

# Analysis on the Determining Factors of International Tourism in New Zealand: Optimisation of Computer-based Algorithmic Linear Regression Model

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**Keywords:** International Tourism, New Zealand, Linear Regression Model, The Elasticity of Demand.

**Abstract:** Scientific tourism management is becoming increasingly significant. Hence, this paper utilizes computer-optimized methods to ensure and analyse the several factors influencing the demand for international tourism in New Zealand from macro and microeconomic perspectives. Moreover, this paper utilizes the 'push' and 'pull' theory with variables from the country of origin as push factors and variables from the destination country as pull factors. Then, data related to the top three source countries from 2009 to 2018 is selected, and Minitab are utilized for correlation analysis, the best subset, and a linear regression equation so that price elasticities of demand are calculated for the variables relating to each of the top three sources countries. The price elasticity of demand is used to show pull factors for stakeholders in the tourism industry and to promote sustainable international tourism development in New Zealand.

## 1 INTRODUCTION

Tourism has become a fast-growing and interconnected branch of the economy (Bunghez, 2016), especially inbound tourism (Li et al., 2018). Given the positive economic contribution of international tourists, investigating the influence of variable factors on the demand of international tourists and applying them to guide the improvement of the inbound tourism strategy is vital.

This paper uses the push-pull theory in tourism to explain how factors in source and destination countries affect international. By arranging the literature from both macroeconomic and microeconomic perspectives, several variables are identified that can potentially affect tourist arrivals in New Zealand. Then by establishing a linear regression equation to study the correlation and elasticity of various variables with the number of inbound tourists to New Zealand, the paper explores the sensitivity between the relative changes in tourism demand and impact indicators such as price (Peng et al., 2015).

This study selects New Zealand as the destination. Among tourist source countries, Australia, China, and The United States are the top three ones from 2009 to 2018. Tourism has been a major driver of

economic growth in New Zealand (Shu et al., 2014). Modelling the influencing factors of tourism demand fosters the growth momentum of the industry in New Zealand (Pham et al., 2017).

## 2 LITERATURE REVIEW

### 2.1 Variables

Demand stems from economics, including desire and purchasing power. In the tourism industry, it is considered to be a measure of the use of a commodity or service by tourists (Frechtling, 2001). Namely, the factors affecting the demand for international inbound tourism influence consumers' judgment and choice of destinations, which is implied in the number of arrivals.

In economics, price is one of them, which can be reflected by the Consumer Price Index (CPI). CPI of destination and competitive countries are both crucial. Australia is the latter one. There is a spillover effect on tourism demand in Australia and New Zealand (Balli and Tsui, 2016). Spillover effects refer to an organization's performance of an activity, which produces the expected effect of the activity, and unexpected one outside the organization (Li et al.,

2011). The demand for inbound tourists from New Zealand can be affected by the Australian tourism demand factors. Therefore, there may be complementary or substitutional relationships between other source countries' tourism demand for New Zealand and Australia.

The Exchange rate is an important factor. Fluctuations in exchange rates dominate changes in overall relative tourism prices over time (Chang, Hsu, and McAleer, 2013). Personal disposable income (PDI) can be used as an index of reflected income and consuming ability; Gross National Income (GNI) has a significant impact on a country's international tourism demand (Khoshnevis and Khanalizadeh, 2017). According to OECD, GNI is based on GDP. Therefore, GNI and GDP are selected as variables in this paper; The Consumer Confidence Index (CCI) is a measure of the attitude of consumers about their expected financial situation (Dominitz and Charles, 2004), so CCI can affect the travel demand of consumers by predicting their future income (Easaw, Garratt, and Heravi, 2005); The Economic policy uncertainties (EPU) index reflects the uncertainty of the country's overall economy (Tsui *et al.*, 2018). It can affect visitors' confidence in trade and business activities, thus influencing the demand for business travel (Tsui *et al.*, 2018); Additionally, price level indices are the proportion of purchasing power parity to the market exchange rate. It can identify the stability of the economic environment in the destination, which customers care about.

The development of air infrastructure can make it easier for tourists to reach their destinations (Kanwal *et al.*, 2020), so people may consider it before traveling; The increase in crime rate causes destinations to be troubled by the negative image, causing the number of tourists to drop significantly (Lorde and Jackman, 2013); Carbon emissions reduce the visiting of tourists with a strong awareness of sustainable development (Chen, Lin, and Hsu, 2017).

## 2.2 Push and Pull Theory

The mentioned factors can play an important role as motivations in consumer behavior when deciding on a destination. The push and pull framework is a valid approach to testing tourist behavior in tourism theory (Chen and Chen, 2015). The 'push-pull theory' was initially one of the key theories in the study of mobile populations and migration. Gradually, it has been applied by scholars to study the push and pull factors that influence tourists' choice of destination, as it is an efficient way to explain tourists' choice of

destination. In tourism, push factors are understood as what tourists will choose one place over another. They are primarily demand-side. Those considered in this study are GNI, CCI, and PDI in source countries. Pull factors such as features, attractions, or attributes of the destination itself. It is primarily an external factor and belongs to the supply side (Prayag and Ryan, 2011). They are price level indices, carbon dioxide emissions, EPU index, CPI, crime rate, airport construction investment, and exchange rate in New Zealand.

## 2.3 Price Elasticity of Demand

Calculating the elasticity of demand for these factors can better reflect the degree of influence. For example, the price elasticity of demand at the destination, the price elasticity of substitution in a competitive market, and the income elasticity. From this, the percentage change of the corresponding independent variable caused by every 1% change in demand can be analyzed (Tribe, 2020). This has important implications for the marketing strategy, pricing, and future tourism demand for destination tourism products and services (Konovalova and Vidishcheva, 2013).

## 3 DATA SOURCES

### 3.1 Dependent Variables

Tourism demand in the study is shown by the number of arrivals, including all visitor numbers as well as arrivals from the top three source countries.

### 3.2 Independent Variables

In this study, independent variables include price level indices, investment and maintenance in air infrastructure, crime rate, three source countries' GNI, exchange rate, PDI, and CPI- New Zealand, CPI-Australia, EPU index, and carbon dioxide emissions.

## 4 METHODOLOGY

Tourism demand elasticity is a unitless measure of the sensitivity of tourism demand to changes in relevant factors (Song *et al.*, 2010), which is simply a measure of how tourism demand varies with changes in its influencing factors. The study of tourism

demand elasticity has two main implications: 1. to understand the changes in tourist tourism demand by each influencing factor. 2. to assist the destination to adjust the prices of tourism products and marketing strategies to maximize revenue based on the results of this study (Tang and Chen, 2017). If the price of the destination decreases, tourists' income is sufficient to purchase and enjoy more tourism products, but the demand for tourism products in alternative countries will reduce because they lose price competitiveness. These two changes are called the income effect and substitution effect respectively (Song, et al., 2010). These two effects can be implied from the values of income and price elasticities in the demand function. Hence, this paper uses correlation and regression analysis to analyse the sensitivity of New Zealand's inbound tourism demand to changes in the influencing factors in the Australian, US, and Chinese markets from the perspective of demand elasticity. The elasticity of demand is expressed as follows:

$$PED = \frac{\% \text{ change in Quantity Demand}}{\% \text{ change in Price}} = \frac{\% \Delta \text{ in } QD}{\% \Delta \text{ in } P}$$

In this paper, the New Zealand arrivals from Australia, China, and the USA are used as the dependent variable (Y) respectively. The multiple linear regression analysis is used to explore the factors influencing the demand for inbound tourism in New Zealand and to establish independent regression equations for the three source countries. Independent variables such as GNI, CPI, and PDI are

expressed as  $X_1, X_2, X_3, \dots$  are expressed and the linear model expressions are as follows.

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n$$

Firstly, the study uses Minitab software to perform correlation analysis for each variable and screened out the variables with r values greater than 0.8. The independent and dependent variables with strong correlations were then calculated using stepwise regression. Although the results obtained were a good fit, some factors that are highly correlated in the relevant literature did not enter the equation. Because this is a purely statistical screening, the 'potential' explanatory power of many independent variables may be wasted. Therefore, to fully utilize and analyze all independent variables, the paper concludes with a method to select the best subset for the study. Since there was a problem of excessive covariance in the first equation establishment, individual variables were excluded and then regressed. The equations obtained afterward fit well, and the adjusted r-squared is above 90%, the equation has passed the F test, P test, and Chi-square test, proving that the equations meet the requirements of linear regression.

## 5 RESULTS

The correlation analysis results are shown in the following tables by Minitab.

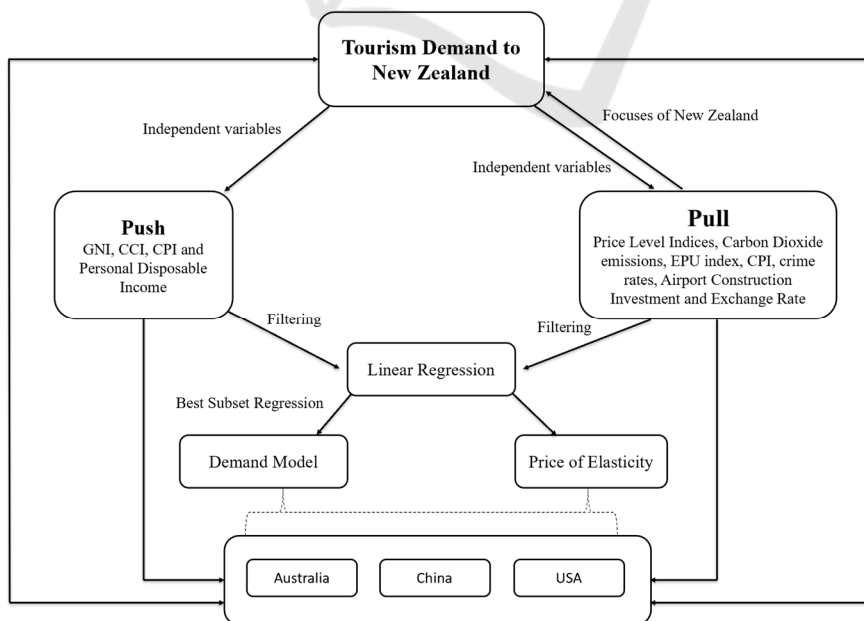


Figure 1: Conceptual Model Diagram.

Table 1: Correlations of variables of Australia.

**AUS**

**Correlations**

	CCI-AUS	Price Level Indices (NZ)	GNI-Australia (USD\$) (thousand)	CO2 Emissions/ten thousand tons	EPU Index
Price Level Indices (NZ)	-0.464				
GNI-Australia (USD\$) (thousand)	-0.444	0.824			
CO2 Emissions/ten thousand tons	-0.323	0.444	0.445		
EPU Index	0.319	-0.595	-0.783	-0.252	
CPI-New Zealand	-0.507	0.780	0.469	0.412	-0.164
New Zealand Crime Rate per 100	0.081	-0.632	-0.187	-0.225	0.198
Air Infrastructure Construction	-0.331	0.401	0.055	0.345	0.242
PDI -AUS	-0.514	0.746	0.457	0.382	-0.217
Exchange Rate-AUD	0.431	-0.481	-0.360	-0.278	0.250
Population from AUS (million)	-0.342	0.568	0.186	0.332	0.039

	CPI-New Zealand	Rate per 100	Air Infrastructure Construction	PDI -AUS	Exchange Rate-AUD
Price Level Indices (NZ)					
GNI-Australia (USD\$) (thousand)					
CO2 Emissions/ten thousand tons					
EPU Index					
CPI-New Zealand					
New Zealand Crime Rate per 100	-0.469				
Air Infrastructure Construction	0.869	-0.259			
PDI -AUS	0.989	-0.421	0.871		
Exchange Rate-AUD	-0.789	0.113	-0.789	-0.862	
Population from AUS (million)	0.936	-0.426	0.965	0.946	-0.829

Table 2: Correlations of variables of China.

**China**

**Correlations**

	CCI-CHN	Price Level Indices (NZ)	GNI-China (USD\$)	CO2 Emissions/ten thousand tons	EPU Index
Price Level Indices (NZ)	0.195				
GNI-China (USD\$)	0.683	0.703			
CO2 Emissions/ten thousand tons	0.379	0.444	0.407		
EPU Index	0.448	-0.595	-0.168	-0.252	
CPI-AUS	0.701	0.699	0.997	0.384	-0.141
CPI-New Zealand	0.667	0.780	0.979	0.412	-0.164
New Zealand Crime Rate per 100	-0.324	-0.632	-0.360	-0.225	0.198
Air Infrastructure Construction	0.870	0.401	0.905	0.345	0.242
PDI- CHN	0.740	0.643	0.994	0.391	-0.074
Exchange Rate-RMB	0.246	-0.540	0.110	0.002	0.268
Population from China (million)	0.737	0.512	0.963	0.285	0.020

	CPI-AUS	CPI-New Zealand	Rate per 100	Air Infrastructure Construction	PDI- CHN	Exchange Rate-RMB
Price Level Indices (NZ)						
GNI-China (USD\$)						
CO2 Emissions/ten thousand tons						
EPU Index						
CPI-AUS						
CPI-New Zealand	0.984					
New Zealand Crime Rate per 100	-0.404	-0.469				
Air Infrastructure Construction	0.912	0.869	-0.259			
PDI- CHN	0.996	0.972	-0.359	0.970		
Exchange Rate-RMB	0.094	-0.047	0.618	0.289	0.155	
Population from China (million)	0.966	0.915	-0.269	0.596	0.750	0.286

Table 3: Correlations of variables of United States.

**USA**  
Correlations

	CCI-USA	Price Level Indices GNI-USA (NZ) (USD\$) (thousand)	CO2 Emissions/ten thousand tons	EPU Index	
Price Level Indices (NZ)	0.582				
GNI-USA (USD\$) (thousand)	0.972	0.599			
CO2 Emissions/ten thousand tons	0.448	0.444	0.388		
EPU Index	-0.143	-0.595	-0.023	-0.252	
CPI-AUS	0.965	0.699	0.988	0.384	-0.141
CPI-New Zealand	0.911	0.780	0.959	0.412	-0.164
New Zealand Crime Rate per 100	-0.328	-0.632	-0.336	-0.225	0.198
Air Infrastructure Construction	0.917	0.401	0.958	0.345	0.242
PDI- USA	0.966	0.497	0.980	0.424	0.053
Exchange Rate-USD	0.171	-0.695	0.116	-0.154	0.540
Population from USA (million)	0.853	0.226	0.894	0.252	0.377

	CPI-AUS	New Zealand Crime Rate per 100	Air Infrastructure Construction	Exchange Rate-USD
Price Level Indices (NZ)				
GNI-USA (USD\$) (thousand)				
CO2 Emissions/ten thousand tons				
EPU Index				
CPI-AUS	0.984			
CPI-New Zealand	0.984			
New Zealand Crime Rate per 100	-0.404	-0.469		
Air Infrastructure Construction	0.912	0.869	-0.259	
PDI- USA	0.948	0.904	-0.293	0.974
Exchange Rate-USD	-0.007	-0.153	0.500	0.293 0.240
Population from USA (million)	0.825	0.760	-0.234	0.972 0.925 0.438

After correlation analysis, several factors which are correlated with the three countries' tourism demand are selected in the following table.

Table 4: Factors correlated with tourism demand.

Australia	CPI-New Zealand	Investment and Maintenance in Airport Infrastructure	Disposable Income-USA		
China	GNI-China	CPI-New Zealand	CPI-AUS	Investment in Air Infrastructure	Personal Disposable Income-CHN
United States	CCI-USA	GNI-USA	CPI-AUS	Investment in Air Infrastructure	Personal Disposable Income-USA

**Price of Elasticity of Demand**

After using best subset, factors that can significantly affect tourism demand are selected and then the linear regression is shown, which has been checked.

**1. For the Australian Market:**

**(1) The Demand Model is below:**

$Quantity\ demanded_x = 2.31 + 1.251 * Disposable\ Income - AUS + 8.03 * Investment\ and\ Maintenance\ in\ Air\ Infrastructure$

After calculating:  $Quantity\ demanded_x = 14,927,948$

**(2) The Formula needed to Calculate Elasticity:**

$$Price\ Elasticity\ of\ Demand = \beta * \frac{Price}{Quantity}$$

Results of price elasticity of demand:

Quantity demanded: Price Elasticity of Demand = 0.844

$D_x$ : Price Elasticity of Demand = 0.104

$I_x$ : Price Elasticity of Demand = 0.297

**2. For the China Market:**

**(1) The demand model is below:**

$Quantity\ demanded_x = -1.913 + 3.84 * Investment\ and\ Maintenance\ in\ Air\ Infrastructure + 0.1385 * Personal\ Disposable\ Income - CHN$

After calculating:  $Quantity\ demanded_x = 3,000,088$

**(2) The formula needed to calculate elasticity:**

$$Price\ Elasticity\ of\ Demand = \beta * \frac{Price}{Quantity}$$

Results of price elasticity of demand:

Quantity demanded: Price Elasticity of Demand = 0.581

$I_x$ : Price Elasticity of Demand = 1.056

$P_x$ : Price Elasticity of Demand = 1.666

**3. For the USA Market:**

**(1) The demand model is below:**

$Quantity\ demanded_x = 5.51 + 0.0988 * CPI - AUS + 5.21 * Investment\ and\ Maintenance\ in\ Air\ Infrastructure + 0.119 * GNI - USA$

After calculating:  $Quantity\ demanded_x = 2,762,046$

**(2) The formula needed to Calculate Elasticity:**

$$Price\ Elasticity\ of\ Demand = \beta * \frac{Price}{Quantity}$$

Results of price elasticity of demand:

Quantity demanded: Price Elasticity of Demand = 0.614

$C_x$ : Price Elasticity of Demand = 3.206



$I_x$ : Price Elasticity of Demand = 0.494

$G_x$ : Price Elasticity of Demand = 2.089

## 6 DISCUSSION

### 6.1 PDI

From the obtained elasticity results (1.666), China's demand responds to the change in PDI positively. The elasticity is greater than 1, indicating that the growth rate of demand is greater than the growth rate of income. That means New Zealand tourism is a luxury for Chinese tourists. Such change in consumers' propensity to consume due to a change in income is consistent with the income effect in economics (Jiang and Tang, 2001). In the push and pull theory, it is regarded as a pull factor to drive tourists to travel to New Zealand.

### 6.2 GNI

Based on the results, it can be found that the USA's per capita GNI elasticity is 2.089, which means that the per capita national income of the USA has a greater impact on the outbound tourism of USA residents to New Zealand. However, The United States is a developed country, and traveling abroad is not a luxury consumption activity for its residents. This is an interesting finding given that USA GNI is not supposed to have much impact on outbound tourism demand.

### 6.3 CPI

The elasticity of demand of Australia's CPI to the USA is 3.206, which shows that Australia's CPI greatly affects Americans' demand for New Zealand travel. The positive cross elasticity means Australia and New Zealand are substitute countries for visitors from America. From the perspective of the substitution effect, if tourists have lower spending power than before in Australia, they tend to reduce demand and increase tourism demand for alternative New Zealand. From the perspective of income effect, that means a decrease in the relative income of tourists, so they will reduce tourism demand, including in New Zealand. However, the substitution effect outweighs the income effect, so demand in New Zealand rises. When Australia's CPI grows, the USA tends to increase tourism demand in New Zealand.

## 6.4 Investment and Maintenance in Air Infrastructure

The price of elasticity of Australia's demand is the least among the three countries. Aviation traffic has been developed and convenient, and the current condition has been able to meet the entry demand of New Zealand tourists (Duval, 2013). The maintenance and upgrade of the airport facilities will not affect their entry. As a result, there is little elasticity.

However, the figure of China is 1.056, which is relatively elastic. According to this, Chinese tourists are sensitive to airport infrastructure investment. Investment in airport infrastructure can increase passenger traffic, provide more services, and increase airfares (Eugenio-Martin, 2016). Due to the small number of flights between New Zealand and China, it is difficult to meet the increasing demand from China (Ozer, Balli, and Tsui, 2018). Thus, an increase in airport accessibility can pull significant increasing Chinese tourism demand. As air traffic between the two countries matures, the index may become less in the future.

The price elasticity of demand in the USA is equal to 0.494, which is inelastic. One of the reasons is that America is more accessible to New Zealand than China. Additionally, due to their higher PDI, USA travellers are less sensitive to the increased airfare caused by the investment in air infrastructure than Chinese travellers (Schiff and Becken, 2011). Therefore, the pulling power is not as strong as that of the Chinese.

Overall, the elasticity of demand for long-distance transportation is greater than that for short-distance transportation. It can be attributed that people traveling long distances have higher requirements for service and put more emphasis on the convenience of air infrastructure (Wu *et al.*, 2020). Therefore, China and USA pay more attention to air investment and construction than Australia.

## 7 CONCLUSIONS

This study mainly uses the push-pull theory to study the influencing factors and price elasticity of Australia, China, and the United States' demand for New Zealand's international tourism. Research shows that Australia and China are less price-sensitive, while the US is more resilient. Changes in PDI and CPI will also have a greater impact on New Zealand's inbound tourism demand. In addition, due to the special geographical location of New Zealand,

aviation infrastructure will directly affect the number of arrivals, so air services should be improved.

This study only considers economic and environmental factors and does not consider political and cultural factors, which may affect international tourism (Cheung and Saha, 2015). Beyond that, the findings of this study are not generalizable because the research only collects tourism data from New Zealand for 10 years, and the short-term fluctuations and lags of variables are not observable (Nghiem, Pham, and Dwyer, 2017). Therefore, there may be errors between the findings and the actual situation.

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