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Applying Regression Model for Changes in Population Age Structure on Domestic Tourism Demand †

Tzong-Shyuan Chen and Jui-Yuan Chu *

Department of Leisure Services Management, Chaoyang University of Technology, Taichung 413310, Taiwan; jsmike@cyut.edu.tw

* Correspondence: jychu@cyut.edu.tw

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Abstract: Changes in age structure are common in most countries because of aging and lower birth rates. In this study, we constructed a domestic tourism demand model using the concept of the proportion of the prime tourist population to investigate the effect of changes in the age structure of the population. A regression model with the time series data of the number of domestic tourists in Taiwan from 2001 to 2021 was adopted in this study. The results showed that there was a significant positive relationship between the proportion of the prime tourist population and domestic tourism demand, indicating that aging impacted the domestic tourism market negatively.

Keywords: population age structure; aging; domestic tourism

1. Introduction

Aging is a common issue as the population age structure changes in many countries around the world in the twenty-first century. According to the United Nations World Population Prospects [1], the proportion of the global population over the age of 65 will increase to 16.4% in 2050, up from 9.7% in 2022. In terms of Taiwan's elderly population, the proportion of people aged over 65 years old exceeded 14% in 2018, entering an aged society, and will exceed 20% in 2025, becoming a super-aged society. Aging affects the consumption, investment, and savings of the whole economy, as well as annuities, retirement benefits, and government revenues and expenditures. It also affects the labor supply and demand in the labor market, the industrial structure, and, ultimately, long-term economic development [2].

Tourism is an integral part of modern life and plays an important role in the development of the global economy. A country's tourism market is composed of two different markets, inbound tourism and domestic tourism, which is also referred to as internal tourism. Generally speaking, the domestic tourism market gradually expands with the development of the economy, the increase of national income, and the adjustment of the vacation system. According to the World Tourism Organization, the domestic tourism market is ten times larger than the international tourism market [3]. With global tourism deeply impacted by COVID-19, the importance of domestic tourism to the development of the domestic tourism industry has become more evident. Looking at the development of the domestic tourism market in Taiwan, according to the data from the Tourism Bureau, the number of domestic tourists was 190.376 million in 2016, which showed the peak of the number of tourists in recent years (Figure 1). After that, the number of domestic tourists gradually decreased, and the number in 2019 was 169.279 million. At the same time, however, the number of outbound tourists reached a record high. The number of domestic tourists in 2020 was affected by COVID-19, and the number of tourists was 142.970 million, a decrease of 15.5% compared with the number of tourists in 2019.

The domestic tourism market is the core of internal tourism, and its market changes are critical to the future development of the domestic tourism industry. In the face of the

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recent decline of the domestic tourism market and the different performances of outbound tourism, this study aims to examine the impact of aging on the domestic tourism market through constructing a regression model for domestic tourism demand based on changes in the age structure of the population. The findings provide a reference for strategies of tourism-related industries.

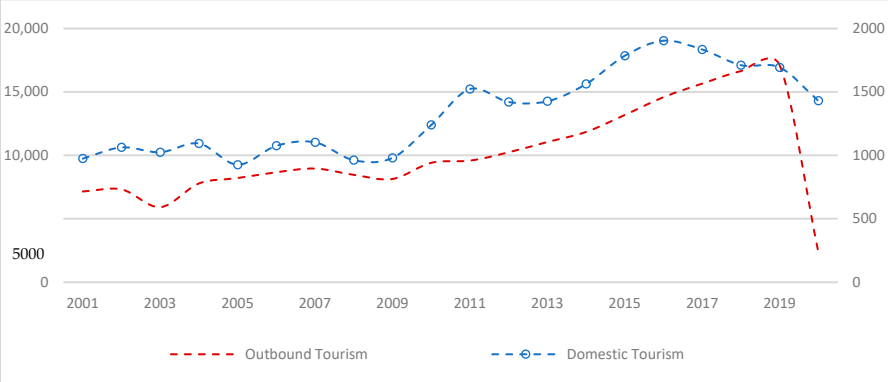

Figure 1. Changes in the number of domestic and outbound tourists from 2001 to 2020.

2. Literature Review

2.1. Domestic Tourism

A review of past studies on tourism demand shows that many related studies mainly have focused on the relationship between tourism demand and its influencing factors, as well as the characteristics and influencing factors of tourism demand. Earlier research on tourism demand mainly focused on international tourism and used aggregate data to analyze the impact of tourism on the economy of a country or region. In recent years, microdata have been used to explore individual or family tourism consumption decisions and influencing factors [4]. However, domestic tourism has received relatively little attention and research among those tourism demand studies.

Using data from 1976 to 1996, the influencing factors of South Korea's tourism expenditure were explored. The empirical results show that working hours, family size, and education time were important factors affecting South Korean domestic tourism expenditure. A two-stage decision budgeting model was used to study the domestic tourism demand of Swedish households. Using monthly data from January 1996 to October 1996, a model of the domestic tourism expenditure system was constructed including accommodation, food and beverage, shopping, transportation, and miscellaneous expenses as variables. Since Swedish households had no consumption records in several domestic tourism expenditure items, the study tried to overcome the sample selection bias caused by zero expenditure. The Hecman model was first used to derive the correction factor Mills λ. Then, this correction factor was put into the Quadratics AIDS system to derive the model coefficients to calculate the income, expenditure, and price elasticities of different household characteristics.

The domestic tourism demand of Chinese urban and rural residents was investigated using a hierarchical linear model. Using data from the National Household Travel Survey from 1996 to 2007, urban residents in 35 major cities and rural residents in 30 provinces were questioned from 2000 to 2007. The study found that absolute personal income was the main factor affecting the demand for domestic tourism. Also, it is observed from the results of the hierarchical linear model that the absolute income effect varied across cities/provinces, showing significant heterogeneity. In addition, relative income has a significant impact on travel demand in certain sub-regions of China. A structural equation model was also used to construct the relationship between tourism motivation, perceived benefits, perceived values, and behavioral intentions in Mongolia, using questionnaire data. The empirical results verified that travel motivation had a significant direct effect on perceived benefits, perceived values, and behavioral intentions.

2.2. Population Age Structure and Consumption

With the coming aging society, the impact of the age structure of the population on consumption has been increasingly emphasized and discussed. The life cycle hypothesis provides a good basis for empirical analysis of the relationship between population age structure and consumption. According to the life cycle hypothesis, an individual's consumption decisions are part of a long-term plan, and the consumption decisions at each age stage in life depend on the allocation of an individual's lifetime resources, rather than on current income. The average propensity to consume in the middle-aged and high-income period is smaller than that in the young and old, which makes the consumption plan formed at an average consumption level. That is, as individuals grow older, their consumption expenditures increase accordingly. In studies [5–7], the life cycle hypothesis was confirmed, showing that as the proportion of the aging population increased, aggregate consumption increased accordingly. However, studies [8,9] showed that population aging had a negative impact on consumption (Table 1).

Table 1. Studies on the relationship between population age structure and consumption.

Author	Age Structure Variables	Results
Attfield and Cannon [5]	Proportion of population by age	Aggregate spending rises as senior population rises
Lefèbvre [10]	Age effect of cohort analysis	Household spending decreases as the head of household age increases
Erlandsen and Nymoen [7]	Proportion of the prime saving population	Aggregate consumption increases as the rate of prime savings decreases
Estrada et al. [6]	Young dependency ratio Old dependency ratio	According to 153 economies worldwide, there is a positive relationship between population aging and aggregate consumption; however, the analysis of 31 Asian developing economies shows a significant negative relationship between population aging and aggregate consumption
Li and Li [9]	Population of age over 65	The increase of elderly population has a negative impact on consumption
Boonyasana and Chinnakum [8]	Young dependency ratio Old dependency ratio	young dependency ratio and old dependency ratio have a negative impact on consumption

The most important key factor in exploring the impact of population age structure on consumption is the setting of population age structure variables. From studies on the relationship between population age structure and consumption in the past two decades, it was found that most of them showed the dynamics of age structure change in terms of the population proportion. Since domestic tourism demand is mainly surveyed for people over 12 years old in Taiwan, the population age structure variables of this study refer to the concept of the proportion of the prime saving population [7] and set the age structure variable of tourism demand according to the proportion of the prime tourist population. Then, the impact of the aging population on the domestic tourism market can be explored.

2.3. Age and Travel

In tourism, the relationship between the age structure of the population and tourism demand has not been discussed in the literature. It is more common to use a cross-sectional age-life cycle to explore its impact on individual or family tourism demand. Henthorne [11], Jang et al. [12], Mehmetoglu [13], and Bernini and Cracolici [14] found a significant positive relationship between age and tourism expenditure, suggesting that population aging had a

positive impact on the development of tourism markets in a country or region. However, Dardis et al. [15], Wang et al. [4], and Frleta and Jurdana [16] showed that younger people spent more on tourism than older people and that population aging may have a negative impact on the tourism market in these countries or regions. The quantile regression model was used to classify tourism expenditure into different quantiles of expenditure, analyze the relationship between different components of expenditure and age, and explore the effect of aging on tourism expenditure.

Age-life-cycle variables are usually measured in terms of the age of individuals or household heads or expressed as dummy variables. Such variable settings cannot show the differences in the proportion of the population across age groups. In addition, such a setting makes generational and age effects confounded, so it is not possible to fully clarify the true effect of age on consumption. Therefore, exploring the impact of aging on tourism demand in terms of age-life-cycle variables fails to capture the real impact of demographic age structure changes on consumption and the dynamic process of change.

In summary, we constructed a model of domestic tourism demand, which sets the age structure variables of tourism demand in terms of the proportion of the prime tourist population, to investigate the impact of aging on the domestic tourism market using time-series data.

3. Method

3.1. Variables of Tourism Demand Population

In general, the dependency ratio is often used in age structure variables to represent changes in age structure [7]. The dependency ratio is the ratio of the dependent population to the working population, i.e., the sum of the 0–14-year-old population and the over-65-years-old population to the 15−64-year-old population. Given that domestic tourism demand is surveyed from people over 12 years old in Taiwan, the age structure variables of this study refer to the concept of the prime saving population ratio [7], and the proportion of the prime tourist population is set as

$$\text{AGE} = \frac{(\text{Population } 26-65 \text{ years old})}{(\text{Population } 12-25 \text{ years old}) \text{and } 66+ \text{ years old})} \quad (1)$$

According to Equation (1), the plot of the prime tourist population proportion from 1981 to 2061 is drawn as Figure 2. The proportion of the prime tourist population reached its peak in 2016, and gradually declined after 2017.

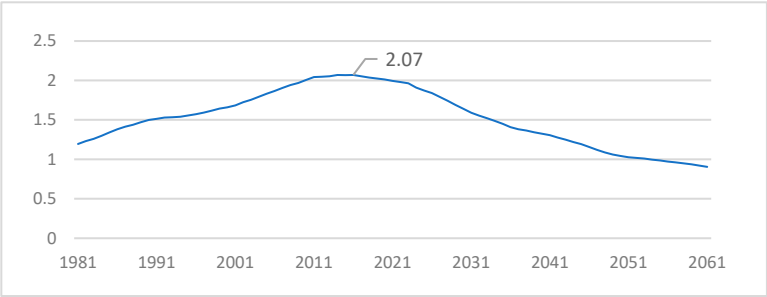

Figure 2. Changes in the proportion of the main tourist population from 1981 to 2061 for Taiwan.

3.2. Model Setting

According to economic theory, the quantity of tourism demand is mainly affected by variables such as income, price, population, and preferences. Therefore, the empirical model of domestic tourist demand in this study is set as follows.

$$TD_i = \alpha + \beta_1 PNI_i + \beta_2 CPI_i + \beta_3 LTD_i + \beta_4 AGE_i + \beta_5 HP_i + \beta_6 COV_i + \varepsilon_i \quad (2)$$

In (2), TD is the number of domestic tourists, PNI is the average national income per person, CPI is the consumer price index, and LTD is the number of domestic tourists in the previous period (representing habit formation) [17,18]. AGE is the proportion of the prime tourist population, HP is the dummy variable of the vacation policy, and COV is the dummy variable of COVID-19; ε is the error term, $i = 1, 2, \ldots, 20$, representing years of 2001 to 2020.

4. Results

Stata statistical software was used to estimate the coefficients of the model, and the empirical results are shown in Table 2. The $\overline{R}^2$ value of the model is 0.896, which shows that the fitness of the model is excellent, and only vacation policy is not significant among the six explanatory variables.

Table 2. Coefficients of estimated demand for domestic tourism.

Variables	β	t
PNI	0.30	2.90 *
CPI	−7249.24	−2.78 *
LDT	0.77	4.15 *
AGE	222,386.90	3.03 *
HP	−9289.80	−0.76
COV	−35,925.38	−2.52 *
Con	121,405.90	1.35
$\overline{R}^2$	0.896	

Note: * $p < 0.05$.

The positive coefficient ($\beta = 0.30, t = 2.90$) of PNI indicates that there is a significant positive relationship between income and domestic travel demand: as the average national income per person increases, domestic travel demand increases. The coefficient ($\beta = -7249.24, t = -2.78$) of CPI is negative, indicating that an increase in prices has a significant negative impact on domestic travel demand. The coefficient of LTD is significantly positive ($\beta = 0.77, t = 4.15$), indicating that domestic tourism has become a part of daily life, and the formation of travel habits has a significant positive effect on domestic tourism demand. The positive estimated coefficient ($\beta = 222386.9, t = 3.03$) of AGE indicates that the age structure of the population has a significant positive effect on the number of domestic tourists. Thus, as the elderly population increases, the proportion of the prime tourist population gradually becomes smaller, and the number of domestic tourists decreases, indicating that aging has a negative impact on the domestic tourism market.

The negative coefficient ($\beta = -9289.80, t = -0.76$) of the HP, although it is not significant, indicates that vacation policy leads to a decline in domestic tourism demand. It is caused by the uncertainty of people's income due to vacation policy. The negative coefficient ($\beta = -35925.38, t = -2.52$) of COV indicates that the COVID-19 epidemic has a significant negative impact on domestic tourism demand. The impact of the epidemic on the domestic tourism market is estimated to be 36 million fewer tourists a year.

Finally, the fitted values of (2) are plotted with the number of domestic tourists in Figure 3. It shows that the tourism demand model constructed in this study has a satisfactory fitness for the number of domestic tourists. Also, it indicates that a domestic travel demand model that considers the age structure of the population is suitable for analysis of changes in domestic tourists and for understanding the impact of aging on the domestic tourism market.

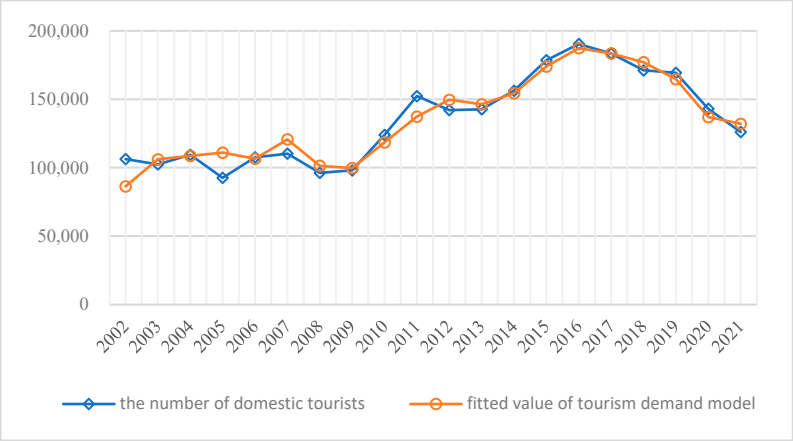

Figure 3. Number of domestic tourists and fitted value.

5. Conclusions

Lower birth rates and aging have become two major features of the changes in the age structure of the population because of the low fertility rate of women of reproductive age and the lengthening of life expectancy in many countries around the world. Aging is crucial to a country's economic or industrial development, so it is important to have information on the impact of aging on the economy or industry and then plan strategies for industrial development.

This study determines the proportion of the prime tourist population, which refers to the concept of the proportion of the prime saving population of Erlandsen and Nymoen [7]. With population age structure variables, a domestic tourism demand model was constructed to explore the impact of aging on the domestic tourism market using time series data from 2001 to 2020 in Taiwan. The results showed that there was a significant positive relationship between the proportion of the prime tourist population and domestic tourism demand, indicating that with the advent of an aging society, the proportion of the prime tourist population gradually declines, and the number of domestic tourists decreases accordingly. Therefore, it is obvious that aging is not conducive to the development of the domestic tourism market. For domestic-tourism-related industries, it is important to actively expand the source of the inbound tourism market to maintain the sustainable development of the industry. As for the domestic tourism senior market, developing new tourism products, increasing their consumption willingness and frequency, and slowing the impact of aging on the tourism industry are issues that the tourism industry must actively face and solve.

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