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RESEARCH ARTICLE

IMPACT OF PRICE INDEXES AND GDP INDEX ON TRENDS INTHE USE OF DOMESTIC AIR TRANSPORT IN VIETNAM

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ABSTRACT

This study aims to determine the impact of price indexes and Gross Domestic Product (GDP) index on trends in the use of domestic air transport in Vietnam. From the theoretical base, the article has developed a model of research and analysis the data of these elements over a 15-year period from 2002 to 2016. Research results show that the GDP index and transport price index of alternative modes have a positive impact on the trend of using domestic air transport service in Vietnam, but price index of air transport has a negative impact. In particular, the level of its impact in air cargo transport is quite low due to the proportion of air cargo transport in cargo transport modes is still low. While domestic passenger transport is strongly influenced by the air passenger transport price index and the passenger transport price index of alternative modes of transport due to the proportion of passenger in modes of transport is quite high. However the impact of GDP index is relatively low. These findings are an important basis for planning transport policy in Vietnam through transport pricing policies.

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INTRODUCTION

Air transport is one of the modes of transport in the national economy. Although operating late, it has played an increasingly important role in Vietnam's transportation system, especially in the process of global economic integration.Over the 15 year period from 2002 to 2016, domestic air transport has increased by more than 10 times in terms of passenger transport volume, reached 28.52 million passengers in 2016 and increased by more than two times in terms of percentage of total transport modes, reached 16.37% in 2016. As for domestic cargo transport, transport volume also increased five times between 2002 and 2016, reaching more than 201 thousand tons in 2016 but its share in transport modes is still small and there is slight downward strend to 0.14% in 2016. This change is largely due to the impact of economic factors such as income, air transport price and alternative transportation price, in part also due to technological change and other factors. This article will study the impact of economic factors through price and income indexes on the trend of using domestic air transport services in Vietnam through the change of its proportion in transport industry. To solve the objective, this study will review the theoretical basis, research model design, data collection and analysis to estimate parameters in the model. The importance of the factors in the model will be the basis for adjusting the air transport structure in the transportation system in Vietnam through the air transport price and other transport price policy.

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Theoretical basis and research design

Theoretical basis

Trends in the use of air transport services show the change in the proportion of air transportation services used in modes of transport. These trends depend on the demand for air transport services. Economic theories have shown that demand for goods and services depends on factors such as consumer's income, product prices, substitute product prices (O. Birchall & D. Verry, 2016).Economic theories have been applied in many studies when studying demand for air transport services and consumer's income are used by GDP or GDP per capita. On the global and regional market, Mark Smyth & Brian Pearce (2008) looked at the impact factors were air transport price and other factors that could affect demand for air transport such as GDP.For the air transport market of countries, many studies have looked at air transport price and income affecting the demand for air transport markets such as the Australian air transport market (Office of Transport Economics Australia,1995), the air transport market in Italy (Lorenzo Castelli et al., 2003), some air transport markets in

the Asia Pacific region (Craig Gallet and Hristos Doucouliagos, 2014), the air tranport market to Addis Ababa (Megersa A. Abate, 2013) or air transport market in the US (Zia Wadud, 2014). In addition to examining the impact of air transport price and GDP, Inter VISTAS Consulting Inc (2007) also examined the impact of alternative means of transport to demand for global air transport markets.As to the national air transport market, Fredrik Kopsch (2012) and Caglar Demirsoy (2012) not only examine the impact of prices and incomes, but also consider the effects of alternative transport prices such as rail or high speed rail and road transport for the air transport market in Sweden and Turkey.

Design research model

From the theoretical basis and reviewing of some related studies, this study designs models of factors affecting the trend of using domestic air transport services in Vietnam are economic factor index.The index is the ratio of times or percentages of relationships that compare two levels of a phenomenon (Nguyen Thi Thu Huyen et al., 2002). The studied index included the GDP index, air transport price index and price index for alternative mode of transportation. These trend are studied both for air cargo transport (Formula 1) and air passenger transport (Formula 2).

$$\text{Model 1: } P_c = \beta_c + \alpha_{ic} I_i + \alpha_{ac} I_{ac} + \alpha_{sc} I_{sc} \quad (1)$$

Where:

P_c: Proportion of domestic air cargo transport in modes of transport (%)

I_i: GDP index

I_{ac}: Domestic air cargo transport price index

I_{sc}:Cargo transport price index of alternative modes of transport

β_c,α_{ic},α_{ac}, α_{sc}: Parameters to estimate in the model

$$\text{Model 2: } P_p = \beta_p + \alpha_{ip} I_i + \alpha_{ap} I_{ap} + \alpha_{sp} I_{sp} \quad (2)$$

Where:

P_p: Proportion of domestic air passenger transport in modes of transport (%)

I_{ap}: Domestic air passengertransport price index

I_{sp}: Passenger transport price index of alternative modes of transport

β_p, α_{ip}, α_{ap}, α_{sp}: Parameters to estimate in the model

MATERIALS AND METHODS

Method of measuring the value of variables

Measure the proportion of air transport

In order to ensure overall consideration which both the number and the distance transported, the proportion of air transport in all modes of transport is calculated in terms of the number of rotation (the number of transport multiplied by the distance transported). To be more specific, for domestic air transport, it is defined by the ratio of tonne-kilometers transported by air transport to the total tonne-kilometers transported by all modes of transport. As for domestic passenger transport, it is defined by the ratio of passenger-kilometers transported by air transportto total passengers-kilometers transported by all modes of transport (Formula 3).

$$P_c = \frac{TPK_a}{TPK_g} \; or \; P_p = \frac{PPK_a}{PPK_g} \quad (3)$$

Where:

TPK_a and TPK_g are respectively tonne-kilometers transported by air transport and tonne-kilometers transported by all modes of transport in the domestic market.

PPK_a and PPK_g are respectively passengers-kilometers transported by air transport and passengers-kilometers transported by all modes of transport in the domestic market.

Measure the GDP index

Base on the concept of index of Nguyen Thi Thu Huyen et al. (2002), the annual GDP index is the ratio of the GDP of that year to the previous year or equal to 1 plus the GDP growth rate of that year (Formula 4)

$$I_i = \frac{GDP_1}{GDP_0} = 1 + i \quad (4)$$

Where:

GDP_1 and $GDP_0$are respectively GDP of that year and the previous year

i is the growth rate of GDP of that year to the previous year

Measure the price indexes

Currently, the General Statistics Office only publishes the transport sector price index in general, including the price index of passenger transport and the price index of cargo transport. Therefore, the domestic air transport index (passenger and cargo) and the price index of alternative modes of transport (passengers and cargo) in this study are calculated according to the following formula:

- The annual domestic air transport price index is based on the method of General Statistics Office (2016) which is based on the method of Lac peyres with the unchanged number is original quantities (q_0). Then It is transformed according to revenue, quantity of the research year and revenue of the previous year (Formula 5).

$$I_a = \frac{\sum p_{a1} q_{a0}}{\sum p_{a0} q_{a0}} = \frac{\sum R_{a1} \frac{q_{a0}}{q_{a1}}}{\sum R_{a0}} \quad (5)$$

Where:

q_{a1} and $q_{a0}$are respectively domestic quantities air transport for the year of research and previous year, measured in tonne-kilometers for cargo transport and passengers-kilometers for passenger transport.

p_{a1} and $p_{a0}$are respectively domestic air transport price for the year of research and previous year, calculated according to tonne-kilometers for cargo transport and passengers-kilometers for passenger transport.

R_{a1} and R_{a0} are respectively domestic air transport revenue for the year of research and previous year.

- Air transport price index is calculated using the formula of Lac peyres (General Statistics Office, 2016). It is calculated by the weighted average of the modes of transport by road, rail, water and air with weights as quantities of previous year. Therefore, the price index

of alternative transport modes is determined from the transport sector price index in general and the domestic air transport index (Formula 6).

$$I_g = \frac{I_a q_a + I_s q_s}{q_g} \; or \; I_s = \frac{I_g q_g - I_a q_a}{q_s} \qquad (6)$$

Where:

q_g, q_a, q_s are respectively all quantities transported, quantities transported by air, quantities transported by alternative of air transport (rail, road and water), measured in tonne-kilometers for cargo transport and passengers-kilometers for passenger transport.

I_g is the general transport price index (cargo and passenger).

Source data

The data on domestic tonne-kilometers and domestic passenger-kilometers of Vietnam's transport sector, GDP growth rate, passenger and cargo transport price index were collected from statistical reports (General Statistics Office, 2016). Tonne-kilometers and passenger-kilometers as well as domestic revenue of air cargo and passenger transported are collected from reports of Civil Aviation Administration of Vietnam and airlines of Vietnam. Data collected during the 15-year period from 2002 to 2016. These data are the basis for calculating GDP index, the share of domestic air cargo transport and domestic air passengers transport, domestic air cargo price index and domestic passenger price index as well as the price index of alternative transport modes of domestic cargo and passenger by air (Table 1).

RESULTS AND DISCUSSION

Trends in the use of domestic air cargo transport service

The results of the regression analysis show that the statistical values of the parameters of GDPindex (α_{ic}), air cargo price index (α_{ac}) and price index of alternative transport modes (α_{sc}) for $|$t-Statistic$|$ > 2 or Prob. <0.05, so the estimated parameters are accepted.The value of adjusted R^2 = 50.96%> 50% with the values of F-statistic = 5.8501 > 2 (Prob. 0.0122 <0.05). This means that 50.96% of the change in the trend of using domestic air cargo transport services in Vietnam is explained by the GDP index, the domestic air cargo transport price index and the cargo price index of alternative modes of transport. Therefore regression models can be applied in reality (Table 2).

Table 2. Result of estimates for trend of using air cargo transport

	β_c	□□□	□□□	□□□
Coefficient	-1.1425	0.0122	-0.0038	0.0037
t-Statistic	-2.1615	2.5337	-2.8687	2.8501
Prob.	0.0536	0.0278	0.0153	0.0158
R^2		0.614714		
Adjusted R^2		0.509636		
F-statistic		5.850080		
Prob. (F-statistic)		0.012201		

Source: Estimated results from Eview

Wald-Test with the null hypothesis that the values of the parameters β_c or α_{ic} orα_{ac} orα_{sc} = 0 give the result that F-statistic

Table 1. Research data

Unit: %

Year	GDP index	Cargo transport			Passenger transport		
		Proportion by air transport	Air transport price index	Alternative price index	Proportion by air transport	Air transport price index	Alternative price index
2002	107.08	0.1557	97.98	98.22	7.0000	93.64	98.20
2003	107.34	0.1490	95.73	95.96	7.1860	91.48	99.85
2004	107.79	0.1508	103.77	104.01	6.3610	99.16	108.23
2005	108.44	0.1751	106.90	107.16	6.5495	102.16	111.50
2006	108.23	0.1801	105.73	105.98	7.1707	101.04	110.28
2007	108.46	0.1836	101.51	101.75	8.2349	97.01	105.88
2008	106.31	0.1079	116.06	113.93	7.7894	106.30	118.55
2009	105.32	0.1210	98.33	97.01	8.8852	97.41	110.94
2010	106.78	0.1503	101.37	110.37	8.6823	111.28	124.84
2011	106.24	0.1616	110.36	116.23	8.3255	116.80	122.96
2012	105.25	0.1888	102.52	107.82	8.2359	116.44	123.50
2013	105.42	0.1105	110.75	104.91	10.4645	90.37	107.38
2014	105.98	0.1108	111.94	104.06	12.0477	91.63	102.43
2015	106.68	0.1197	98.07	95.98	14.8109	84.48	96.15
2016	106.21	0.1406	94.63	95.96	16.3707	87.43	99.39

Source: Processing from the results of data collection

Method of estimating the parameters of the model

The parameters of the formula in Equation 1and 2 are estimated by the Ordinary Least Square (OLS) method of Eview software. Parameters are accepted when statistic values $|$t-Statistic$|$ ≥ 2 or Prob. ≤ 0.05. The model is accepted when the value of Adjusted R^2 is greater than or equal to 50% and the statistical value of F-statistic is less than or equal to 0.05. The accepted parameters will be tested by Wald-Test with the null hypothesis each parameter is zero to confirm the impact on the trend of using domestic air transportation services in Vietnam.The Wald-Test value will be rejectedwhen Prob. ≤ 0.05.

values of the variables having Pro. ≤ 0.05 and Chi-square ≤ 0.05 (Table 3). Therefore, the null hypotheses are rejected and the GDP index, the domestic air cargo transport price index as well as the price index of alternative transport modes really have an impact on the trend of using domestic air cargo transport services in Vietnam.From the results of the estimation of parameters and test of hypotheses in Table 2 and Table 3 for the trend of using air cargo transport services in the Vietnam's domestic market as following formula 7 bellowed.

$$\mathbf{P_c} = -1.1425 + 0.0122\,\mathbf{I_i} - 0.0038\,\mathbf{I_{ac}} + 0.0037\mathbf{I_{sc}} \qquad (7)$$

Table 3. Result test the hypothesis in the model of cargo transport

	Hypothesisβ_c=0		Hypothesisα_{ic}=0		Hypothesis α_{ac}=0		Hypothesis α_{sc}=0	
	Value	Prob.	Value	Prob.	Value	Prob.	Value	Prob.
F-statistic	4.6719	0.0536	6.4198	0.0278	8.2296	0.0153	8.1228	0.0158
Chi-square	4.6719	0.0307	6.4198	0.0113	8.2296	0.0041	8.1228	0.0044

Source: Wald-Test results

Trends in the use of domestic air passenger transport service

The regression analysis about the proportion of air passenger transport service by GDP index, domesticair passenger transport price index and the passenger transport price index of alternative modes of transport shows that the statistical value ($\boldsymbol{\alpha_i}$) of the GDP index is Prob. = 0.2686> 0.05 so there is no statistical significance (Table 4). Thus, the GDP index is excluded from the model.

Table 4. Result test the hypothesis in the model of passenger transportfor the first time

	β_p	□□□	□□□	□□□
Coefficient	75.8815	-0.5639	-0.4219	0.3152
t-Statistic	1.4621	-1.1653	-3.1549	2.0522
Prob.	0.1717	0.2686	0.0092	0.0647
R^2		0.629161		
Adjusted R^2		0.528023		
F-statistic		6.220820		
Prob (F-statistic)		0.009978		

Source: Estimated results from Eview

After excluding GDP index variable, the result of the regression analysis shows that the statistical value of the parameters of the domestic air passenger transport price index and the passenger transport price index of alternative modes of transport having |t-Statistic| > 2 (Prob. <0.05), so the estimated parameters are accepted. The value of adjusted R^2 = 51.39% >50% with the values of F-statistic = 8.4017> 2 (Prob. = 0.005229 < 0.05). This means that 51.39% of the change in the trend of using domestic air passeng transport services in Vietnam is explained by the domestic air passenger transport price index and the passenger price index of alternative modes of transport. Therefore regression models also can be applied in reality (Table 5).

Table 4. Result test the hypothesis in the model of passenger transport for the second time

	β_p	□□□	□□□
Coefficient	15.9219	-0.4509	0.3448
t-Statistic	2.3188	-3.3819	2.2431
Prob.	0.0389	0.0054	0.0446
R^2		0.583383	
Adjusted R^2		0.513947	
F-statistic		8.401717	
Prob (F-statistic)		0.005229	

Source: Estimated results from Eview

Wald-Test with the null hypothesis that the values of the parameters β_p or α_{ap} orα_{sp} = 0 give the result that F-statistic values of the variables having Pro. ≤ 0.05 and Chi-square ≤ 0.05 (Table 6). Therefore, the null hypotheses are rejected and the domestic air passenger transport price index as well as the price index of alternative transport modes really have an impact on the trend of using domestic air passenger transport services in Vietnam.

Table 6. Result test the hypothesis in the model of passenger transport

	Hypothesisβ_p=0		Hypothesis □□□=0		Hypothesis □□□=0	
	Value	Probability	Value	Probability	Value	Probability
F-statistic	5.3769	0.0389	11.4373	0.0054	5.0313	0.0446
Chi-square	5.3769	0.0204	11.4373	0.0007	5.0313	0.0249

Source: Wald-Test results

From the results of the estimation of parameters and test of hypotheses in Table 5 and Table 6 for the trend of using air passenger transport services in the Vietnam's domestic market as following formula 8bellowed.

$$\mathbf{P_p} = -15.9219 - 0.4509\,\mathbf{I_{ap}} + 0.3448\mathbf{I_{sp}} \quad (8)$$

Conclusions and policy implications

Research results show that the GDP index and cargo transport price index of alternative modes have a positive impact on the trend of using domestic air cargo transport service in Vietnam, but price index of air cargo transport has a negative impact. To be more specific when other factors remain unchanged, if the GDP index increased by 1%, the proportion of domestic air cargo transport increased by 0.0122%; when the cargo index of alternative modes of transport increased by 1%, the proportion of air cargo transport increased by 0.0037%.Meanwhile, if the domestic air cargo transport index increased by 1%, its proportion in modes of transport decreased by 0.0038%.In general, the impact of these indexes is quite small because the domestic air cargo transports account for a very small proportion of the modes of transport and do not show the advantage of speed and time. one of these reasons is that the Vietnam's per capita income is still low and the domestic route network is rather short, except for the routes from North to South and vice versa. On the other hand, goods transported by air are mainly lightweight, high value so that they are affected by the income index more than the price index and demand of these goods are also less elastic by price. As for domestic passenger transport, the impact of the GDP index is not statistically significant. The passenger transport price index of alternative modes of transport also has a positive effect, while the domestic air passenger transport index also has a negative effect. Specifically, when other factors remained unchanged, if the passenger transport index for alternative modes of transport increased by 1%, the proportion of domestic air passenger transport increased by 0.3448% and if the domestic passenger transport price increased by 1%, it's proportion in modes of transport decreased 0.4509%.Different from domestic air transport, the impact of these indexes is significant because the domestic air passenger transport accounts for a large proportion of modes of transport and this proportion is strongly impacted by the air passenger transport price index and the passenger transport price index of alternative modes of transport. These findings are an important basis for transport

policy makers in transport of Vietnam. They can use the State's price management policy to adjust the share of air transportation in modes of transport in Vietnam, especially in the domestic passenger transport market due to the strong influence of the air passenger transport index and the passenger transport price index of alternative modes of transport to this market.

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