GEMA PUBLICA
JURNAL MANAJEMEN DAN KEBIJAKAN PUBLIK
ISSN Cetak 2460-9714
ISSN Online 2548-1363

E-COMMERCE AND ECONOMIC GROWTH IN INDONESIA: ANALYSIS OF PANEL DATA REGRESSION

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Abstract

Digital economy has a major contribution to Indonesia's Gross Domestic Product (GDP). Digital economy sector that has the highest growth is e-commerce. The development of e-commerce and rapid improvements in internet infrastructure are expected to encourage public consumption, so as to increase GDP growth. The purpose of the research examines the general overview of economic growth and several e-commerce indicators in Indonesia and analyzes the effect of several e-commerce indicators on economic growth in Indonesia from 2016 to 2018. Economic growth and several e-commerce indicators in Indonesia have a positive trend. DKI Jakarta has some of the highest e-commerce indicators compared to other provinces, while East Nusa Tenggara has the biggest number of additional points internet access locations from 2016 to 2018. The results of panel data regression analysis show that the variable computer users, e-commerce users, internet access, and expenditure on information technology communication have a positive and significant effect on economic growth in Indonesia and the e-commerce indicators that have the greatest influence is computer users. Thus, the results of this study indicate the importance of utilizing the role of e-commerce in promoting economic growth in Indonesia.

Keywords: ***economic growth; e-commerce; panel***

INTRODUCTION

The industrial revolution 4.0 provides changes in various sector, one of them is the digitalization of economy. Digitalization of economy is an economic and business activity in global market competition by utilizing technology such as the internet. Indonesia has a vision to become the country with the largest digital economy in Southeast Asia by 2020. A study by the Institute for Development of Economics and Finance shows that Indonesia's digital economy contributes to Indonesia's Gross Domestic Product (GDP) by 5,5 percent in 2018 (INDEF, 2019). If it compared with other sectoral contributions to Indonesia's GDP in 2018, the digital economy is ranked sixth. Based on a report by Google entitled "e-Conomy SEA 2019", the sector

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ISSN Cetak 2460-9714
ISSN Online 2548-1363

of digital economy in Indonesia consists of online transportation, online media, online travel, and e-commerce. E-commerce has the highest growth compared to others, which is 88 percent from 2015 to 2019 (Google & Temasek, 2019).

One thing that supports the development of e-commerce is the increase in the number of internet users (Wibowo, 2020). Based on the data from International Telecommunication Union (ITU), the percentage of internet users in Indonesia continues to increase. The percentage of internet users in Indonesia reached 25,44 percent of the total population in 2016, then continued to increase until it reached 39,91 percent of the total population in 2018. A survey released by We Are Social & Hootsuite (2019) shows that 93 percent of internet users in Indonesia have searched for goods or services by online and 86 percent of internet users in Indonesia have purchased goods or services by online in 2018.

The rapid development of e-commerce is expected to encourage Indonesia's economic growth. This is supported by the Government Work Plan 2019 by Indonesian Ministry of National Development Planning in 2018. In this publication, one of the efforts to encourage Indonesia's economic growth is by encourage public consumption through e-commerce consumption and encourage the improvements of internet infrastructure (Bappenas, 2018). Liu claimed that the analysis of the development of e-commerce in improving the economy in China is based on the expenditure method of GDP accounting. The development of e-commerce have stimulated consumption via the number of e-commerce users and the development of national digital infrastructure reflects the increase of government spending (Liu, 2013).

Data from the eMarketer research institute shows that the value of e-commerce transactions in Indonesia continues to increase from year to year. The value of e-commerce transactions in Indonesia reached 69,8 trillion rupiah in 2016, then it reached 108,4 trillion rupiah in 2017, and it reached 144,1 trillion rupiah in 2018. The value of e-commerce transactions continues

ISSN Cetak 2460-9714
ISSN Online 2548-1363

to increase, so that e-commerce is expected to significantly encourage Indonesia's economic growth.

In supporting the development of e-commerce, the government has released Economic Policy Package XIV based on Presidential Regulation about the road map of e-commerce to reach the target of making Indonesia the country with the largest digital economy in Southeast Asia by 2020. The e-commerce road map is expected to make it easier for people to take advantage of e-commerce by providing strategic directions and guidance to accelerate the implementation of the National E-Commerce System for 2016-2019. This policy will be used as a reference in developing the implementation of e-commerce. Therefore, this research examines the general overview of economic growth and several e-commerce indicators in Indonesia and analyzes the effect of several e-commerce indicators on economic growth in Indonesia from 2016 to 2018.

METHODOLOGY

Method of Collecting Data

The study uses secondary data in the form of panel data, including cross-section data consisting of 34 provinces in Indonesia and time series data consisting of 3 years (2016 to 2018). The panel data structure used is a balanced panel because each individual unit in this study have the same number of time units. The data used are sourced from the Central Bureau of Statistics (BPS), the Ministry of Communication and Information Technology (Kemkominfo), and the Directorate General of Fiscal Balance, Ministry of Finance (DJPK Kemenkeu). The variables used are Gross Regional Domestic Product at constant prices (GRDP) and e-commerce indicators consisting of computer users (Comp), ICT spending (ExpICT), internet access (InternetAccess), and e-commerce users (Ecommerce).

Analysis Method

The analysis in this study consists of descriptive analysis and inferential analysis. Descriptive analysis provides an overview in the form of graphs and tematic maps of several e-commerce indicators in Indonesia. Inferential

ISSN Cetak 2460-9714
ISSN Online 2548-1363

analysis uses panel data regression to analyze the effect of several e-commerce indicators on economic growth in Indonesia from 2016 to 2018, and standardization of variable coefficients to find out which independent variables that have the most significant influence on the dependent variable.

Common Effects Model (CEM)

Common Effects Model (CEM) assumes that each individual unit has a constant intercept value and has the same slope value because they do not vary over time. Greene stated that CEM with the Ordinary Least Squares (OLS) method is an efficient and consistent estimator for α and β (Greene, 2002). The model form of the Common Effects Model can be written as follows (Gujarati & Porter, 2013):

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + v_{it} \quad (1)$$

Fixed Effects Model (FEM)

Fixed Effects Model (FEM) assumes that each individual unit has its own intercept value and does not vary over time. The slope value in FEM is assumed to be the same and does not vary over time. Gujarati and Porter stated that the intercept value in FEM has different value for each individual unit because it uses dummy variable techniques to help capture these differences (Gujarati & Porter, 2013). Greene stated that in FEM, the individual effects that are not observed in the model can be correlated with independent variables (Greene, 2002). The model form of FEM can be written as follows (Gujarati & Porter, 2013):

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + v_{it} \quad (2)$$

Random Effects Model (REM)

Random Effects Model (REM) assumes that the individual effects in the model are random (Greene, 2002). Gujarati and Porter stated that the error composite term u_{it} consists of two components: μ_i, which is the cross-section error component and v_{it}, which is the combined error component of the cross-section and time series (Gujarati & Porter, 2013). Baltagi stated that in REM, the individual effects that are not observed in the model do not correlated with

ISSN Cetak 2460-9714
ISSN Online 2548-1363

the independent variables (Baltagi, 2021).The model form of REM can be written as follows (Gujarati & Porter, 2013):

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + (\mu_i + v_{it})$$
$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + u_{it} \quad (3)$$

Note:
i : the individual unit i-th ($i = 1,2, \dots, N$)
t : time t ($t = 1,2, \dots, T$)
α_i : intercept with different values for each individual unit
α: average intercept value for all individuals
β_k : regression coefficient of k-th independent variable
X_{kit}: k-th independent variable for individual unit i-th and time t
Y_{it}: dependent variable for the i-th individual unit and time t
μ_i: component of random cross-section error
v_{it}: the combined error component of the cross-section and time series

There are three tests in determining the best model among those three models described, there are Chow test to test the better model between CEM and FEM, Breusch Pagan Lagrange Multiplier (BP-LM) test to test the better model between CEM and REM, and Hausman test to test the better model between FEM and REM.

1. Chow test

   Baltagi stated that the Chow test is to determine whether there are individual effects. If all of the individual effects are zero, then the intercept for each individual unit are the same. The Chow test is tested on FEM with the F statistical test. The hypothesis of the Chow test is as follows (Baltagi, 2021):

   H_0: $\mu_1 = \mu_2 = \cdots = \mu_{N-1} = 0$

   H_1: at least one $\mu_i \neq 0; i = 1,2, \dots, N-1$

   F statistic that is used is (Greene, 2002):

$$F_{statistic} = \frac{(R^2_{LSDV} - R^2_{pooled})/(N-1)}{(1 - R^2_{LSDV})/(NT - N - K)} \sim F_{((N-1);(NT-N-K))} \quad (4)$$

   N: number of individual units
   T: many periods of time
   K: number of independent variables
   R^2_{pooled}: coefficient of determination on CEM
   R^2_{LSDV}: coefficient of determination on FEM

ISSN Cetak 2460-9714
ISSN Online 2548-1363

If the value of $F_{statistic} > F_{(\alpha;(N-1),(NT-N-K))}$, then the null hypothesis is rejected, so that at the significance level α, there is sufficient evidence to conclude that the FEM is better than the CEM.

2. Hausman test

Baltagi stated that the Hausman test is to determine whether there is a correlation between unobserved individual effects and the independent variable. The hypothesis of the Hausman test is as follows (Baltagi, 2021):

$H_0: E(u_{it}|X_{it}) = 0$

$H_1: E(u_{it}|X_{it}) \neq 0$

The test statistic used is (Greene, 2002):

$$H = (\widehat{\boldsymbol{\beta}}_{\boldsymbol{FEM}} - \widehat{\boldsymbol{\beta}}_{\boldsymbol{REM}})' \sum^{-1} (\widehat{\boldsymbol{\beta}}_{\boldsymbol{FEM}} - \widehat{\boldsymbol{\beta}}_{\boldsymbol{REM}}) \sim \chi^2_{(K)} \quad (5)$$

$\widehat{\boldsymbol{\beta}}_{\boldsymbol{FEM}}$: vector estimation of FEM parameter

$\widehat{\boldsymbol{\beta}}_{\boldsymbol{REM}}$: vector estimation of REM parameter

$\sum^{-1}$: the inverse variance-covariance matrix $\widehat{\boldsymbol{\beta}}_{\boldsymbol{FEM}} - \widehat{\boldsymbol{\beta}}_{\boldsymbol{REM}}$

If the value of $H > \chi^2_{(\alpha;K)}$ then the null hypothesis is rejected, so that at the α significance level, there is sufficient evidence to conclude that FEM is better than REM, and the model chosen is FEM.

3. BP-LM test

BP-LM test is based on the residual value of CEM. The hypothesis of BP-LM test is as follows (Greene, 2002):

$H_0: \sigma_\mu^2 = 0$

$H_1: \sigma_\mu^2 \neq 0$

The test statistic used is (Greene, 2002):

$$LM = \frac{NT}{2(T-1)} \left[\frac{\sum_{i=1}^{N} [\sum_{t=1}^{T} v_{it}]^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} v_{it}^2} - 1 \right]^2 \sim \chi^2_{(1)} \quad (6)$$

If the value of $LM > \chi^2_{(\alpha;1)}$ then the null hypothesis is rejected, so at the significance level α, there is sufficient evidence to conclude REM is

ISSN Cetak 2460-9714
ISSN Online 2548-1363

better than CEM and the model chosen is REM.

The selected panel data regression model needs to be tested for the classical assumptions, so that the estimation model can fulfill the criteria for Best Linear Unbiased Estimator (BLUE) (Gujarati & Porter, 2013). The classical assumptions on the panel data regression model are normality, non-multicollinearity, homoscedasticity, and non-autocorrelation. The model used in this study is as follows:

$$lnGRDP_{it} = \alpha + \beta_1 Comp_{it} + \beta_2 lnExpICT_{it} + \beta_3 InternetAccess_{it} + \beta_4 Ecommerce_{it} + u_{it} \quad (7)$$

i : province, i = Aceh, Sumatera Utara, ..., Papua
t : year, t = 2016, 2017, 2018
$Comp_{it}$: percentage of computer users
$lnExpICT_{it}$: logarithm natural of ICT spending
$InternetAccess_{it}$: number of additional points internet access locations
$Ecommerce_{it}$: percentage of e-commerce users
u_{it} : the combined error component of the cross-section and time series

RESULTS AND DISCUSSIONS

General Overview of Economic Growth and Several E-Commerce Indicators in Indonesia

General Overview of Indonesia's Economic Growth

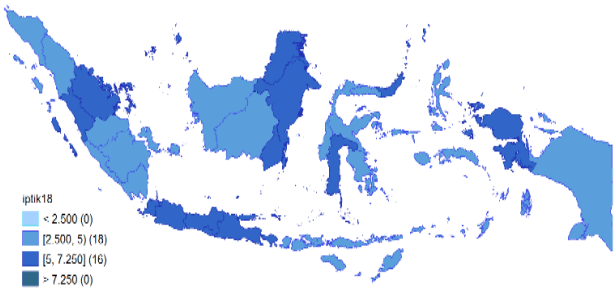
Economic growth in Indonesia from 2016 to 2018 has increased, but the growth rate remains at five percent. One of the causes of slow economic growth is the lack of technology utilization (Çalışkan, 2015), whereas technology has an essential role in economic growth (Todaro & Smith, 2012). DKI Jakarta has the highest Gross Regional Domestic Product (GRDP) value compared to 33 other provinces in Indonesia, with an average annual GRDP value of 1,637,160 billion rupiah during the 2016 to 2018 period.

General Overview of Information and Communication Technology Development Index in Indonesia

The Information and Communication Technology Development Index (ICT index) is a measure of ICT development in a region. ICT development index by province in Indonesia in 2018 is divided into two categories, low and medium. The province with the highest ICT index is DKI Jakarta and the

ISSN Cetak 2460-9714
ISSN Online 2548-1363

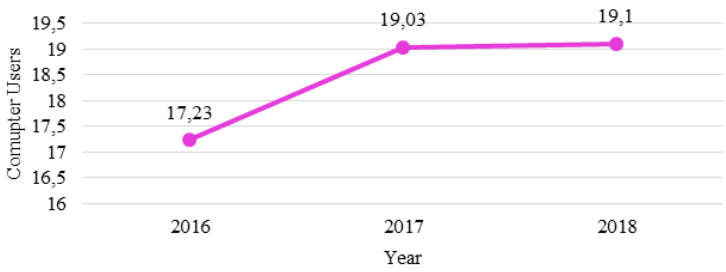
lowest is Papua.



Source: Central Bureau of Statistics
Figure 1. ICT Development Index in Indonesia in 2018

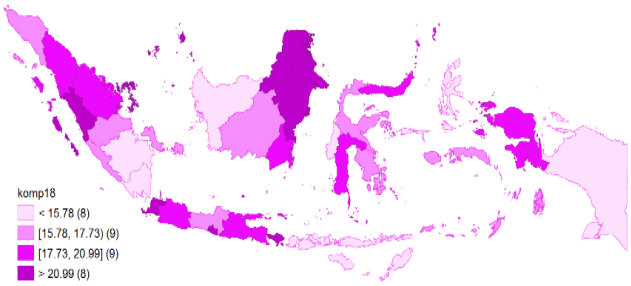
Computer Users in Indonesia

Computers are one of the e-commerce indicators that can describe the progress of e-commerce infrastructure. The high number of computer users can indicate the number of people who are interested in buying and selling goods or services online (Setiawan, 2002). The percentage of computer users in Indonesia from 2016 to 2018 had constantly been increasing. The increasing number of computer users could be caused due to National Industry Policy 2015-2019 by the Ministry of Industry which stated that the computer industry is a priority to be developed in 2015-2035, so that computer users will continue to increase (Kemenperin, 2016). DKI Jakarta is the province with the most significant percentage of computer users compared to 33 other provinces, while Papua province is the lowest province in computer use as shown in Figure 3.



Source: Central Bureau of Statistics
Figure 2. Computer users in Indonesia 2016-2018 (percent)

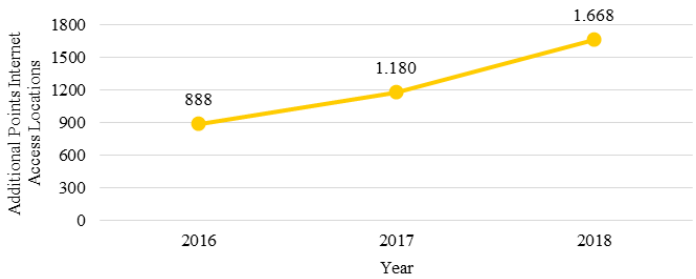
ISSN Cetak 2460-9714
ISSN Online 2548-1363



Source: Central Bureau of Statistics
Figure 3. Computer users by province in Indonesia in 2018 (percent)

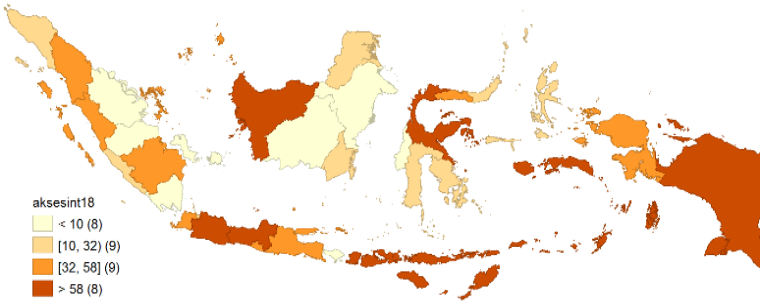
Internet Access in Indonesia

Internet access is the number of additional points internet access provided by the Ministry of Communication and Information Technology in public places, such as schools, health centers, and government offices, in border areas and areas that are advanced, outermost, and left behind. Based on Figure 4, the number of additional points internet access locations in Indonesia from 2016 to 2018 continues to increase. This internet access is one of the Universal Obligations in developing the border areas and areas that are advanced, outermost, and left behind. According to the third Nawacita, which is developing Indonesia from the outskirt, one of the efforts is that to make the number of additional points internet access locations in Indonesia more distributed throughout Indonesia. Overall, the province with the highest number of additional points internet access compared to 33 other provinces from 2016 to 2018 is East Nusa Tenggara. Based on the Figure 5, East Nusa Tenggara has an additional 232 internet access location points in 2018.



Source: Ministry of Communication and Information Technology
Figure 4. Additional points internet access locations in Indonesia 2016-2018 (units)

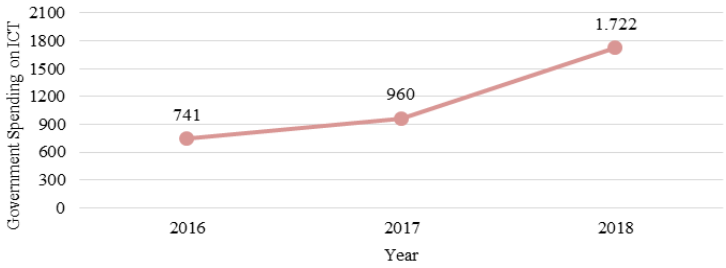
ISSN Cetak 2460-9714
ISSN Online 2548-1363



Source: Ministry of Communication and Information Technology
Figure 5. Additional points internet access locations by province in Indonesia in 2018 (units)

Government spending on ICT in Indonesia

ICT spending which is being pursued continuously can prepare a region to face the 4.0 industrial revolution and utilize the role of e-commerce. Based on Figure 6, government spending on ICT in Indonesia from 2016 to 2018 continues to increase. In a document entitled "Making Indonesia 4.0" by the Ministry of Industry, it is explained that in facing the industrial revolution 4.0, government spending on ICT in Indonesia is still lower than other countries in 2016 (Kemenperin, 2018). This is one of the reasons that government spending on ICT must keep increasing, so that Indonesia can achieve the vision of being the most significant digital economy in Southeast Asia by 2020.



Source: Ministry of Finance
Figure 6. Government spending on ICT in Indonesia 2016-2018 (billion rupiah)

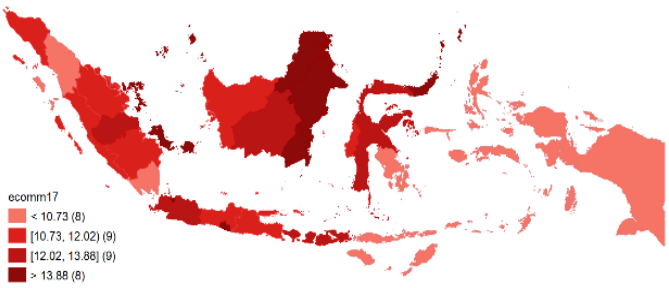
E-commerce Users in Indonesia

E-commerce users represent the number of sellers and buyers of goods and services via the internet. E-commerce users show how many people in an area have used the internet to buy and sell goods and services. Overall, the province with the highest percentage of e-commerce users compared to 33

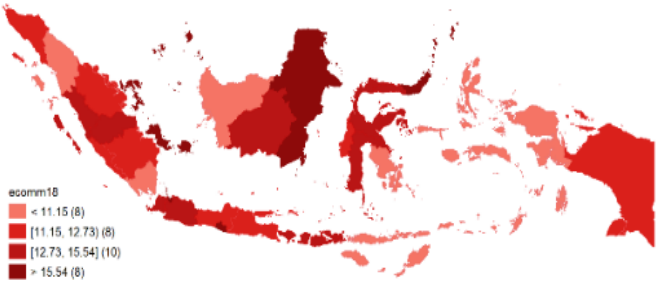
ISSN Cetak 2460-9714
ISSN Online 2548-1363

other provinces from 2016 to 2018 was DKI Jakarta with the percentage of e-commerce buyers in 2017 was 14,72 percent and the percentage of e-commerce sellers in 2017 was 6,55 percent. Meanwhile, the province with the lowest percentage of e-commerce users from 2016 to 2018 was West Papua with the percentage of e-commerce buyers in 2017 was 3,75 percent and the percentage of e-commerce sellers in 2017 was 2,88 percent.

Source: Central Bureau of Statistics
Figure 7. E-commerce users by province in Indonesia in 2016 (percent)



Source: Central Bureau of Statistics
Figure 8. E-commerce users by province in Indonesia in 2017 (percent)



Source: Central Bureau of Statistics
Figure 9. E-commerce users by province in Indonesia in 2018 (percent)

The Effect Of Several E-Commerce Indicators on Economic Growth in Indonesia

This study analyzes the effect of e-commerce on economic growth in Indonesia from 2016 to 2018 using panel data regression analysis. The result of the Chow test (Appendix A) shows that the p-value = 0,0000 < α = 0,05,

ISSN Cetak 2460-9714
ISSN Online 2548-1363

which means reject null hypothesis. Thus, it can be concluded that with a significance level of 5%, there is sufficient evidence to conclude that there are individual effects in the model and it can be said that fixed effects model is better than common effects model.

The result of the Hausman test (Appendix B) shows the p-value = 0,9641 > α = 0,05 which means it fails to reject null hypothesis. It can be concluded that at the 95 percent of confidence level, there is not enough evidence to conclude that there is a correlation between unobserved individual effects and independent variables, or it can be said that there is no correlation between the unobserved individual effects and the independent variables. This means that the model chosen in this study is random effects model with Generalized Least Squares (GLS) estimation method.

Table 1. The effect of e-commerce on GRDP at constant price.

Variable	Coefficient	St. Error	t-value	Pr(>|t|)
(1)	(2)	(3)	(4)	(5)
C	11,35179*	0,19111	59,4005	0,00000
Comp	0,021257*	0,00365	5,8246	0,00000
lnExpICT	0,01983*	0,00894	2,2191	0,02881
InternetAccess	0,000381*	0,00017	2,2566	0,02628
Ecommerce	0,005776*	0,00317	1,8244	0,07117
R-Squared	0,43269			
Adj. R-Squared	0,4093			
F-statistic	18,496			
Prob(F-statistic)	0,00000			

From Table 1, the equation can be obtained as follows:

$$\widehat{lnGRDP}_{it} = 11{,}35179^{*} + 0{,}02126 Comp^{*}_{it} + 0{,}01983 lnExpICT^{*}_{it} + 0{,}00038 InternetAccess^{*}_{it} + 0{,}00578 Ecommerce^{*}_{it}$$

*) significance level of 5%

Based on Table 1, the value of adjusted R-Squared is 0,4093. This means that 40,93 percent of the variation in dependent variable is determined by those independent variables used in the equation, and the rest 59,07 percent is determined by the other factors. The next step of testing the meaning of the model is simultaneous test. It also can be seen in Table 1 that the value of F-statistic = 18,496 > $F_{(0,05;4;97)}$= 0,176, which means that with a significance level of 5%, there is sufficient evidence to conclude that at least one independent variable used in the equation has a significant effect on the

ISSN Cetak 2460-9714
ISSN Online 2548-1363

dependent variable used in the equation. The last step of testing the meaning of the model is partial test. Independent variables that have $t_{value} > t_{(0,05;97)} = 1,6607$ results a decision to reject null hypothesis, which means those independent variable has a significant effect on the dependent variable at the significance level of 5%. It can be seen in Table 1 that variables Comp, ExpICT, InternetAccess, and Ecommerce have a significant and positive effect on GRDP at the significance level of 5%.

The Comp variable has a positive and significant effect on GRDP at constant price, with a coefficient value is 0,021257. This means that for every one percent increase in computer users, then the GRDP at constant price on average increases by 2,13 percent, assuming the other variables are constant. This is in line with the research by Economides which stated that a computer network has a positive effect on the value of production and consumption of economic activity, therefore it can increase the value of GDP (Economides, 1996). In addition, the use of ICT can promoting the economic growth. One of the things that shows the use of ICT is the number of people who use computer (Burhan, 2018).

The ExpICT variable has a positive and significant effect on GRDP at constant price with a coefficient value is 0,01983. This means that for every one percent increase in ICT spending, the GRDP at constant price on average increases by 0,02 percent, assuming the other variables are constant. This is in line with the research by Agustina and Pramana which proves that ICT spending has a positive and significant effect on GDP (Agustina & Pramana, 2019). Research by Vu and Elseoud also proves that ICT spending has a positive and significant effect on economic growth (Elseoud, 2014; Vu, 2005).

The InternetAccess variable has a positive and significant effect on GRDP at constant price with a coefficient value is 0,000381. This means that for every one unit increase in additional points internet access, the GRDP at constant price on average increases by 0,04 percent, assuming the other variables are constant. This is in line with the research by Liu which stated that the development of internet infrastructure by government has a positive and significant effect on GDP (Liu, 2013). This is supported with the report

ISSN Cetak 2460-9714
ISSN Online 2548-1363

by Pepper and Garrity in the World Economic Forum which stated that the increasing of internet access can significantly increase the economic growth in developing countries (Pepper & Garrity, 2016).

The Ecommerce variable has a positive and significant effect on GRDP at constant price with a coefficient value is 0,005776. This means that for every one percent increase in e-commerce users, then the GRDP at constant price on average increases by 0,58 percent, assuming the other variables are constant. This is in line with the research by Liu and also Qu and Chen which prove that e-commerce users have a significant effect in increasing the GDP in China (Liu, 2013; Qu & Chen, 2014).

The value of the intercept in the model shows the average value of the intercept in 34 provinces in Indonesia. In this study, the intercept value in the model is 11.35179. This means that the average change in GRDP in 34 provinces in Indonesia in 2016-2018 is 11.35 percent. Then, the GRDP change on average in each province in Indonesia in 2016-2018 is 11.35179 + μ_i percent with μ_i is a random error component of each province in Indonesia attached to Appendix F. The value of μ_i Shows the deviation of the intercept value of each province to the intercept value in the model.

CONCLUSIONS

Based on the analysis that has been done, it can be concluded that economic growth and several indicators of e-commerce in Indonesia have a positive trend, where DKI Jakarta has the highest of some e-commerce indicators compared to other provinces, while NTT has the most number of additional internet access points. Computer users, ICT spending, internet access, and e-commerce users have a positive and significant effect on Indonesia's economic growth, where computer users have the most significant influence on Indonesia's economic growth from 2016 to 2018.

Some suggestions that can be conveyed are that the government is expected to support the development of e-commerce in Indonesia with various policies that can encourage e-commerce indicators, such as increasing com-

ISSN Cetak 2460-9714
ISSN Online 2548-1363

puter users, increasing ICT infrastructure, expanding internet access, and increasing public interest in buying or selling goods or services by online, so that e-commerce can be maximally utilized in increasing economic growth. In addition, the community is expected to increase human resources and knowledge and use of technology so that ICT readiness in Indonesia can continue to increase.

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