	6,749
Taiwan	12	417	362	160	214	780
Weak Dollar	21	1,773	1,172	1,730	290	7,047
Strong Dollar	99	3,012	639	6,166	205	37,163
Coin-in						
Australia	12	493,324	341,579	420,209	56,178	1,163,812
Canada	12	33,777,160	30,805,827	21,059,169	8,289,794	67,578,313
China	12	746,602	430,930	827,944	269,780	2,787,310
England	12	4,534,092	4,225,454	2,167,038	1,170,072	9,014,681
Germany	12	1,587,359	1,529,085	551,424	861,859	2,508,378
Hongkong	12	274,290	201,965	218,430	91,214	877,305
Israel	12	388,587	318,875	187,986	211,643	864,458
Japan	12	8,300,756	8,258,324	3,308,527	3,867,213	13,894,391
Mexico	12	10,864,785	10,913,636	2,569,157	5,927,349	16,578,393
Taiwan	12	376,760	416,616	124,869	152,102	529,772
Weak Dollar	21	3,271,721	2,551,434	2,217,367	861,859	9,014,681
Strong Dollar	99	6,741,600	539,992	12,991,143	56,178	67,578,313
Drop						
Australia	12	2,227,301	1,803,913	1,840,010	627,263	7,015,203
Canada	12	46,450,894	34,657,430	31,095,351	14,689,839	115,702,268
China	12	106,857,988	69,249,121	101,652,961	17,539,380	354,635,119
England	12	3,268,468	1,939,050	2,736,184	740,613	8,595,089
Germany	12	665,409	633,325	491,220	132,740	1,963,048
Hongkong	12	96,036,634	93,839,190	40,534,542	13,891,298	179,852,406
Israel	12	1,785,809	1,475,702	872,830	809,597	3,468,351
Japan	12	16,626,902	13,418,859	10,744,783	4,058,640	38,712,026
Mexico	12	31,782,068	28,407,142	13,205,645	17,125,169	67,031,074
Taiwan	12	42,661,961	37,134,398	21,365,239	21,377,484	98,670,850
Weak Dollar	21	2,159,964	1,032,380	2,439,757	194,315	8,595,089
Strong Dollar	99	41,767,697	25,901,162	54,294,402	132,740	354,635,119

Linear Panel Data Analysis

Results of linear panel data analysis for the three dependent variables (Visit frequency, Coin-in, Drop) are reported in this section, along with results of diagnostic tests, and tests for model selection. Even though OLS estimates of regression coefficients are known to be biased and inconsistent (see, for example, Naude & Saayman, 2005), the OLS results are also included for comparative purposes. The linear panel data analysis method used in this study (Croissant & Millo, 2008) is briefly described below:

1) The following models were estimated using the package plm in software R-OLS, the fixed-effects model, and the random-effects model.

2) The F-test for individual and/or time effects was used to compare the OLS model with the fixed effects model, and the Hausman test (Hausman, 1978) was used to choose between the fixed effects and random effects model.

3) Since Visit frequency, Coin-in, and Drop for some of the countries exhibit an increasing trend (see Figures 1(a)-1(c)), a time variable ranging from 1 to 12 was added as a predictor. The alternative approach, which is commonly used in econometric modeling, is to use the unit root test, and in case this test points to the existence of a unit root test (by not reject the null hypothesis of unit root), then fitting a first-difference model. This approach was not taken for two reasons:

(a) There is only T=12 years in the data, and the unit root test would have very little power (see, for example, DeJong & Whiteman, 1992).
(b) There is considerable amount of literature suggesting that unit root testing in time series analysis is not very useful (see Campbell & Perron, 1991; Christiano & Eichenbaum, 1990; Miron, 1991; Cochrane, 1991).

Next, the results of panel data analysis for each of the three dependent variables are summarized. The p-values of the F-tests of poolability for testing the null hypothesis of OLS model vs. the FE model for each of the three dependent variables were less than 0.00001, indicating that the FE model fitted the data better than the OLS model. The p-values of the Hausman test for Coin-in and Visit Frequency were above 0.90, indicating that the RE model fitted the data better than the FE model for both Visit frequency Coin-in. The P-value of the Hausman test for Drop was less than 0.00001, and therefore the FE model was used.

Next, the results of diagnostic testing performed on the three FE models are summarized:

(i) serial correlation was found to be highly significant for all three response variables (P-value < 0.00001),

(ii) cross-sectional correlation was found to be highly significant for Visit frequency and Drop (p-value < 0.00001), but not significant for Coin-in (P-value = 0.12), and

(iii) heteroskedasticity was highly significant for all three response variables (P-value < 0.00001).

Since the errors in the fitted models for the three response variables were autocorrelated and exhibit heteroskedasticity, sandwich package in the R system was used (Zeileis, 2004) and the P-values were computed for testing the significance of the regression coefficients using the heteroskedasticity consistent (HC) covariance matrices and the method of Arellano (Arellano, 1987). The selected panel data models for the response variables are shown in Table 3; the p-values shown in Table 3 were obtained by using HC covariance matrices. Conclusively, exchange rate (weak dollar), GDP, and CPI were significant for Visit frequency and Coin-in. Only exchange rate (weak dollar) and GDP were significant for Drop. Moreover, all of the coefficients for exchange rate and PCI were negative, indicating that when exchange rate (dollar is weaker) and relative price decreases, Visit frequency and Coin-in increases. The coefficient values for GDP were all positive, indicating when income increases, Visit frequency, Coin-in, and Drop increases as well. For example, compared to strong dollar, we would expect visit frequency increases by 1,175.7 for weak dollar.

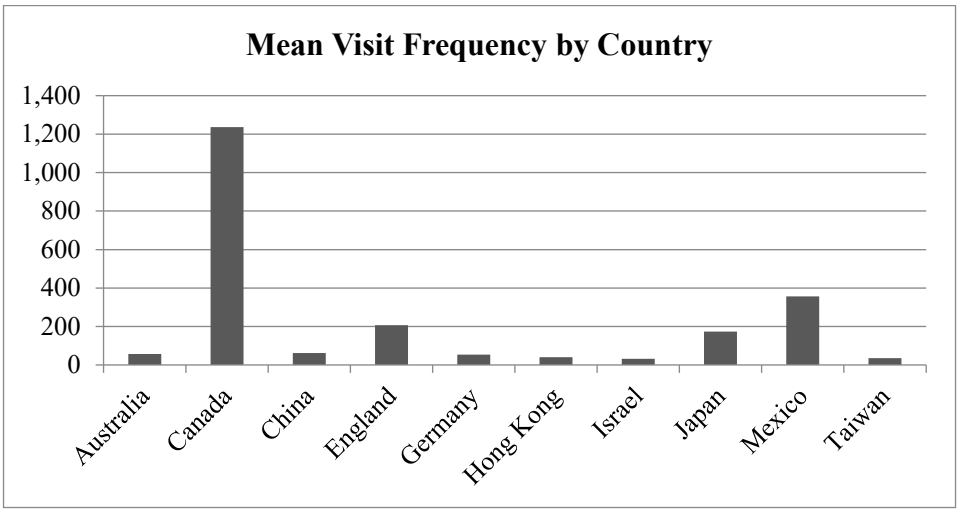
Table 3

Panel models for Visit frequency, Coin-in, and Drop

	Visit frequency (Random effect)		Coin-in (Random effect)		Drop (Fixed effect)	
	Coefficient	p	Coefficient	p	Coefficient	p
Intercept	-1949.09	0.16	-5068236.05	0.10		
Weak Dollar	-1175.70	0.01*	-3095514.90	0.02*	-45181898.80	0.00*
GDP	1.01	0.00*	2060.04	0.00*	42795.30	0.00*
CPI	-1833.57	0.00*	-4638578.25	0.01*	-19185765.20	0.44

Note. *$p < .05$

Visit frequency. The two graphs of Figure 2 show the Visit frequency by country averaged over years (top graph), and the average Visit frequency by year averaged over countries (bottom graph). Figure 2 shows that the Visit frequency, averaged over countries, is highest from Canada, followed by Mexico, Japan, and England. Further, Visit frequency (averaged over countries) has an upward trend, and this trend is more pronounced past 2007. Figure 3 indicates the top countries where the Visit frequency tends to increase with time. Table 3 indicates that all the three predictors (Exchange rate, GDP, and CPI) are highly significant in this case. As expected, exchange rate has a negative impact on Visit frequency.



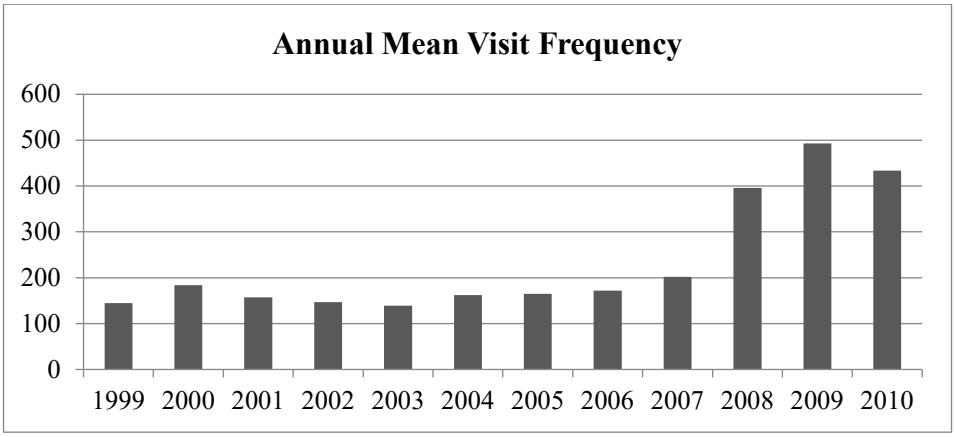


Figure 2. Visit frequency by country averaged over years (top) and Visit frequency by year averaged over countries (bottom)

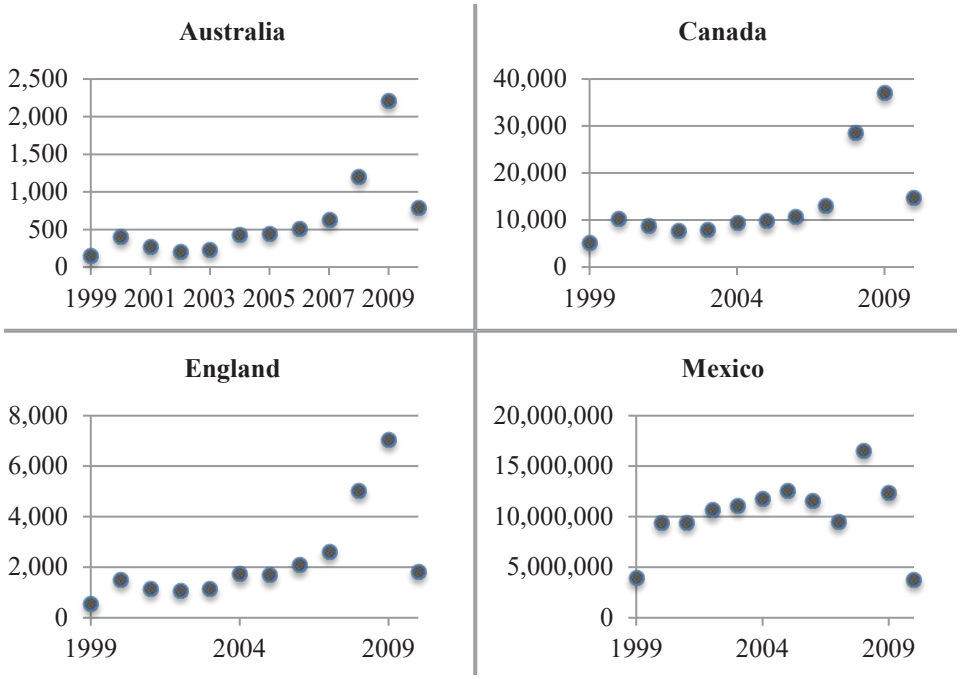


Figure 3. Plot of Visit frequency vs. year by country.

Coin-in. Figure 4 shows graphs of average Coin-in averaged over years (top graph) and averaged over countries (bottom graph); the bottom graph shows an overall upward trend through the years. An upward trend in Coin-in for Canada, England, Japan, and Mexico visitors can be seen in Figure 5, which was higher than the other six countries. Table 3 shows that all the three predictors (Exchange rate, GDP, and CPI) have a significant impact on Coin-in. Exchange rate has a negative impact on Coin-in as well.

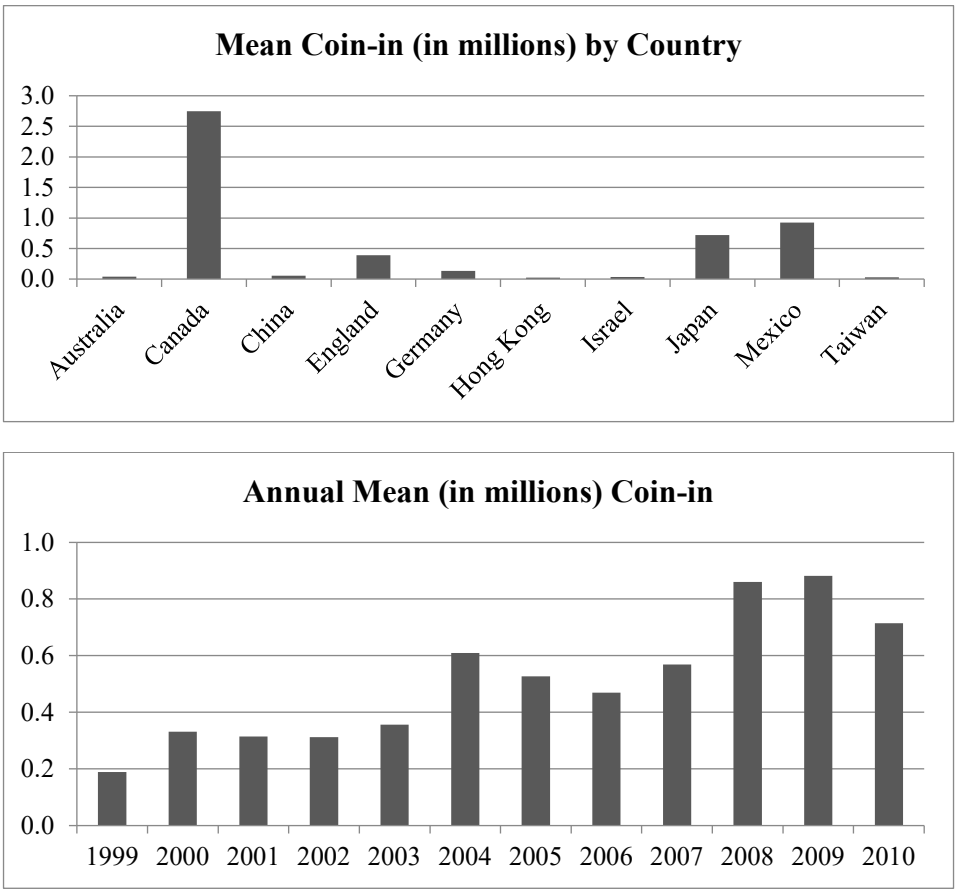


Figure 4. Mean of Coin-in by country averaged over years (top) and mean of Coin-in by year averaged over countries (bottom).

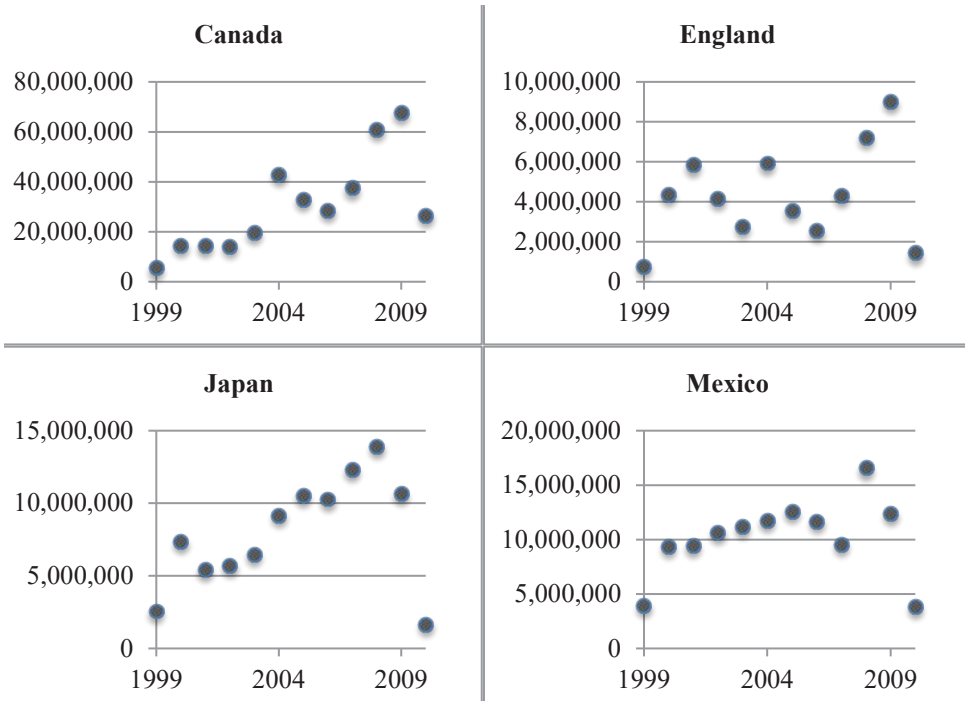


Figure 5. Plot of Coin-in vs. year by country.

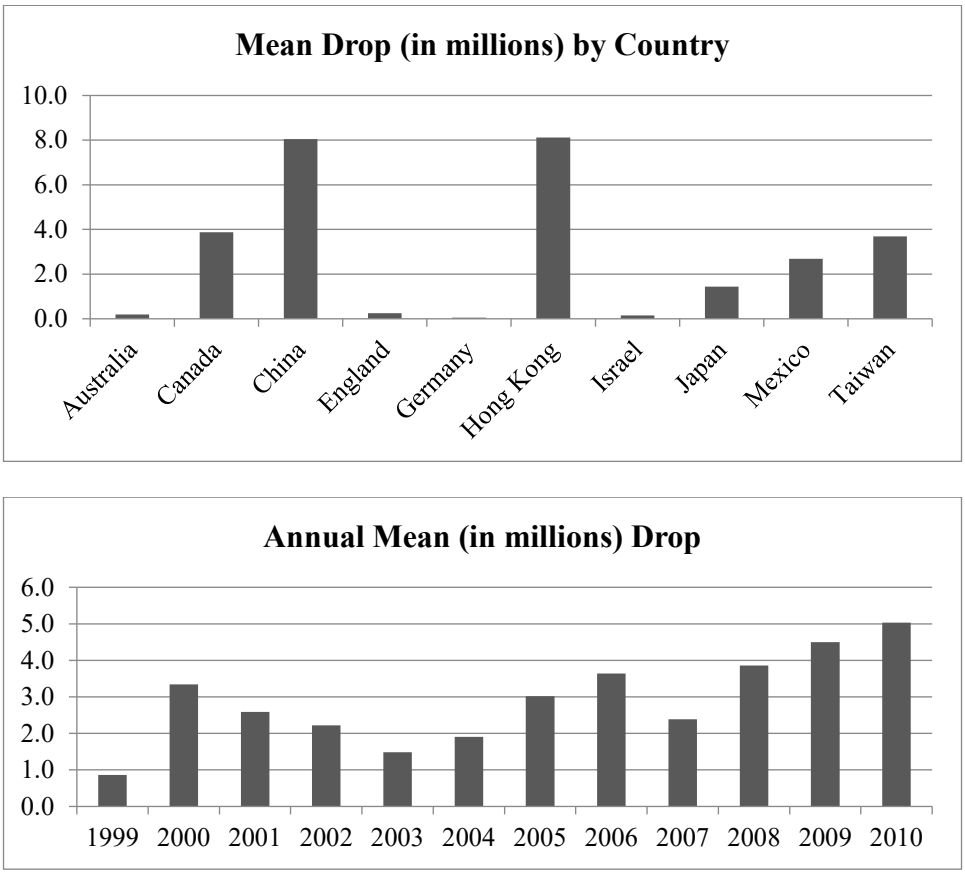


Figure 6. Mean of Drop by country averaged over years (top) and mean of Drop by year averaged over countries (bottom).

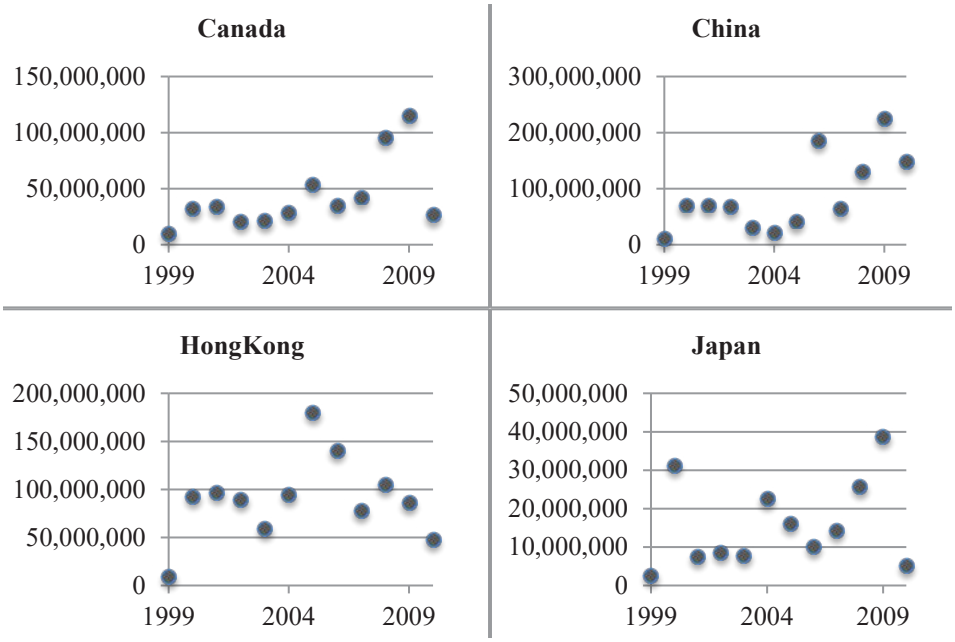


Figure 7. Plot of Drop vs. year by country.

Conclusion

Discussion and Implications

The effect of exchange rate on international gaming demand in Las Vegas was examined in this study. Secondary data was obtained from a single property located on the Las Vegas Strip and linear panel modeling was used for data analysis. Log-transformed tourist visits (represented in Visit frequency) and gaming expenditure (represented by Coin-in and Drop) were used as dependent variables, while log-transformed exchange rate was used as the predictor. The results of the panel data analysis indicated that exchange rate is a significant predictor for Visit frequency, Coin-in, and Drop.

Overall, results of this study supported the research hypothesis and indicated that exchange rate does have a significant impact on international gaming demand. As shown in previous studies on general tourism demand, study results were alike for the gaming industry. The negative relationship between foreign exchange rate and gaming demand (Visit frequency, Coin-in, and Drop) indicates the decrease in gaming demand when exchange rate increases. In other words, the overall competitiveness for a destination declines if the exchange rate rises (Dwyer & Forsyth, 2011). Overall, study finding is coherent with the literature that suggested exchange rate is related to international travel (Crouch, 1994b; Dwyer et al., 2002; Loeb, 1982; Qu & Or, 2006; Raab & Scher, 2003; Tse, 2001).

These findings are expected to contribute to the theoretical foundations by validating the impact of exchange rate as an economic determinant for tourism demand. Further, GDP and CPI were both significant on Visit frequency and Coin-in. Usually income has a positive impact while price has a negative impact on tourism demand (Dwyer & Forsyth, 2011). However, while GDP had a positive significant impact for all gaming demand variables as generally suggested, CPI had a negative significant impact for Visit frequency and Coin-in only. Study results were mostly consistent to existing literature, thus further adds value to the gaming research stream by incorporating exchange rate and other economic indicators as a predictor variable in the model.

Simultaneously, these findings suggest that casino marketers should take exchange rates into consideration for future marketing plans for international visitors. The growth of international gaming demand during the past years has been making a progressive impact on the Las Vegas gaming industry. Despite the economic recession, the international market demand rather increased and revealed its potential. LVCVA acknowledged the foreign countries as a growth market and incessantly aims to increase the international market share. Foreign visitors are continuously expected to become vital for the success of casinos that are constantly seeking potential markets to maintain occupancy rates and gaming revenue.

Casino marketers may not have full control over foreign exchange rate but they can utilize it to determine tourist behavior and as a component to increase price competitiveness. Casino marketers can use currency exchange rates to recognize international gaming demand from diverse countries and advantageously target the global market during different times throughout the year. With increasing competition, exchange rate can become functional in providing a basic standard of international marketing strategy. For example, currency exchange rates in some countries could be appreciating, while declining in other countries; casino marketers can utilize this information to effectively target their efforts. Generally, foreign currency exchange rate information is easily attainable, and marketers can estimate the chances of which international market is more likely or not likely to travel by evaluating the currency compared to the U.S. dollar. This will allow casino marketers to budget marketing plans more accurately and develop customized marketing strategies for different countries.

Although Las Vegas has experienced struggling moments due to the great recession and other competing gaming destinations (i.e. Singapore and Macau), advantages still exist. Casino marketers should exploit currency exchange rates carefully and direct their marketing resources to those promising countries within their target, while LVCVA continues to press for more foreign visitors. Currency exchange rate can act as a promising indicator to strategically expand the market for casino businesses and increase gaming demand if used proficiently.

Limitations and Recommendations for Future Studies

As is true with all research, this study has some limitations. Findings from this study cannot be generalized to all international countries or all casinos, as data was acquired only from one high end property in Las Vegas. It is recommended to consider many other property level factors, such as promotion complimentary offers, pricing strategies, and marketing activities across the countries in future studies. Other casino properties are likely to show different visit frequency rankings in terms of international tourists, therefore, observing gaming demand from other countries will be beneficial as well.

The potential explanatory variables that are analyzed as economic determinants for tourism demand becomes crucial to identify an empirical model. Even though panel data modeling yields unbiased and consistent results when there are omitted variables, future research may include replicating the study by incorporating a mixture of other variables, so as to gain a deeper understanding of the exchange rate effect. Future studies should also consider integrating alternatives of measures for income and price to validate its impact on gaming demand. The estimated effects were relatively large because the data compiled in annual data for 10 countries. It is recommended to choose a single country or fewer countries to increase data reliability for future studies. Finally, secondary data that was used in this study was only retrieved up to 2010. Future research may attempt to replicate this study by employing the use of current data.

References

Ahlgren, M., Dalbor, M. C., & Singh, A. K. (2009). Estimating the effect of the 2003 gaming tax restructuring on riverboat gaming volume. *UNLV Gaming Research & Review Journal, 13*(2), 45-58.

Anastasopoulos, P. G. (1989). The U.S. travel account: the impact of fluctuations of the U.S. dollar. *Journal of Hospitality & Tourism Research, 13*(3), 469-481.

Campbell, J. Y., & Perron, P. (1991). Pitfalls and opportunities: What macroeconomists should know about unit roots. *NBER Macroeconometrics Annual, 6*, 141-220.

Cargill, T. F., & Eadington, W. R. (1978). Nevada's gaming revenues: Time characteristics and forecasting. *Management Science, 24*, 1221-1230.

Chadee, D., & Mieczkowski, Z. (1987). An empirical analysis of the effects of the exchange rate on Canadian tourism. *Journal of Travel Research, 26*(1), 13-17.

Cheng, K. M. (2012). Tourism demand in Hong Kong: income, prices, and visa restrictions. *Current Issues in Tourism*, *15*(3), 167-181.

Christiano, L. J., & Eichenbaum, M. (1990). Unit roots in real GNP: do we know, and do we care? *Carnegie-Rochester Conference Series on Public Policy, 32*(1), 7-61.

Cochrane, J. H. (1991). Volatility tests and efficient markets: A review essay. *Journal of Monetary Economics, 27*(3), 463-485.

Croissant, Y., & Millo, G. (2008). Panel data econometrics in R: The plm package. *Journal of Statistical Software, 27*(2), 1-43.

Crouch, G. I. (1992a). Effect on income and price on international tourism. *Annals of Tourism Research, 19*(4), 643-664.

---. 1994b. Price Elasticities in International Tourism. *Journal of Hospitality & Tourism Research, 17*(3), 27-39.

---. 1996c. Demand elasticities in international marketing: A Meta-Analytical Application. *Journal of Business Research, 36*(2), 117-136.

De Hoyos, R. E. & Sarafidis, V. (2006). Testing for cross-sectional dependence in panel-data models. *The Stata Journal, 6*(4), 482-496.

Dejong, D. N., & Whiteman, C. H. (1992). Integration versus trend stationarity in time series, *Econometrica, 60*(2), 423-433.

Dwyer, L., Forsyth, P., & Rao, P. (2002). Destination price competitiveness: Exchange rate changes versus domestic inflation. *Journal of Travel Research, 40*(3), 328-336.

Dwyer, L., & Forsyth, P. (2011). Methods of estimating destination price competitiveness: a case of horse for courses? *Current Issues in Tourism, 14*(8), 751-777.

Eadington, W. R., Wells, R. H., & Gossi, D. (2010). Estimating the impact of California tribal gaming on demand for casino gaming in Nevada. *UNLV Gaming Research & Review Journal, 14*(2), 33-45.

Eisendrath, D, Bernhard, B. J., Lucas, A. F., & Murphy, D. J. (2008). Fear and managing in Las Vegas. An analysis of the effects of September 11, 2001, on Las Vegas Strip gaming volume. *Cornell Hospitality Quarterly, 49*(2), 145-162.

Haugen, J. (2015). Broadening Vegas' foreign visitor appeal. Retrieved from http://www.travelweekly.com/North-America-Travel/Broadening-foreign-visitor-appeal

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271.

Hollier R. (1991). Conflict in the Gulf: Response of the tourism industry. *Tourism Management, 12*(1), 2-4.

Huddleston, A. (July, 2011). Las Vegas sees record numbers for foreign visitors. Retrieved from http://vegastradeshows.co/international_visitors_vegas/

International Monetary Fund (2016). World Economic Outlook Database. Retrieved from http://www.imf.org/external/np/fin/ert/GUI/Pages/CountryDataBase.aspx

Jones, J. (2015). Las Vegas hits record 42 million visitors in 2015, even before New Year's Eve crowds. Retrieved from http://www.latimes.com/travel/california/la-trb-las-vegas-visitor-record-20151230-story.html

Kuo, H., Chen, C. Tseng, W., Ju, L., & Huang, B. (2008). Assessing impacts of SARS and Avian Flu on international tourism demand to Asia. *Tourism Management, 29*(5), 917-928.

Las Vegas Convention and Visitors Authority. (2016). Stats & Facts. Retrieved from http://www.lvcva.com

Li, G., Wong, K. K. F., Song, H., & Witt, S. F. (2006). Tourism demand forecasting: A time varying parameter error correction model. *Journal of Travel Research*, *45*(2), 175–185.

Loeb, P. D. (1982). International travel to the United States: An econometric evaluation. *Annals of Tourism Research, 9*(1), 7–20.

Lucas, A. F. (2011). Estimating untracked gaming volumes by hotel occupancy segments. *Cornell Hospitality Quarterly, 52*(2), 209-218.

Lucas, A. F. (2013). Examining the link between poker room business volume and gaming activity in slot and table games: A closer look at a key assumption in the full service theory. *UNLV Gaming Research & Review Journal*, *17*(1), 43-63.

Lucas, A. F., Dunn, W. T., & Singh, A. K. (2005). Estimating the short-term effect of free-play offers in a Las Vegas hotel casino. *Journal of Travel & Tourism Marketing, 18*(2), 53-68.

Lucas, A. F., & Tanford, S. (2010). Evaluating the impact of a new resort amenity on gaming business volumes. *UNLV Gaming Research & Review Journal, 14*(2), 1-13.

Miron, J. A. (1991). The role of economic history in economic research: A review essay. *Journal of Monetary Economics, 27*(2), 293-299.

Naude, W. A., & Saayman, A. (2005). Determinants of tourist arrivals in Africa: a panel data regression analysis. *Tourism Economics, 11*(3), 365-391.

Qu, H., & Or, Y. (2006). Determinants of the travel demand model for the Canadian tourists to the U.S. *International Journal of Hospitality & Tourism Administration, 7*(4), 1-19.

R Core Team (2015). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Raab, C., & Schwer, K. R. (2003). The short- and long-term impact of the Asian financial crisis on Las Vegas Strip baccarat revenues. *Hospitality Management, 22*(1), 37-45.

Sayre, M. (Jun, 2008). LV Convention authority targets international visitors. Retrieved from http://www.lasvegasnow.com/Global/story.asp?S=8467655

Song, H, & Witt, S. F. (2003). Tourism forecasting: The general-to specific approach. *Journal of Travel Research*, *42*(1), 65–74.

Song, H, & Witt, S. F. (2006). Forecasting international tourist flows to Macau. *Tourism Management*, *27*(2), 214–224.

Song, H., Wong, K. K. F., & Li, G. (2003). Modelling and forecasting the demand for Thai tourism. *Tourism Economics, 9*(3), 363–387.

Song, H., Wong, K. K. F, & Chon, K. K. S. (2003). Modelling and forecasting the demand for Hong Kong tourism. *International Journal of Hospitality Management, 22*(4), 435–451.

Tan, A. Y., McCahon, C., & Miller, J. (2002). Stability of inbound tourism demand models for Indonesia and Malaysia: the pre-and postformation of tourism development organizations. *Journal of Hospitality & Tourism Research, 26*(4), 361-378.

Thalheimer, R., & Ali, M. M. (2003). The demand for casino gaming. *Applied Economics, 35*, 907-918.

Thalheimer, R., & Ali, M. M. (2008). The demand for casino gaming with special reference to a smoking ban. *Economic Inquiry, 46*(2), 273-282.

Tse, R. (2001). Estimating the impact of economic factors on tourism: evidence from Hong Kong. *Tourism Economics, 7*(3), 277-293.
Turner, L. W., & Witt, S. F. (2001). Factors influencing demand for international tourism: tourism demand analysis using structural equation modeling, revisited. *Tourism Economics, 7*(1), 21-38.
Uysal, M., & Crompton, J. L. (1984). Determinants of demand for international tourist flows to Turkey. *Tourism Management, 5*(4), 288-297.
Vanegas, M., & Croes, R. R. (2000). Evaluation of demand; US tourists to Aruba. *Annals of Tourism Research, 27*(4), 946-963.
Velotta, R. N. (July, 2012). International tourists in Las Vegas outspend domestic travelers, analyst says. Retrieved from http://vegasinc.com/business/realestate/2012/jul/10/international-tourists-las-vegas-outspend-domestic/
Webber, A. G. (2001). Exchange Rate Volatility and Cointegration in Tourism Demand. *Journal of Travel Research, 39*(4), 398-405.
Witt, S. F., & Martin.C. A. (1987). Econometric models for forecasting international tourism demand. *Journal of Travel Research, 25*(3), 23–30.
Witt, S. F., & Witt, C. A. (1995). Forecasting tourism demand: A review of empirical research. *International Journal of Forecasting*, *11*(3), 447–475.
Wong, K. F., Song, H., Witt, S. F., & Wu, D. C. (2007). Tourism forecasting: To combine or not to combine? *Tourism Management*, *28*(4), 1068–1078.
Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
Wooldridge, J. M. (2009). *Introductory Econometrics: A Modern Approach,* 4th ed. Mason, OH: South Western / Cenage Learning.
Yeo, S. (2011). *Targeting a niche market in Las Vegas gaming industry*. (Master's thesis). Retrieved from http://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=2168&context=thesesdissertations
Zeileis, Achim (2004). Econometric Computing with HC and HAC Covariance Matrix Estimators. *Journal of Statistical Software, 11*, 1-17.