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COMPARISON OF IMPACT OF FACTORS ON VALUE ADDED OF VIETNAM AIRLINES AND VIETJET AIR BASING ON THE COBB-DOUGLAS PRODUCTION FUNCTION

Mr. Nguyen Hai Quang
PhD. in economics, Training Department, Vietnam Aviation Academy, Vietnam

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ABSTRACT
This study aimed to identify and compare the impact of factors in Cobb-Douglas production function on the value added of Vietnam Airlines and VietJet Air. Analyses of Vietnam Airlines data for the period of 2007-2016 and VietJet Air for the period of 2012-2016 show that the contribution coefficient of total assets and labor costs to the value added of VietJet Air is higher than Vietnam Airlines and the growth of Vietnam Airlines' value added depends on total assets, labor costs as well as total factor productivity. The research results also give that Vietnam Airlines no longer presents economies of scale advantage. However total factor productivity still plays the key role in Vietnam Airlines' growth. In contrast, VietJet Air is in the early stages of development therefore it presents economies of scale advantage and it is developing strongly. These findings is the basic to suggest policies for Vietnam Airlines and VietJet Air improving their competitiveness and business efficiency.

KEYWORDS: Cobb-Douglas production function, value added, Vietnam Airlines, VietJet Air.

INTRODUCTION
In recent years, the appearance and effective operation of VietJet Air following the low cost airline model has made the competition in the Vietnam's air transport market more and more increasingly, especially in the domestic passenger transport market. This also makes Vietnam's domestic air transport market grow very fast and the competition by the price and difference of the airlines brings many benefits for people. According to the Civil Aviation Administration of Vietnam, with only 8% market share in the first year of operation (2012), after 5 years VietJet Air's market share in the domestic market has increased to 41.5% and Vietnam Airlines' market share was down from 69.3% in 2012 to 42.5% in 2016. This result shows the initial success of VietJet Air and Vietnam Airlines also has to find measures to protect market share. Vietnam Airlines and VietJet Air in the past based on the model elements of the Cobb-Douglas production function. To solve this problem, this study will research the theoretical basis, system of previous studies concerned. Then this study will design a model for research, collect and analyze data of Vietnam Airlines and VietJet Air to estimate and test parameters in the model. The importance of the factors in the Cobb-Douglas production function model of firms will be the basis for considering the possibility of bringing economies of scale and suggesting solutions to each airline.

MATERIALS AND METHODS

Theoretical basis and research model

Theoretical basis
Production function is a function that presents the dependence of output on inputs. Based on Knut Wicksell's research, the Cobb-Douglas production function model was developed by Charles Cobb and Paul Douglas in 1928. In economics, Cobb-Douglas production function is widely and popularly used in the analysis of growth and productivity. In microeconomics, the production function denotes the quantity of product by the producer. In macroeconomics, the production function denotes the gross domestic product (GDP) of a country, sector or region. The Cobb-Douglas production function model is the form of formula (1).

$$Q = A.K^{\alpha}.L^{\beta} \quad (1)$$

Where:

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Q: Output.
A: Total factor productivity such as science and technology, management or geographical advantage...
K: Capital amount.
L: Labor force.
α and β: contribution coefficient or elastic coefficient respectively of capital amount and labor force.
In formula (1), when doubling the capital and labor we will obtain $Q' = A.(2K)^{\alpha}.(2L)^{\beta} = 2^{\alpha+\beta}.(A.K^{\alpha}.L^{\beta})$, or $Q' = 2^{(\alpha+\beta)}.Q$.
So if $\alpha + \beta > 1 \rightarrow Q' > 2Q$ and productivity increases by scale, in contrast if $\alpha + \beta < 1 \rightarrow Q' < 2Q$ and productivity decreases by scale. In case $\alpha + \beta = 1$, the yield will not change by scale.

Research overview

Up to now, there have been many studies applied the Cobb-Douglas production function in different aspects. Dana Hajkova & Jaromir Hurnik (2007), Jean-Claude Nachega & Thomson Fontaine (2006) or Phan Nguyen Khanh Long (2012) studied to analyze the impact of inputs on GDP. As regards an industry or locality in Vietnam, there have been also some authors' studies such as Mai Van Xuan and Nguyen Van Hoa (2011), Dang Hoang Thong and Vo Thanh Danh (2011), Thai Giang and Nguyen Phuc Tho (2012) or Tran Linh (2014). Meanwhile, J Felope & MC Combie (2001) have researched to applicate for businesses and industries as well as regions. One of the methods of determining GDP today is the value added method. Accordingly, GDP of the economy is calculated by the total value added of economic fields or economic sectors or enterprises in the economy. Value added is a statistical indicator of the business performance of an enterprise which measured by the output value subtracting the input value of an enterprise over a given period of time. So many studies have developed the Cobb-Douglas production function to apply for business, industry or regional use, and output is measured by value added as studied by J Felope and MC Combie (2001), Jesus Felipe And F.Gerard Adams (2005) or Latvijas Banka (2009). There are several studies in the air transport industry relating to this issue. First of all, Anton Brits (2010) used the production function to measure the total factor productivity of South African Airways in 6-years period 2000-2005. Input variables are workers, capital, fuel costs, and materials. The total output is tons-km converted. Next, Robert A. Powell II (2012) studied the productivity of US passenger airliners, including seven traditional airlines and five low cost carriers over the period 1995-2010 to compare the two models of the airlines. Input variables are the cost of resources such as labor, capital, fuel, materials. The output is turnover, passenger and cargo performed kilometer (converted into ton-miles).

Research model

Air transport is a service field so value added is the most comprehensive indicator to gauge the airline's output. It is also the contribution of airlines to GDP. Above all, the factors affecting the output value of Vietnam Airlines and Vietjet Air are compared according to the model in formula (2).

$$VA = A.K^{\alpha}.L^{\beta} \quad (2)$$

Where: VA is value added created by airline

Research methods

Method of measuring the value of variables

Measure the value added

In the theory of macroeconomics, Duong Tan Hiep (2001) showed that the value added of an enterprise includes: depreciation, wages, rent, interest, indirect taxes and profits. Based on these theories, Trinh Minh Tam and et al. (2007) have formulated a cumulative value added formula of net profit, interest rate, production tax, labor costs and depreciation. Production tax include corporate income tax and other taxes such as resource tax and business rates. At present, the air transport sector is not subject to resource tax, the remaining business rates is very small, maximum 3 million VND per year, so it is possible to ignore this tax, while the total net profit and profit tax are the profit before tax. Therefore, the VA of the airlines is measured by the following formula (3).

$$VA = \text{Labor cost} + \text{Depreciation} + \text{Interest} + \text{Earning before tax} \quad (3)$$

Measure the amount of capital

In this research the airline's amount of capital is determined by the source of capital (total liabilities and equity) or total assets of the airline in the annual balance sheet. It is made by two sources which are equity (equity of different owners) and liabilities (current liabilities and non-current liabilities). The capital of the airline will fluctuate during operation so the annual capital is measured by the average value in the period (average value of the beginning and end of the year). This method was applied in the reality by Bieniasz and Gołas (2011) or Chu Thi Thu Thuy (2014) in their studies.

Labor measurement

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Although there are also many studies using the labor force for analysis. However, normaly the labors of the enterprises are different in qualifications, skills and work positions so if calculating by the number it will be difficult to ensure consistency. Therefore it needs to be converted in value by labor cost. This factor is also an important factor for attracting specific airline employees in the market mechanism. In fact, there were some studies using labor costs or wages to measure labor variables such as studies of Jesus Felipe and F. Gerard Adams (2005) or Tran Cam Linh's (2014).

Source data

Data is collected from activity report and financial report annual of Vietnam Airlines for period of 10 year from 2007 to 2016; while VietJet Air is period of 5 years from 2012 to 2016 (since the start of opertion). Collected data includes the total value of capital (measured by average value of the beginning and end of the year), labor cost, depreciation of fixed assets, interest and earning before tax. The datas show that Vietnam Airlines has a long history of development and stable growth. Meanwhile, just operating for 5 years but VietJet Air has a very fast growth rate and obtains impressive numbers on value added (Figure 1).

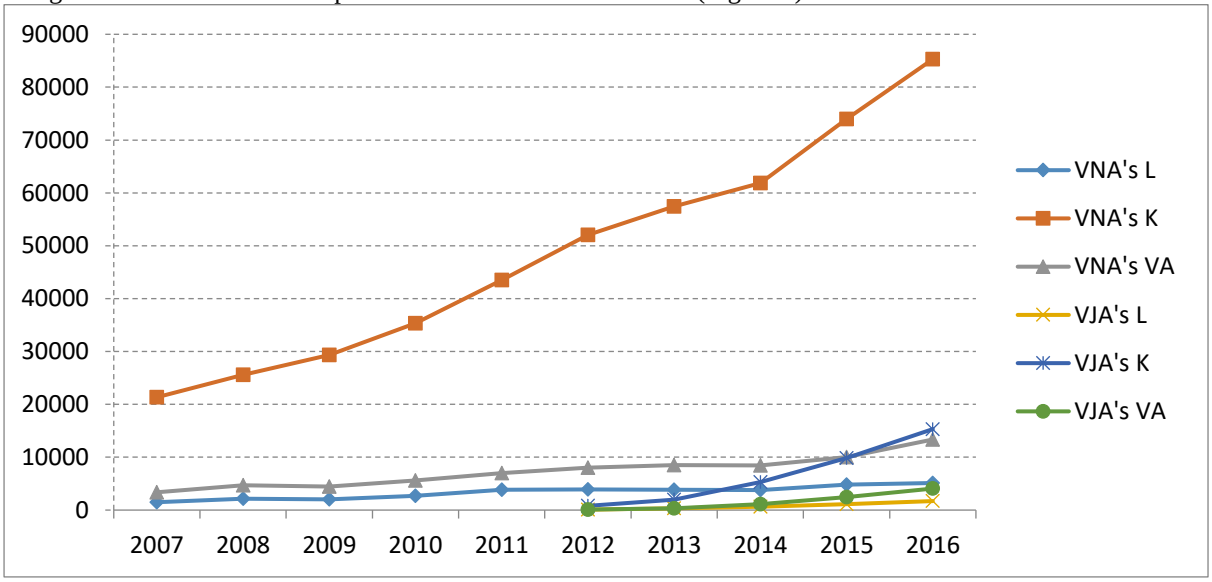

Figure 1. Data charts of Vietnam Airlines and VietJet Air

Source: Analyzed from the financial statements of the airlines

The efficiency of the value added generated on a unit labor cost of two airlines was not much difference during the period surveyed, the average of Vietnam Airlines was 2.18 and VietJet Air was 2.08. However, the efficiency of the value added generated on a unit capital of VietJet Air is 0.24. It is much higher than Vietnam Airlines at 0.15 (Table 1).

Table 1. Descriptive statistics of research data

Unit: Million VND

Airline / Variable	Minimum	Maximum	Mean	Std. Deviation	Variability
Vietnam Airlines					
Capital (K)	21,339,264	85,285,452	48,564,536	21,340,697	0.4394
Labor cost (L)	1,484,769	5,117,876	3,370,180	1,214,113	0.3603
Value added (VA)	3,362,387	13,348,896	7,341,069	3,001,168	0.4088
VA/K ratio	0.16	0.16	0.15	0.14	0.93
VA/L ratio	2.26	2.61	2.18	2.47	1.13
VietJet Air					
Capital (K)	800,050	15,314,556	6,652,417	5,983,554	0.8995
Labor cost (L)	78,928	1,703,036	779,638	650,764	0.8347
Value added (VA)	93,303	4,071,526	1,620,265	1,649,849	1.0183

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VA/K ratio	0.12	0.27	0.24	0.28	1.13
VA/L ratio	1.18	2.39	2.08	2.54	1.22

Source: Analyzed from the financial statements of the airlines

The method of estimating parameters of the model

For convenience in estimating the parameters in the model, the formula (2) is converted to a linear form in logarithm (Equation 3).

$$Log(VA) = C + \alpha.log(K) + \beta.Log(L) \quad (3)$$

Where: C = log(A)

The parameters of the formula in Equation (3) are estimated by the Ordinary Least Square (OLS) method of Eview software. Parameters are accepted when statistic values $|t\text{-Statistic}| \geq 2$ 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 hypothesis each parameter is zero to confirm its effect on value added and the hypothesis $\alpha + \beta = 1$ to cosider the possibility of economies of scale. The result of Wald-Test with hypothesis $\alpha + \beta = 1$ will be rejected when F-statistic ≥ 2 or Prob. ≤ 0.05.

RESULTS AND DISCUSSION

Results of estimated parameters and production function model

The results of the analysis show that the statistic values of the capital and labor cost parameters have $|t\text{-Statistic}| \geq 2$ or Prob. ≤ 0.05 for both Vietnam Airlines and VietJet Air. The value of adjusted R2 in the case of Vietnam Airlines is 98% and in the case of VietJet Air is nearly 100% with the values of F-statistic are very small for both two cases. This means that 98% of the data surveyed is explained in the regression model of Vietnam Airlines and it is almost 100% for VietJet Air's case. Hence the regression models of both airlines can be applied in practice (Table 2).

Table 2. Estimated results of parameters

	Vietnam Airlines			VietJet Air		
	C	α	β	C	α	β
Coefficient	0.2061	0.4918	0,4587	-5.4249	0.7637	0.5607
t-Statistic	0.2899	3.0275	2,5352	-14.835	8.8100	6.9408
Prob.	0.7803	0.0192	0,0389	0.0045	0.0126	0.0201
R^2	0.986114			0.999637		
Adjusted R^2	0.982147			0.999274		
F-statistic	248.5529			2754.110		
Prob. (F-statistic)	0.000000			0.000363		

Source: Estimated results from Eview

From the analysis results (Table 3), Cobb-Douglas production function model by data of Vietnam Airlines and VietJet Air are as follows:

Model of Vietnam Airlines: $Log(VA) = 0.2061 + 0.4918.K + 0.4587.L \rightarrow VA = 1.2289.K^{0.4918}L^{0.4587}$

Model of VietJet Air: $Log(VA) = -5.4249 + 0.7637.K + 0.5607.L \rightarrow VA = 0.0044.K^{0.7637}L^{0.5607}$

Test the hypothesis of the parameters in the model

Wald-Test gives F-statistic having probability ≤ 0.05 for both Vietnam Airlines and VietJet Air when the hypothesis $\alpha = 0$ and $\beta = 0$ for each airline (Table 3). Hence these hypotheses is rejected and capital and labor cost have indeed an impact on the value added of both Vietnam Airlines and VietJet Air.

Table 3. Results test the hypotheses in the models

Test Statistic	Hypothesis α = 0		Hypothesis β = 0		Hypothesis α + β = 1	
	Value	Probability	Value	Probability	Value	Probability
Model of Vietnam Airlines						
F-statistic	9.1658	0.0192	6.4270	0.0389	1.1250	0.3241
Chi-square	9.1658	0.0025	6.4270	0.0112	1.1250	0.2888
Model of VietJet Air						

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F-statistic	77.6169	0.0126	48.1744	0.0201	300.4565	0.0033
Chi-square	77.6169	0.0000	48.1744	0.0000	300.4565	0.0000

Source: Wald test results

Table 4 also shows that the Wald-Test results with the hypothesis $\alpha + \beta = 1$ gives the Probability ≤ 0.05 in the F-statistic analysis in case of VietJet Air's model. The estimated result having $\alpha + \beta = 1.3244$ can confirm that the model of VietJet Air having $\alpha + \beta$ is surely greater than 1. Therefore, the VietJet Air's value added was increased by economies of scale for capital and labor cost. As for the model of Vietnam Airlines, result of Wald-Test with the hypothesis $\alpha + \beta = 1$ gives Probability > 0.05 in the F-statistic analysis. The estimated results having $\alpha + \beta = 0.9505$ can not confirm that the model of Vietnam Airlines having $\alpha + \beta$ is surely less than 1. In other words, the value added of Vietnam Airlines was not increased by economies of scale for capital and labor cost but but it is not completely correct in all years surveyed.

Comparison of factors affecting value added

Vietnam Airlines has a long history of development in recent years, the starting point surveyed is also relatively large and the growth rate is not still very high. In contrast, VietJet Air operated just for 5 years and it witnessed highly growth rate because of low point in beginning. The above models show that the contribution including capital and labor costs to the value added of VietJet Air is higher than the value added of Vietnam Airlines in period surveyed. Meanwhile, apart from these two factors, Vietnam Airlines also relies on total factor productivity (Table 4)

Table 4. Compare the model of Vietnam Airlines and VietJet Air

	Vietnam Airlines	VietJet Air	Difference between VNA and VJA
Average growth of VA in period 2007-2016	16.56%		
Average growth of VA in period 2012-2016	13.50%	157.02%	-1.4352
Elasticity of capital	0.4918	0.7637	-0.2719
Elasticity of labor cost	0.4587	0.5607	-0.1020
Impact of total factor productivity	1.2289	0.0044	1.2245

Source: From research results

CONCLUSION

Capital and labor are important factors affecting the output of airlines. This study shows that the contribution coefficient of capital (represented by total capital) and labor (represented by labor costs) to the value added of VietJet Air in the recent past is higher than of Vietnam Airlines and the value added of Vietnam Airlines depends on total capital, labor costs as well as total factor productivity. Specifically, in the case of VietJet Air, the elasticity coefficient of value added by capital is 0.7637, by labor is 0.50607, by total factor productivity is 0.0044. The corresponding figures for Vietnam Airlines are 0.4918, 0.4587 and 1.2289. This means that when other factors remain unchanged, if VietJet Air increased by 1% in capital, the value added would increase by 0.7637% and if VietJet Air increased the labor cost by 1%, the value added would increase by 0.50607%. Similar figures for the case of Vietnam Airlines are respectively 0.4918% and 0.4587%. The results also point that Vietnam Airlines has no longer showed economies of scale, but total factor productivity plays the key role in growth. In fact, in recent years Vietnam Airlines has almost no increase in the number of employees but it only increases its labor cost and assets. In contrast, VietJet Air is in the early stages of development so it is taking advantage of economies of scale and VietJet Air is developing very strongly. These research findings suggest to airlines the following issues:

Firstly, in order to improve competitiveness and business efficiency, airlines have to focus on both the development of their assets (capital resource) and human resources as welll as the total factor productivity. In particular, it is essential to invest in assets as the aircraft fleet because it is an important factor in growth.

Secondly, due to no longer showing economies of scale, apart from investing in width, Vietnam Airlines should continue to focus on in-depth development of total factor productivity such as developing new generation aircraft technology, improving service quality, managing efficiency...

Thirdly, the business efficiency of VietJet Air has increased sharply by scale so it is necessary to continue to focus on expanding the scale by investing in increasing assets, especially aircraft fleet, human resource development, specially focusing on the development of specific human resources such as pilots, aircraft operators, aircraft maintenance technicians, flight attendants... Besides, VietJet Air have to also focus on

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developing technology and improving management efficiency to promote the role of total factor productivity, especially when the scale is large enough and it maybe difficult to promote the economic scale advantage.

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