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Measuring the operation performance of transport logistics between 2010-2020: the case of Hochiminh City, Vietnam

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Abstract
This study is to measure the productivity of transport logistics included road, rail, marine, inlannd water and air transportation, the case of hochiminh City, Vietnam (HCM). The objective is to evaluate the labor productivity and capital productivity then assess how they impact on Gross Domestic Product (GDP) of HCM transport logistics. By applying Cobb – Douglas production function (Cobb-Douglas) and Multivariate regression (MR). The main findings are an increase 1% both Labor and Capital is accompanied by a more than 1% increase in products and the whole transport logistics system operates with increasing profits. The goods labor productivity and the passenger capital productivity impact on GDP of HCM transport logistics. The passengers labor productivity and the goods capital productivity do not impact on GDP of HCM transport logistics.

Keywords: transport logistics, productivity, Hochiminh, HCM, Vietnam, Cobb-Douglas, Multivariate regression

1. Introduction
The average GDP of HCM transport logistics between 2010 and 2020 is 86,070.21 billion VND. According to the actual price, GDP in 2010 is 37,023 billion VND, 2020 is 132,390 billion VND. The average GDP proportion of HCM transport logistics contributes to the whole HCM GDP between 2010 and 2020 is 15.67%. The highlight point is although Covid 19 virus was occurred at the end of 2019 and spread continuously strongly the whole 2020 that made all economies in the world was heavily badly affected. Nevertheless, the proportion of HCM transport logistics / the whole HCM GDP was still achieved at 10.07% and 9.65% in 2019 and 2020, respectively. Despite quite good GDP, but the productivity from 2010 to 2020 is very low and fluctuates abnormally. The average GDP in HCM transport logistics volume from 2010 to 2020 for cargo is 109,290.32 VND, passenger is 17,425.57 VND, the sum of cargo and passenger is 126,715.89 VND. The average GDP growth in HCM transport logistics productivity between 2010 and 2020 of cargo is 11.13%, passenger is 12.08%, cargo and passenger is 10.50%. These Tables tell that the productivity of passenger is better than the goods transported productivity which is proven that HCM transport logistics industry has not been able to properly promote its function of transporting goods to serve the socialist-oriented market economy.

2. Literature review
A transportation network plays an important lifeline engineering system, and its reliability is critical when faced with natural or artificial disasters. The reliability of the transportation network impact on the decision-making process of the managers of a country or province during disasters. When a disaster strikes, one or more important nodes in the transportation network may completely lose their basic function, that may greatly reduce the reliability of the transportation network. Therefore, identifying critical nodes in the transportation network is of utmost importance in the analysis of the reliability of the transportation network (Longjian Wang, Shaoya Zheng, Yonggang Wang *et al*., 2021) [1]. An integral part of our daily lives that cannot forget that is the role of transportation, giving us access to people, education, jobs, services, and goods. Our choices of transportation and patterns are influenced by four interrelated factors which are the land using - environment, infrastructure, available modes, and emerging technologies. These factors impact on the way of our choice to move ourselves and goods. In turn, these factors have influence on various exposures, lifestyles and health outcomes (Andrew Glazener, Kristen Sanchez, Tara Ramani *et al*., 2021) [2]. As in study of Luqi Wang, Zebin Zhao, Xiaoxia Wang *et al*., (2021) [3] giving that "Transportation de-carbonization is a complex problem involving the economy, population, technology and environment and transportation structure policy has the highest de-carbonization efficiency". In order to enhance the operational efficiency of a transportation system that needs a key instrument

in transforming living environments in a better way has been known as the concept of a smart city (Ahmad Feizi, Shinhye Joo, Valerian Kwigizile *et al*., 2021) [4]. Transportation is an important factor infulenced on the evolution of population distribution (F.X. Zhao, H.Y. Shang, 2021) [3]. A balance between various land use and transportation objectives is enabled by the total travel time is constrained within an acceptable range (Shaopeng Zhong, Yu Jiang, Otto Anker Nielsen, 2021) [6]. The impact of reseacrch and developmennt investment on transportation green total factor productivity makes decreased and then gets increased. The impact factor of interprovincial technology spillover on transportation green total factor productivity is always negative over the research period. The influence of foreign direct investment on transportation green total factor productivity depends on the pollution haven and pollution halo effects. Wehighlighted the needing for regional coordinating development and encouragement of green technology spillover. It should also promote the green total factor productivity growth with regional differentiation (Xiaohui Yang, Zhen Jia, Zhongmin Yang, 2021) [7]. A potential opportunity for freight transportation in urban areas can be provided by public transportation. Through the sharing of infrastructure, vehicles or even space inside wagons that synergies can be realized and can lead to be more efficient which environmentally friendly transportation of goods in the cities (Ralf Elbert, Johannes Rentschler, 2021) [8]. Research on these impacts of transportation policies and projects can help to promote positively and reduce adverse health consequences of decisions made by transportation agencies. The National Cooperative Highway Research Program of the United State of America in 2019 published a research roadmap for transportation and public health. The future leaders of transportation authorities, transportation providers, and advocacy organizations may be more likely to consider transportation policies that incorporate a health perspective if their training includes research findings which increases their awareness of the health impacts of these policies (Andrew L. Dannenberg, Daniel A. Rodriguez, Laura S. Sandt, 2021) [9]. According to Jun Yan, Zhifeng Liub, Caixia Zhang *et al*., (2021) [10] stated that "The limitations of actual transportation conditions in the flexible job shop scheduling problem are neglected. The proposed finite transportation conditions have a significant impact on scheduling under different scales of scheduling problems and transportation times". Today, the costs of between supply and demand of transportation is not able to measure precisely due to the inconstant economic and environment conditions (Laxminarayan Sahoo, 2021) [11]. In order to tackle transportation problems in using deep reinforcement learning is an emerging interdisciplinary field. Although fast development, a comprehensive and overall review of existing deep reinforcement learning applications and adaptations in transportation research is still missing (Nahid Parvez Farazi, Bo Zou, Tanvir Ahamed et al., 2021) [12]. The market for electric vehicles has grown exponentially over the past decade, largely driven by ambitious sales targets in regions around the world. Needing requires an efficient and safe collection and transportation system for the issues of batteries must be managed properly to maximize reuse and recycling. However, the logistics of transporting end-of-life batteries are rarely examined in depth in scholarly research (Margaret Slattery, Jessica Dunn, Alissa Kendall, 2021) [13]. Transportation systems are vital connection for economies. However, the transportation industry is associated at high energy consumption and carbon emissions (Qiang Du, Cheng Lu, Patrick X.W. Zou *et al*., 2021) [14]. The stability and security of system performance are strongly emphasized because of the development of integrated and intelligent transportation systems. An ability of rebound and vulnerability are representative indicators in the performance analysis of transportation systems. A big number of related researches have emerged in recent years (Shouzheng Pan, Hai Yan, Jia He *et al*., 2021) [15]. It is usually to understand that mobility refers to a distinct vector for pathogens, but the importance of prevention and the infusion of public health practices within transportation systems is not manifest. Replication studies of this effect are important as transportation is veiled in modern societies, since its demand is not direct, but derived. The field of transportation has a strong association with not only mortality of a disease, but also its recovery rates as well. The impact, or even the presence of transportation is veiled because of transportation comprises of derived demand dynamics. The reflect transportation and logistics are statistically associated with epidemiological data (Peter J. Stavroulakis, Vasiliki A.Tzora, Elena Riza *et al*., 2021) [16]. Based on study in 2021 of Pengfeng Shu, Ying Sun, Binglei Xie *et al*., said that "Last mile transportation is important in both freight and passenger transport as it accounts for a large portion of the costs and emissions in the transportation industry. In urban transport, the continuously growing travel demands and the rapid development of mass transit systems place a high stress on last mile transportation, which is a vital but underdeveloped part of urban transportation systems. This underdevelopment greatly impedes the further improvement of bus sharing rates and the realisation of sustainable transportation". A damaged or highly congested transportation network faces a big challenge to make a quick and orrect traffic management decisions (Seyedmohsen Hosseini, AbdullahAl Khaled, 2021) [18].

Methodology

3.1 Study model

3.1.1 Cobb – Douglas

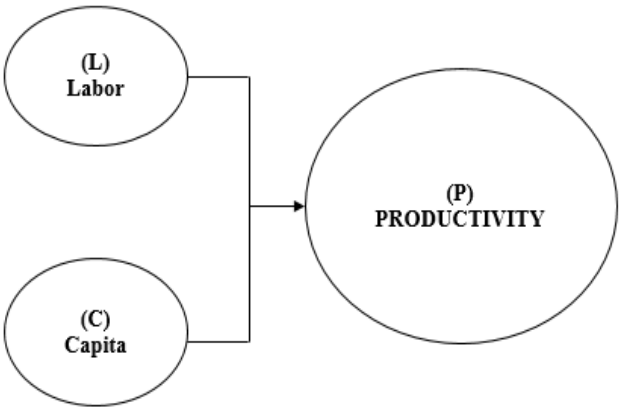

Fig 1

Basic formula: $P = a + L^i C^w$

Caculation formula:

Step 1: $\text{Ln } P = a + \text{Ln}L^i C^w$

Step 2: $\text{Ln } P = a + \text{Ln}L^i C^w$ by multivariate regression.

Where,

a is other impacts beyond L and C which this paper does not analyze.
i + w = 1 means the transport logistics system is subjected to constant income to scale
i + w > 1 means the increase of 1 percent (1%) in both Labor and Capital is accompanied by a more than 1% increase in product and the whole transport logistics system operates with increasing profits.
i + w < 1 means the the transport logistics system is characterized by profict is gradually decreased.

3.1.2. Multivariate regression

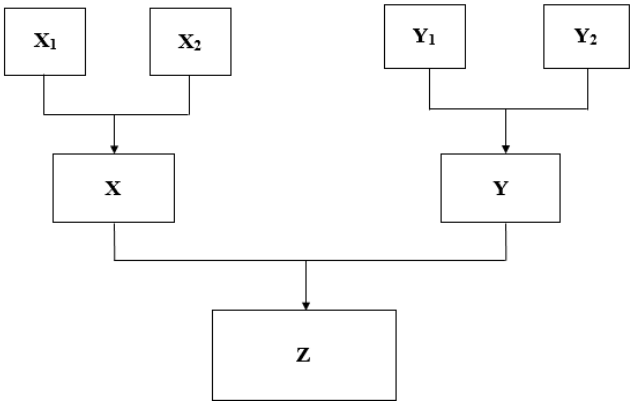

Fig 2

X_1 is goods labor productivity of HCM transport logistics, the calculation is total goods productivity divided by total labor (total goods productivity / total labor).
X_2 is passengers labor productivity of HCM transport logistics, the calculation is total passengers productivity / total labor.
Y_1 is is goods capital productivity of HCM transport logistics, the calculation is total goods productivity / total capital.
Y_2 is is is passenger capital productivity of HCM transport logistics, the calculation is total passenger productivity / total capital.
X is labor productivity of HCM transport logistics which is sum of goods labor productivity and passengers labor productivity.
Y is capital productivity of HCM transport logistics which is sum of goods capital productivity and passengers capital productivity.
Z is GDP of HCM transportat logistics.

Multivariate regression:

$$Z = a + x_1X_1 + x_2X_2 + y_1Y_1 + y_2Y_2 + e$$

Where,
a is the intersection point between the vertical axis and the regression lines.
e is other impacts beyond L and C which this paper does not analyze.
$a + x_1 + x_2 + y_1 + y_2 = 0$ meaning that the MR model is built has no statistical significance.
$a + x_1 + x_2 + y_1 + y_2 \neq 0$ meaning that the MR model is built has statistical significance and be accepted.
$x_1, x_2, y_1, y_2 > 0$, it means the X_1, X_2, Y_1, Y_2 impacts on Z, respectively.
$x_1, x_2, y_1, y_2 =< 0$, it means the X_1, X_2, Y_1, Y_2 do not impacts on Z, respectively.
Hypethesis:
X_1 impacts on Z.
X_2 impacts on Z.
Y_1 impacts on Z.
Y_2 impacts on Z.

4. Data source: All data are from Statistics Department and Statistical Yearbook of HCM.

5. Study result.
5.1 Resulf of analyze Cobb – Douglas

Table 1: Result of measuring the impact of Labor and Capital on Productivity of HCM transport logistics.

Input variables (L, C)	R square (RS)	Adjusted R Square (ARS)	Significance F (SF)	Coefficients	Value of Coefficients (VC)	P-Value (PV)
	0.818458457 (82%)	0.773073071 (77%)	0.00108619 (0.11%)	a	-12.39250688	0.08773829
L				i	1.728484484	0.0771043
C				w	0.256895089	0.50996133

The Table of table 1 gives us information how the Labor and Capital have influence on productivity of HCM transport logistics. The RS is 82% and ARS is 77% is indicated that the RM model is built by logarite of Cobb-Douglas is at high statistical significance.
$a + i + w \neq 0$ is meant the model is accepted at the SF level is 0.11%.
i + w = 1.728484484 + 0.256895089 = 1.985379573 > 1, it means the increase of 1 percent in both Labor and Capital is accompanied by a more than 1 percent (1%) increase in product and the whole transport logistics system operates with increasing profits.
P-Value: i = 0.0771043, w = 0.50996133 which both are at high value is to indicate that they have high statistical significance.

5.2 Resulf of analyze multivariate regression.

Table 2: Result of measuring the impact of Labor Productivity and Capital Productivity on GDP of HCM transport logistics.

Independent variables	R square (RS)	Adjusted R Square (ARS)	Significance F (SF)	Coefficients	Value of Coefficients (VC)	P-Value (PV)
	0.93057971 (93%)	0.88429952 (89%)	0.00126852 (0.13%)	a	-112769.97	0.0113132
X_1				x_1	757434.229	0.0888196
X_2				x_2	-2787485.3	0.25741971
Y_1				y_1	-707097.71	0.13051225
Y_2				y_2	4539961.22	0.13211969

Looking at table 2, with the RS = 0.93057971 (93%), ARS = 0.88429952 (89%) and SF is 0.00126852 (0.13%) is to proven the MR model is built at very high suitable with the input data and $a + x_1 + x_2 + y_1 + y_2 = -112769.97 + 757434.229 + -2787485.3 + -707097.71 + 4539961.22 = 1690042.466 \neq 0$ is to mean that we fail to reject the model and it result at the statistical significant level is 0.13%.

$x_1 = 757434.229$, $y_2 = 4539961.22$ that are > 0, which means X_1 and Y_2 impact on Z.

$x_2 = -2787485.3$, $y_1 = -707097.71$ that are < 0, which means X_2 and Y_1 do not impact on Z.

P-Value: x_1, x_2, y_1, y_2 are 0.0888196, 0.25741971, 0.13051225, 0.13211969, respectively that all of them are at small value is indicated the high statistical significance of the MR model built.

Table 1: Data of table 1

Year	Labor (L) (person)	Capital (C) (VND Billion)	Production (P) (Million tons/km)	Ln(L)	Ln(C)	Ln(P)
2010	125,260	202,771	80,821	11.7381	12.2198	11.3000
2011	148,133	235,368	60,931	11.9059	12.3689	11.0175
2012	146,349	243,865	66,049	11.8937	12.4044	11.0982
2013	149,953	270,498	103,832	11.9181	12.5080	11.5505
2014	160,496	294,854	106,567	11.9860	12.5942	11.5765
2015	175,545	348,343	131,097	12.0757	12.7609	11.7837
2016	186,501	290,517	149,220	12.1362	12.5794	11.9132
2017	185,051	318,584	152,931	12.1284	12.6716	11.9377
2018	194,889	537,997	167,017	12.1802	13.1956	12.0259
2019	202,427	555,045	186,754	12.2181	13.2268	12.1375
2020	207,232	585,663	188,656	12.2416	13.2805	12.1477

Table 2: Data of table 2

Year	X1 (VND Billion)	X2 (VND Billion)	Y1 (VND Billion)	Y2 (VND Billion)	GDP (Z) (VND Billion)
2010	0.57135558	0.07387035	0.577235772	0.074630597	37458.00
2011	0.33066231	0.080663998	0.32352067	0.078921818	47371.00
2012	0.36199769	0.0893139	0.337828962	0.083350869	56042.36
2013	0.616206411	0.076223883	0.510909111	0.063198753	60862.00
2014	0.579503539	0.084481856	0.484391438	0.070616114	68180.00
2015	0.663567746	0.08323222	0.49947688	0.062650075	86807.00
2016	0.706564576	0.093538372	0.689795064	0.091318345	95154.00
2017	0.7067349	0.119691328	0.60487295	0.102440175	107038.00
2018	0.733473926	0.123511332	0.393739654	0.06630271	120708.00
2019	0.783778408	0.106494324	0.667835801	0.089622268	134762.00
2020	0.78222870	0.118627714	0.54085440	0.07962823	132,390

6. Discussion

Based on the results of table 1, because the i + w = 1.985379573 > 1, the increase of 1% in both Labor and Capital is accompanied by a more than 1% increase in product and the whole transport logistics system operates with increasing profits.

As per the result shown in the table 2 that $x_1 = 757434.229$ which is mean (X_1) the goods labor productivity of HCM transport logistics (total goods productivity / total labor) impacts on GDP of HCM transport logistics. $y_2 = 4539961.22$ that means (Y_2) the passenger capital productivity of HCM transport logistics (total passenger productivity / total capital) impacts on GDP of HCM transport logistics.

$x_2 = -2787485.3$ and $y_1 = -707097.71$ is to be proven that (X_2) the passengers labor productivity of HCM transport logistics (total passengers productivity / total labor) and (Y_1) the goods capital productivity of HCM transport logistics (total goods productivity / total capital) do not impact on GDP of HCM transportat logistics.

7. Conclusion

As per the results of table 1, table 2 and discussion, we can have conclusion is that the increase of 1% in both Labor and Capital is accompanied by a more than 1% increase in product and the whole transport logistics system operates with increasing profits. The goods labor productivity and the passenger capital productivity of HCM transport logistics impact on GDP of HCM transport logistics. The passengers labor productivity and the goods capital productivity of HCM transport logistics do not impact on GDP of HCM transport

logistics.

Therefore, in order to increase the productivity of HCM transport logistics, it must be increased the input scale of Labor and Capital of HCM transport logistics. And in order to increase the GDP of HCM transport logistics, it must be increased the goods labor productivity and increased the passenger capital productivity of HCM transport logistics.

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