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# An Investigation of the Natural Vacancy Rate in the Hong Kong Lodging Market

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# An Investigation of the Natural Vacancy Rate in the Hong Kong Lodging Market

**Abstract**

Knowing the natural vacancy rate of a real estate market can yield highly useful information regarding future price movements. Past studies have been conducted to predict natural vacancy rates for office properties, but little research has delved into natural vacancy rates for the lodging market, and even less so within Hong Kong. This study aims to provide an estimate for the natural vacancy rate in the Hong Kong lodging market from 2008 to 2016 by using previous rent adjustment models, and also to predict whether the structural rate has changed over time.

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in the Hong Kong Lodging Market

By

Jonathan Wai

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in

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in the

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of

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Committee in charge:

Professor Crocker Liu, Chair

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The dissertation of Jonathan Wai is approved:

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Thesis Committee Chair

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## **Abstract**

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Knowing the natural vacancy rate of a real estate market can yield highly useful information regarding future price movements. Past studies have been conducted to predict natural vacancy rates for office properties, but little research has delved into natural vacancy rates for the lodging market, and even less so within Hong Kong. This study aims to provide an estimate for the natural vacancy rate in the Hong Kong lodging market from 2008 to 2016 by using previous rent adjustment models, and also to predict whether the structural rate has changed over time.

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Chair

Date

## **Biographical Sketch**

Jonathan Wai was born and raised in Hong Kong, where he attended Hong Kong International School throughout his childhood years. He began his studies abroad when was admitted to the Lawrenceville School during the beginning of high school. He began his undergraduate studies at New York University, and shortly transferred to the School of Hotel Administration at Cornell University as a Sophomore.

At the School of Hotel Administration, Jonathan is part of the Cornell Real Estate Club and also the Ye Hosts Honorary Society. His interest in real estate has led him to pursue and complete a Minor in Real Estate.

Jonathan's most recent work experiences include positions in Proprium Capital Partners, a real estate private equity firm based in Hong Kong and PwC's Financial Markets group, a real estate specialist valuation group. After graduation, Jonathan is moving to New York to work in real estate investing.

This work is dedicated with profound gratitude to  
my parents, my brother, my family, and all my close friends.  
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## I. INTRODUCTION

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In the real estate investing world, the use of statistics and regressions to estimate future market conditions have yet to take hold as a common practice amongst analysts. Given the widespread availability of data in recent years, the analysis of such information could yield highly useful knowledge regarding pricing, occupancy, and general market dynamics. Specifically, the analysis of such data could provide an estimate of the natural vacancy level of any given space market, which could then be used to estimate future rent changes. This relationship between vacancy rates and rental rates is known as the rent adjustment model. Empirical studies have demonstrated that changes in rent are directly related to excess demand or supply in the market, quantified by the deviation of actual vacancy rates from the “natural” or “equilibrium” vacancy rate (Rosen, 1984; Wheaton and Torto, 1988, 1994). This natural vacancy level can also serve as a proxy for the relative profitability of a given submarket, which can help guide investment decisions.

The natural vacancy rate of real estate draws its parallel from the natural unemployment rate in labor markets. In the labor market, 0% unemployment is never optimal due to frictional forces of the labor market. Because job searching requires time, the duration spent searching for a job produces a level of frictional employment in the labor markets. Without vacancies in the labor market, you would have to find someone who occupies the job you want, and also wants the job that you currently have.

This concept can be similarly applied to the real estate market when thinking about a natural vacancy level. The theory of a natural vacancy rate in the real estate market asserts that real estate markets in reality is not frictionless, and thus cannot operate at a true equilibrium (where supply equals to demand, thus resulting in zero vacancy). Due to the decentralized nature of real estate markets, it can be highly difficult for a landlord to be matched with the best available tenant. As a landlord, the objective is to find the best tenant who will be willing to pay most for a certain space. Because of this, landlords will anticipatorily set high rents so that not all tenants will be interested in the lease (Krainer, 2001). As such, even in equilibrium we expect there to be vacancies due to the inherent friction present within the market (Wheaton 1988).

Knowing the natural vacancy rate of any given market can yield highly useful knowledge for landlord and investors. If the actual vacancy rate is below the natural rate, rents will rise. The excess demand in the market will prompt an increase and rents, subsequently driving vacancy back up to its equilibrium level. Conversely, when the actual vacancy rate is above the natural level, prices will go down as due to the excess supply in the market. Thus, the natural rate is a long run equilibrium determined by structure of the economy. The natural vacancy rate can then be defined as the equilibrium level of vacancy where there is no pressure to either increase or decrease rents. Beyond knowing the direction of future pricing, knowing the natural vacancy rate of a rental property will also help guide investment decisions. In the long run, investing in a market where the natural vacancy is low or declining will yield a higher return on investment than otherwise, *ceteris paribus*.

For this paper, we will test the traditional model of rent adjustment by applying it to the lodging market in Hong Kong. We predict that changes in ADR are directly related to deviations in the actual vacancy rate of hotels relative to its equilibrium level. However, it is likely that ADR movement is also impacted by other factors beyond vacancy rates. This paper will also explore the correlation between these factors and changes in ADR over time.

This paper will focus on the natural vacancy rate of the Hong Kong lodging market. This paper focuses on answering two questions. First, what is the natural vacancy rate of hotels within the Hong Kong lodging market from 2008-2016? In order to determine this, we analyze occupancy rates and ADR rates over the course of the eight years. The second question we attempt to answer is - what are the other factors that drive changes ADR, and by how much? The structure of this paper will be as follows:

- I. Introduction
- II. The Market
- III. Literature Review
- IV. The Model
- V. Data
- VI. Estimates
- VII. Conclusion & Discussion

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## II. THE MARKET

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### OVERVIEW OF HONG KONG

Hong Kong, officially known as the Hong Kong Special Administrative Region of the People's Republic of China, is an autonomous territory of China. Hong Kong became a British colony following the first opium war, and was returned as a special administrative region to China in 1997. Hong Kong follows the political principle of "one country, two systems", as the territory maintains a separate political and economic system from China. Under Hong Kong's Basic Law, the region was able to maintain a capitalistic economy throughout the years, paving its way to becoming a financial hub of Asia.

Hong Kong's economy is driven by free trade, low taxation, and minimal government intervention. It currently stands as the world's ninth largest trading economy, and has the seventeenth highest GDP per capita in the world. The four major economic sectors of Hong Kong are - trading and logistics (22.3% of GDP in terms of value-added in 2015), tourism (5%), financial services (17.6%), and professional services and other producer services (12.3%). Hong Kong's relationship with mainland China has been and will continue to be the biggest driver of Hong Kong's economic growth. Currently, trade with mainland China accounts for about half of Hong Kong's total trade by value. Ease of travel between mainland China and Hong Kong has also spurred a growth of Chinese visitors to Hong Kong - from 4.5 million in 2001 to 47.3 million in 2014. However, economic slowdown of China in recent years and the continued appreciation of the Hong Kong dollar relative to other currencies have led to a decline in mainland visitors to the territory, with 2015 seeing a 3% drop in Chinese visitors.

As the financial hub of Asia, Hong Kong has one of the greatest concentrations of corporate headquarters in Asia. The Hong Kong Stock Exchange currently ranks as the world's sixth largest stock exchange by market capitalization. About 51% of the firms listed in the Hong Kong Stock Exchange are mainland Chinese-based companies. Its currency, the Hong Kong dollar, is currently the eighth most traded currency in the world, and has been pegged to the US dollar

since 1983. Hong Kong is also commonly known as one of the freest economy in the world, and has been consistently ranked number one in the Index of Economic Freedom since 1995.

## OVERVIEW OF HONG KONG'S TOURISM INDUSTRY

The tourism industry represents a major segment of Hong Kong's economy. It contributed approximately 5% to Hong Kong's GDP in 2015. With 271,800 employed people, the tourism industry accounts for 7.2% of total employment in Hong Kong. Mainland Chinese remain as the number source of visitors to the territory, accounting for 76% of total visitors in 2016. However, this means that Hong Kong's tourism industry is highly exposed to mainland economic slowdowns and changes in travel preferences of the mainland Chinese. This was evident in recent years as 2016 recorded a 6.7% decline in mainland arrivals to Hong Kong amidst a slow growing Chinese economy. Moreover, Hong Kong recently implemented a new measure called "one trip per week" for Shenzhen residents, greatly limiting the number of visits in a week neighboring Shenzhen residents are permitted. **Table 1** below highlights some general statistics of Hong Kong's tourism industry.

	<b>2016</b>	<b>vs 2015</b>
Total visitor arrivals	56,654,903	-4.5%
<i>Overnight arrivals</i>	26,552,681	-0.5%
<i>Same-day arrivals</i>	30,102,222	-7.7%
Average hotel occupancy rate	87%	+100 bps
Average achieved hotel room rate	HK \$1,287	-3.7%
Average length of stay of overnight visitors	3.3 nights	<i>no change</i>
Overnight visitor per capita spending	HK \$6,599	-8.8%
Total tourism expenditure associated to inbound tourism	HK \$296.2 bn	-10.1%

**Table 1 – Hong Kong Lodging Market Statistics**

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### III. LITERATURE REVIEW

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#### THE RENT CHANGE MODEL

The first empirically tested model of rent change with the natural level of vacancy was created by Smith (1974). His model defined demand as:

$$D = f(R, U, Y, P) \text{ (1)}$$

$D$  is defined as the demand for housing service, which is a function of variables  $R$ ; the user cost of home ownership,  $U$ ; real income per household,  $Y$ ; the price level,  $P$ ; and demographic variables. Level of vacancies can then be expressed by:

$$VL = S - D \text{ (2)}$$

$S$  is defined as the supply of rental housing, assumed to be fixed in the short term, and  $VL$  is defined as the vacancy level. Dividing by  $S$  then provides the vacancy rate:

$$V = VL/S = 1 - (1/S) f(R, U, Y, P) \text{ (3)}$$

With the hypothesis that changes in rent is determined by excess demand or supply (over the natural level of vacancy), the rate of change of nominal rents  $R^*$  will then be a function only of the vacancy rate  $V$  and the natural vacancy rate  $V^*$ , giving:

$$R^* = g(V^* - V) \text{ (4)}$$

Because costs also affect rental inflation, since landlords pass increases in operating costs to their tenants, a new variable must be introduced.  $T^*$  equals to the rate of change of property taxes, as property taxes represents a major operating expense for these properties. The new equation will then be:

$$R^* = r(V^* - V, T^*) \text{ (5)}$$

Assuming that a constant natural vacancy rate occurs over the period of interest, the regression equation is then:

$$R^* = b_0 - b_1V + b_2T^* + \text{error} \text{ (6)}$$

As the definition of the natural vacancy rate is the level of vacancy in which there is equalized supply and demand, which means that at that level of vacancy, there is no upward or downward

pressure on rental rates. The natural vacancy rate is then solved by determining  $V$  when  $R^*$  equals zero.

A simplified version of this equation emerged under Wheaton and Torto (1988). By using real rent instead of nominal rent as the dependent variable, the revised equation cancelled the need to include operating costs. This is because real rent will theoretically include the inflationary changes in operating costs, thus eliminating the need for that extra variable. The new regression equation will then be as follows:

$$R^* = b_0 - b_1V + \text{error} \quad (1)$$

The natural vacancy rate will then be determined by setting  $R^*$  to zero and solving for  $V$ , resulting in the following equation:

$$V^* = b_0 / b_1 \quad (2)$$

## REVIEW OF PREVIOUS STUDIES

Wheaton and Torto (1998) was one of the first empirical studies done to prove the correlation between changing rents and excess vacancy over the natural rate. His study examined rental and vacancy rates from 1968 to 1986 within the US national office market. Unlike other studies, Wheaton and Torto defined the natural vacancy rate as one that changes over time, which is incorporated into his definition of the natural vacancy rate:

$$V^* = b + ct \quad (1)$$

Where  $V^*$  is the natural vacancy rate,  $b$  is the intercept term, and  $t$  being time, and  $c$  being the rate of which the natural vacancy rate changes over time. The new estimating equation used by Wheaton and Torto is then:

$$R^* = a[b + ct - V(t)] \quad (2)$$

His study yielded two interesting conclusions regarding the rental adjustment mechanism within the national US office market. First, he discovered that the natural vacancy rate did in fact vary over time. Specifically, he was able to determine that the slope of equation (1) was equal to .34. This means that the natural vacancy rate would increase by .34% every year, as the natural vacancy rate increased from 7% in 1968 to 13% in 1986. His second finding was that for every percentage point of excess vacancy in the market above the natural rate, rents would adjust

downward by 2.3%. This meant that if the actual vacancy rate were 10% while the natural level is 15%, real rents would decrease by 12% per year. Thus, his study proved not only the existence of a rental adjustment mechanism within the national office market, but that the natural vacancy rate was in fact not constant over time.

Another study done on the natural vacancy rate for a hotel market was DeRoos (1999). Unlike Wheaton and Torto, DeRoos' paper did not use a time trending equation to estimate the natural vacancy rate. His study concluded that the natural occupancy rate for the US lodging market from 1987 to 1998 was 62.9 percent. His paper also discovered that the natural occupancy rate for hotels differed by geography, and also by chain scale, or by submarket. Furthermore, his paper compared actual average occupancy rates to the estimated natural occupancy rate, and computed the difference as development gaps in the lodging market. By comparing the average occupancy rate from 1987 to 1997 to the natural occupancy rate of 62.9 percent, he was able to determine the long run occupancy gap, which could then be translated into number of rooms needed to drive down actual occupancy levels to the equilibrium level of 62.9 percent. He discovered that the long-run room gap was 51,170 rooms. This number was compared to the short-run room gap, which was determined by the difference in actual occupancy rate of 1997 to the equilibrium level of 62.9 percent. The short-run room gap was then determined to be 95,890. Given the actual supply growth in 1997 was 125,000 rooms, his conclusion was that the nationwide lodging industry in the US for 1997 overshot the short-run supply gap, which is also significantly above the long-run supply gap.

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## IV. MODEL

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For our research we will use the following rent change equation derived from Wheaton and Torto (1988), which originally applied for commercial office properties. The relationship between rents and the natural vacancy rate is defined as:

$$[R(t)-R(t-1)] / r(t-1) = a[V^*-V(t)] + d_1x_1+d_2x_2\dots \quad (1)$$

Where  $R(t)$  represents ADR during time  $t$ , thus the left hand side representing the monthly change in ADR.  $V^*$  is defined as the natural vacancy rate, and  $V(t)$  as the actual vacancy rate during time  $t$ . The difference between the natural vacancy rate and actual vacancy rate will then be multiplied by an adjustment factor of  $a$ , which defines the speed of which the changes in ADR is affected by differences between the natural vacancy rate and the actual vacancy. The other variables that we suspect has a direct correlation to changes in ADR are defined as  $x_1$ ,  $x_2$ , and so on, with  $d_1$ ,  $d_2$ , as the respective coefficients of each variable. However, in order to incorporate the possibility that the natural vacancy rate has changed over time, we defined the natural vacancy rate as:

$$V^* = b + ct \quad (2)$$

This equation defines the relationship between the natural vacancy rate and other variables. The intercept term defined here as  $b$ , and the variable of time defined as  $t$  with a rate of change of  $c$ . By substituting this definition of the natural rate to equation (1) above, we then arrive at the following equation:

$$R^* = a (b + ct - V(t)) + d_1x_1 + d_2x_2 \quad (3)$$

Multiplying out variable  $a$  will then give the following:

$$R^* = ab + act - aV(t) + d_1x_1 + d_2x_2 \quad (4)$$

The coefficients can then be simplified, where  $B_0 = ab$ ,  $B_1 = ac$ ,  $B_2 = d_1$ ,  $B_3 = d_2$ , and  $B_4 = -a$ . Resulting in the following regression equation:

$$R^* = B_0 + B_1t + B_2x_1 + B_3x_2 + B_4V(t) \quad (5)$$

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## V. DATA

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For our regression, we used the following data listed out in **Table 2** below. The time period we decided to examine was from January 2008, to September 2016. STR supplied data throughout these years on vacancy rates, supply, demand, and ADR. Because we decided to use monthly data, seasonal adjustment to ADR and vacancy rates was necessary in order to remove the volatility effects of hotel seasonality. **Table 2** summarizes the mean, maximum, and minimum values of the data over the course of the aforementioned time period.

Variable	Mean	Max	Min
Vacancy rate	16.8%	39.3%	8.3%
Supply (rooms)	1,822,100	2,060,601	1,426,376
Demand (rooms)	1,521,631	1,849,840	980,977
ADR (USD)	\$200	\$270	\$138
Revenue (USD)	\$307,153,142	\$434,883,773	\$145,377,115
CPI	89.8	103.8	77.9
Retail sales	82.9	135.3	49.2
USD:HKD	7.76	7.81	7.75
RMB:HKD	1.20	1.28	1.08
Chinese arrivals	2,724,446	4,896,001	1,012,386
American arrivals	142,210	192,500	98,684
Lending rate (%)	5.05%	6.56%	5.00%

**Table 2 - Summary Statistics of Data**

Another factor to consider is the influence of random events such as pandemics and sports events on ADR change. For example, in 2009 Hong Kong experienced a swine flu pandemic that caused a citywide closure of schools. This lasted for many months and is likely to have had a negative impact on the lodging market, and ADR. In order to account for such disruptions, we used dummy variables for five different events that we believe may have had a significant impact on ADR. Some events were annually reoccurring while others happened only once. **Table 3** below gives information on these events, and their date of occurrence(s).

<b>Event</b>	<b>Dates</b>
Swine Flu	5/1/09 - 5/1/10
Umbrella Revolution Protests	9/26/14 -12/15/14
2009 East Asian Games	12/5/09 -12/13/09
Art Basel	March every year from 2013 to 2016
Ruby Sevens	March every year from 2008 to 2016

**Table 3 - Summary of Dummy Events**

## VI. THE ESTIMATES

The result of the regression analysis is displayed in **Table 4** below. This model yielded an r-squared value of .11 but only had the event dummy variables and also the variable of time. The estimated natural vacancy rate was 12.8 percent, or an 87.2 percent natural occupancy rate. The adjustment rate, or variable *a* was found to be .003. While the r-squared value for this model is disappointing, the coefficient of the most important variable, vacancy, was negative; this is the correct direction. The p-value for vacancy was also statistically significant at the .05 alpha level, and thus we can conclude that vacancy rates did have a significant impact on changes in ADR.

<i>R-squared = .11</i>			
<b>Variable</b>	<b>Estimated Coefficient</b>	<b>T- Stat</b>	<b>P-Value</b>
C	.062	1.886	.062
Time	-.209 E-03	-1.082	.282
VAC	-.252 E-02	-2.019	.046
Swine	.023	1.447	.151
Umbrella	-.033	1.379	.171
Rugby	.388 E-02	.180	.857
Art	-.052	-1.614	.110

**Table 4 - Model 1**

The estimating equation from model one will then be the following:

$$R^* = .062 - .209E-03t - .252E-02V(t) + .23Swine - .033Umbrella + .338E-02Rugby - .052Art \quad (1)$$

The results of another model we used are displayed in **Table 5** below. This model was more extensive and incorporated other factors such as Drmb; period to period change in RMB exchange rate, Dchv; period to period change in Chinese visitors, Dam\_arr; period to period change in American visitors. However, the results of this model were disappointing as the estimated natural vacancy rate was found to be negative which is not possible. As such, we have decided model one to be the better fit, despite a slightly lower r-squared value. Furthermore, we also found that the adjusted r-squared value for model was only .02 above that of model one. As

such, model two did not significantly improve the fit with more variables, and thus why we have chosen model one as the best estimating equation for the Hong Kong lodging market.

<i>R-squared = .17</i>			
<b>Variable</b>	<b>Estimated Coefficient</b>	<b>T- Stat</b>	<b>P-Value</b>
C	-.500	-.630	.530
Time	-.167 E-03	-.801	.425
VAC	-.270 E-02	-2.168	.033
Drmb	.641	.817	.416
Dchv	-.011	-.375	.708
Dam_arr	-.072	-2.263	.026
Swine	.030	1.762	.081
Umbrella	-.027	-1.139	.258
Rugby	.040	1.484	.141
Art	-.051	-1.581	.117
EAGames	-.026	-.531	.597

**Table 5 - Model 2**

The estimating equation from model two will then be the following:

$$R^* = -.5 - .167E-03t - .270E-02V(t) + .651Drmb - .011Dchv - .072Dam\_arr + .03Swine - .027Umbrella + .04Rugby - .051Art - .026Eagames \quad (2)$$

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## VII. CONCLUSION & DISCUSSION

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We can conclude that the natural vacancy rate for both models had no evidence of time variation. As the coefficient from both models for variable  $t$  was not statistically significant at the alpha level (.05), we are able to reject the hypothesis of a time-varying natural vacancy rate. This likely means that the lodging market in Hong Kong is a very mature and developed one. The fundamental infrastructure of the lodging market in Hong Kong has largely remained the same in the past eight years, supporting a temporally constant natural vacancy rate. Usually markets that are changing or maturing are expected to experience a change in their natural vacancy rate over time. For example, Wheaton and Torto's paper suggested that the growth in the natural vacancy rate for the office market from 1968 to 1986 was due to changes in tenant turnover and length of leases. Their suggestion was that the office sector used to be dominated by few large tenants, and has then transitioned into a much broader base of tenants which consequently may have caused an increase the natural vacancy rate to accommodate increased frictions in the market.

Another interesting finding is rate of rental adjustment, or variable  $a$ , which we found to be .003, based on model one. This means that for every percentage point of excess vacancy in the market over the natural vacancy, ADR will decrease by .3 percent. Given that the average vacancy rate of the Hong Kong lodging market was 13 percent last year, and that the natural vacancy rate based on model was estimated to be 12.8%, the decrease in ADR should then be .06%. However, this was based on model one which did not have a very high r-squared value – the predicted change in ADR based on our model may be inaccurate.

While the r-squared values for models one and two are not too high, we do believe that many of the variables we chose are significant drivers of ADR change. As mentioned before, Hong Kong's lodging industry is highly exposed to the travelling behavior of mainland Chinese. As such, we expect variables like exchange rate of RMB to HKD, and number of Chinese visitors to be a significant driver of ADR change in Hong Kong hotels. A previous paper by Liu, Moulton, and Quan (2013) performed a similar regression analysis on RevPAR in Hong Kong with an R-squared value of .84; variables included Chinese consumer confidence, U.S. consumer confidence, Chinese real-estate development, and others. With further analysis, perhaps changing

the time period or changing to other similar variables that are better proxies for mainland Chinese's travelling behaviors, we believe that these variables could be significant.

Overall we found the results to be disappointing given the low r-squared values for our models. As this is a first examination of the Hong Kong market, further analysis is needed to produce a better regression model. Perhaps the use of annual, or quarterly data, instead of monthly data would have yielded better results. With further research and analysis, we believe that a superior model with a better fit of the Hong Kong lodging market could be produced.

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## REFERENCES

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- deRoos, J. A.. "Natural occupancy rates and development gaps: A look at the U.S. lodging industry". *Cornell Hotel and Restaurant Administration Quarterly* 40.2 (1999): 14-22.
- Hagen, Daniel A., and Julia L. Hansen. "Rental Housing and the Natural Vacancy Rate." *Real Estate Economics* 16.4 (1988): 419-29.
- Parli, Richard L., and Norman G. Miller. "Revisiting the Derivation of an Equilibrium Vacancy Rate." *Journal of Real Estate Portfolio Management* 20.3 (2014): 195-208. Normmiller.net.
- Rosen, K.T., and L.B. Smith. "The Price-Adjustment Process for Rental Housing and the Natural Vacancy Rate". *The American Economic Review* 73.4 (1983): 779–86.
- Smith, L.B. "A Note on the Price Adjustment Mechanism for Rental Housing". *American Economic Review* 64.1 (1974): 478–81.
- Wheaton, W.C., and R.G. Torto. "Vacancy Rates and the Future of Office Rents". *Real Estate Economics* 16.4 (1988): 430–36.
- Wheaton, W. "Vacancy, Search, and Prices in a Housing Market Matching Model." *Journal of Political Economy* 61 (1990): 1,270-1,292.
- "Hong Kong – the Facts." GovHK 香港政府一站通. Hong Kong Government, n.d. Web. 24 May 2017.
- "Tourism Performance in 2016." Tourism Commission - Tourism Performance. Hong Kong Tourism Commission, 08 Mar. 2012. Web. 24 May 2017.