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The Impact of ICT on Economic Growth in the Fourth Industrial Revolution: Modeling Using Principal Component Panel Regression

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Abstract: In the fourth industrial revolution, information and communication technology (ICT) has posed a paradox. On the one hand, ICT plays an important role in human life, not only as information and communication devices but also as the booster of economic activities to enhance revenue. On the other hand, ICT has also created disruption in various aspects of life which resulting in disadvantages to some groups in the society. This study aims to examine whether technology still has a positive effect on the economy. To achieve this objective, it took a case study from East Java Province, Indonesia. The data is panel consisting of gross regional product and the number of ICT users in East Java. More specifically, the number of ICT users consists of several variables, i.e. the number of the mobile phone users, the number of computer users, the number of internet users, the number of internet users for transactions of goods and services, and the number of the internet users for financial facilities. The analysis employed least square panel regression with gross regional product as the response variable and the number of ICT users as a predictor variable. However, there was a high correlation between the predictor variables that caused the model regression not proper. This problem was solved by combining least square panel regression with Principal Component Analysis (PCA). Using PCA method, the dimension of the variable was reduced to be one principal component. This principal component is a linear combination of the predictor variables. Then, this principal component was regressed with the gross regional product. The best panel regression model is the Fixed Effect Model. This model shows that all predictor variables have positive coefficients. It means that ICT still has a positive impact on economic growth.

Keywords: Information and communication technology, economic growth, panel regression, principal component.

1. Introduction

Solow's economic growth model explains that economic growth is interaction between capital stock, labor force, and technology advances. Solow's model also explains the influence of the factors to the output of goods and services of a country. The existence of technology has indeed brought about major changes in various aspects of life in the world. Five clusters will emerge in the Fourth Industrial Revolution including those from economic, business, national and global relations, society, and individuals. Economically, if the existence of technology can be utilized optimally, it can increase a country's economic growth, both in an effort to reduce unemployment and increase employment opportunities [1].

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Information and Communication Technology (ICT) can have a significant effect on the economy. According to the literature study, the effect is related to two important aspects. First, the ICT sector has become an important industry at the global level coinciding with the growth of the service industry. Second, the ICT revolution has contributed significantly to the overall economy by increasing productivity [2]. According to the Oxford Economic report, the ICT sector contributed significantly to economic growth and the number of jobs in Indonesia [3]. In addition, according to the Ministry of Communication and Information of the Republic of Indonesia, the development of ICTs has transformed the society with the growing information and the number of developed devices. In this case, the access or use of ICTs has become an indicator of a nation's development. Globally, the International Telecommunication Union (ITU) as a world telecommunications organization proposes ICT measurement standards aimed to indicate this condition. The indicators used in Indonesia are adapted to the national ICT condition. E-commerce activities refer to the use of electronic facilities and technology to conduct trade (sales, purchases, transfers, or exchanges of products, services, and information) where shipping of products or services can occur through or outside the internet [4]. To find out how the progress of the Indonesian people in accessing ICTs, the Ministry of Communication and Information of the Republic of Indonesia conducted a survey every year. In line with this, the Central Statistics Agency also conducted the same survey. The difference is that BPS conducted the survey in SUSENAS (National Socio-Economic Survey) currently known as People's Welfare Statistics. In 2015, it only included the ICT sector in the survey questionnaire.

One indicator used to see the progress of the community in accessing ICTs is internet use. The role of the internet in the economy is important. As stated by previous research the spread and utilization of the internet are guaranteed to provide direct benefits for both housing penetration and company penetration. Home penetration provides the advantage of increasing household income, while the company penetration increases the productivity factors. Indirectly, it can be said that the development of the internet has an impact on increasing income in the community and in the business sector so that overall, it can contribute to the growth of Gross Domestic Product (GDP).

Research on the influence of the use of ICT on economic growth has been carried out by Lubis and Maria [5]. This study used GRDP as the dependent variable and the independent variable was technology measured through effective capital per labor. To find out whether technology affected GDP in an area, Ordinary Least Square (OLS) regression analysis was used for models with time-series data. The results of the study indicate that technology has a positive and significant influence on GRDP. In addition, Agustina and Pramana [6] also analysed the impact of ICT index and ICT investment on Indonesian economic growth. The results of the study indicate that the ICT index and ICT investment have a positive effect on the economic growth in all provinces, although the impact is different among the provinces. Other studies about the influence of information technology and communication on economic growth include Erumbana and Das [7], Farhadi, Ismail, and Fooladi [8], Haftu [9], Iscan [10] and Yousefi [11]. The most method used in these previously research is regression model.

Multiple regression analysis is the most popular method used to respond to the response of the dependent variable of several independent variables. One of the assumptions of multiple linear regression is the multicollinearity test. Multicollinearity shows the existence of a conflict or a strong relationship between two or more independent variables in a multiple regression model. The regression model used in this study is a regression data panel. Multicollinearity can produce regression coefficients generated by multiple regression analysis to be very weak or unable to provide results that represent the nature or influence of the resulting independent variables [12]. One method used to overcome the problem of multicollinearity is Main Component Analysis (PCA). The main component analysis is a good method to obtain the estimation coefficient in the regression equation that occurs in the case of multicollinearity. This method is a statistical technique that can be used to explain the structure of variances of a set of variables through several new variables which are interconnected, and linear combinations of the original variables. Then, this new variable is called the main component [13].

This study discusses the economic growth in East Java Province. The aim of this study is limited to find out what ICT Indicators influence economic growth in the East Java Province. The data used is from 2015 to 2017 with the variables of economic growth and several indicators of Information and Communication Technology (ICT). This paper presents the results of a hybrid model using the panel data regression estimation method with PCA, namely a combination of PCA and Common Effect Model (CEM), PCA and Individual Fixed Effect Model (FEM), PCA and Fixed Effect Model (FEM), and PCA and Random Effect Model (REM). From the four methods, the best model was chosen.

2. Literature Review

Research on the influence of information and communication technology on economic growth is a fairly developed topic in today's econometrics modeling. In relation to economic growth, information and communication technology (ICT) has helped increase economic growth. Based on a growth model using panel data from a total of 62 countries for the period 2000-2006 revealed that the effects of ICT economic growth differ in different groups of countries [11]. Meanwhile, the case in Turkey shows that there is a strength of the relationship between the GDP sector and the ICT proxy [10]. Then other research also shows that there is a positive associative between the growth rate of real GDP per capita and the ICT index [8] Whereas in India, the increasing role of ICT investment in motivating aggregate economic growth in India, although largely limited to the service sector. In addition, the economy has not succeeded in extending the effects of ICT across the board, thereby limiting productivity gains from the use of ICT [7]. This result is contrary to research in Sub-Saharan, the Internet has not contributed to GDP per capita during the study period. The insignificant impact of the internet can be caused by low technology penetration, low ICT skills of Internet users, lack or lack of local content on global networks, and the relatively immature technological situation in the region [9].

Next, brief review on modelling methodology is presented in the following section.

2.1 Multicollinearity

One of the classical assumptions of the regression model is that there is no multicollinearity among the predictor variables in the model. Multicollinearity is the presence of a linear correlation between predictor variables in a regression model. The multicollinearity assumption must be fulfilled in analyzing the regression method so that the resulting regression parameter estimates will lead to biased estimation. Some ways to detect multicollinearity are as follows [14].

a. The R^2 value is high but there are only a few or no significant parameters if tested partially using t-test statistics.
b. The correlation coefficient between predictor variables is high.
c. The sign on the parameter coefficient is different from the correlation coefficient between the response variable and the predictor variable.
d. The value of the Inflation Factor Variance (VIF) in the regression model should be checked with the following equation.

$$VIF = \frac{1}{1-R_j^2} \quad (1)$$

Where R_j^2 is the determination coefficient in the *j*-predictor variable, $j = 1, 2,\ldots,k$. If the VIF value is greater than 10, then it indicates multicollinearity between predictor variables [14].

2.2 Principle Component Regression

Principal component regression (PCR) consists of a two-stage procedure. The first one is to apply principal component analysis (PCA) and the second one is to apply by regression model using the selected principal components as new explanatory variables in the model. Therefore, this procedure modeling can be seen as a hybrid least square regression and principle component analysis.

Principle component analysis is dimension reduction technique by transforming the original variables to the new variables. The new variables are orthogonally and combination linear of the original variables even though the original and the new variables have the same variance and covariance structures. Additionally, the new variable is called the principal component. In general, the purpose of the regression of the main component is to reduce the data dimensions and for the needs of interpretation [15].

The independent variable in the main component analysis is the result of a linear combination of variable Z (the value of the standardized variable X). The estimating coefficient of this method is obtained from the depreciation of the dimensions of the main components, where the number of the main components chosen must maintain the maximum diversity. The way to get the main component starts from the feature root selection procedure (sometimes called latent root or eigenvalue) from the equation:

$$\left| Z'Z - \lambda I \right| = 0 \quad (2)$$

where Z is the centralized and scaled X matrix, and Z'Z is the correlation matrix. To obtain the main component, the standardization of the original data is carried out using the following equation:

$$Z_{ji} = (Z_{ji} - \bar{Z}_j) / S_{jj}^{1/2} \quad (3)$$

Where

$$n\bar{Z}_j = \sum_{i=1}^{n} Z_{ji} \quad (4)$$

$$S_{jj} = \sum_{i=1}^{n} (Z_{ji} - \bar{Z}_j)^2 \quad (5)$$

For each root feature λ_j there is a Characteristic Vector γ_j that meets a homogeneous equation system:

$$\left(Z'Z - \lambda I \right)\gamma_j = 0 \quad (6)$$

The vector characterizes the solution =, which is chosen from many comparable solutions that exist for each j, is a solution that is normalized such that $\gamma_j^{'}\gamma_j$ = 1. It can also be seen that if all λ_j is different, then each pair of characteristic vectors will be orthogonal to each other. The vector γ_j is used to return *Z* to the main component *W* in the form:

$$W_j = \gamma_{1j}Z_1 + \gamma_{2j}Z_2 + \ldots + \gamma_{rj}Z_r \qquad (7)$$

So, the sum of squares for each new variable W_j, whose elements W_{ji} i = 1,2, ..., n, is. In other words, W_j takes a number of total diversity.

Not all JWs are used but they follow a certain selection rule. In this case, there is no selection rule agreed upon by all statisticians. Components can be calculated up to a certain proportion of a large amount of data (maybe 75 percent or more) m which has been explained. In other words, the largest *k* contributor will be chosen to produce $\sum_{j=1}^{k} \lambda_j / r > 0.75$. This kind of rule can give variable W, which is the result of a transformation of the original variables Z_i. Furthermore, the least squares procedure is used to obtain the forecasting equation for Y as a function of the selected W_j variables. The entry sequence W_j has no effect on this because everything is orthogonal to each other. When the regression equation in W_j has been obtained, this equation can be returned to the original variable function Z_i if desired, or interpreted based on the variables W_j. The selected principal components are regarded as new explanatory variables in the model

2.3 Data Panel Regression

Panel data regression is a regression with the panel data structure. Panel data is a combination of cross section data and time series data. Cross section data is data from one or more variables collected for several individuals at a time. Meanwhile, time series data is data from one or more variables collected from time to time. So, in panel data, the same unit cross section is collected from time to time (Gujarati and Porter, 2010). In general, the panel regression model equation can be written as follows.

$$Y_{it} = \beta_{0it} + \beta_1 X_{1it} + \beta_2 X_{2it} + \ldots + \beta_k X_{kit} + \varepsilon_{it} \qquad (8)$$

Where, Y_{it} is the individual unit response variable and the t-time period, β_{0it} is intersection coefficient of the second individual unit and t-time period β_k, is the coefficient of the slope with k as the number of predictor variables (k = 1, 2, ...,*l*), X_{kit} is Kth predictor variable from the ith individual unit and t-time period, ε_{it} is regression error from the 1st individual for the t-time period, *i* is number of individual units, with = 1, 2, ..., N, *t* is number of time periods, with = 1, 2, ..., T , and *k* is number of predictor variables.

The best model for data panel regression can be common effect model, fixed effect model, and random effect model.

Common Effect Model (CEM). The common effect model (CEM) is an approach to estimating the simplest panel data. In this approach, all data is combined without regard to the individual and time. In the CEM model, interception (β_0) is constant or the same in each individual and every time. The regression equation in CEM can be written as follows (Gujarati and Porter, 2010).

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \ldots + \beta_k X_{kit} + \varepsilon_{it} \qquad (9)$$

Fix Effect Model (FEM). The term fixed effect arises from the fact that although the intercept has the possibility of changing for each subject, the entities of each interception do not change over time. This is called time invariant (Gujarati and Porter, 2010). The types of fixed effect models are as follows.

1. FEM is with a constant slope, but the intercept varies with each individual. In this model, it is assumed that the time effect is ignored. This type of FEM is called FEM between individuals. In this model, individual variables are variables that are used as dummy variables. The regression model for FEM between individuals can be written as follows.
2.

$$Y_{it} = \alpha_0 + \alpha_1 D_1 + \ldots + \alpha_{N-1} D_{N-1} + \beta_1 X_{1it} + \ldots + \beta_k X_{kit} + \varepsilon_{it} \qquad (10)$$

3. FEM is with a constant slope coefficient, but the coefficient of interception varies at any time. It is assumed that individual effects are ignored, but there are different effects over time. The t index on the intercept indicates that the intercept at each time is different while the individual intercept is constant. The dummy variable in this model is a variable from time series data. Regression models for FEM between times are as follows.

$$Y_{it} = \lambda_0 + \lambda_1 D_1 + \ldots + \lambda_{T-1} D_{T-1} + \beta_1 X_{1it} + \ldots + \beta_k X_{kit} + \varepsilon_{it} \quad (11)$$

Random Effect Model (REM). If there are many cross-section units, the FEM method can reduce the degree of freedom and the efficiency of the estimated parameters. To overcome this problem, REM method is used. REM will estimate panel data where the disturbance variables may be related (error terms) between time and between individuals (Gujarati and Porter, 2010). The general equation of REM is as follows.

$$Y_{it} = \alpha_i + \mathbf{\beta}'\mathbf{X_{it}} + w_{it} \quad (12)$$

With value,

$$w_{it} = \varepsilon_{it} + u_i \quad (13)$$

The best model can be selected using Chow Test, Hausman Test and Lagrange Multiplier Test. The Chow test was conducted to select the best model between the Common Effect Model (CEM) and Fixed Effect Model (FEM). Hausman test is done to choose the best model between the Fixed Effect Model (FEM) and Random Effect Model (REM). Lagrange Multiplier is a test conducted to determine whether the Random Effect model is better than the Common Effect model [14].

3. Methodology

The data of this study is panel data with time unit 2015-2017 and the individual unit is 38 districts of East Java. The map of the individual unit is presented in Figure 1. There are 6 cities and 31 districts across East Java. Surabaya, the capital of East Java, is the biggest city.

Then, the research variables is presented in Table 1.

Table 1 - Research variable

Variable	Variable Name	Scale
Y	Gross Regional Domestic Product of East Java (constant price)	Ratio
X_1	The number of people who use mobile phone	Ratio
X_2	The number of people who use computer	Ratio
X_3	The number of people who use the internet	Ratio
X_4	The number of people who use the internet for purchasing/selling goods/services	Ratio
X_5	The number of people who use the internet as financial facilities (e-banking)	Ratio

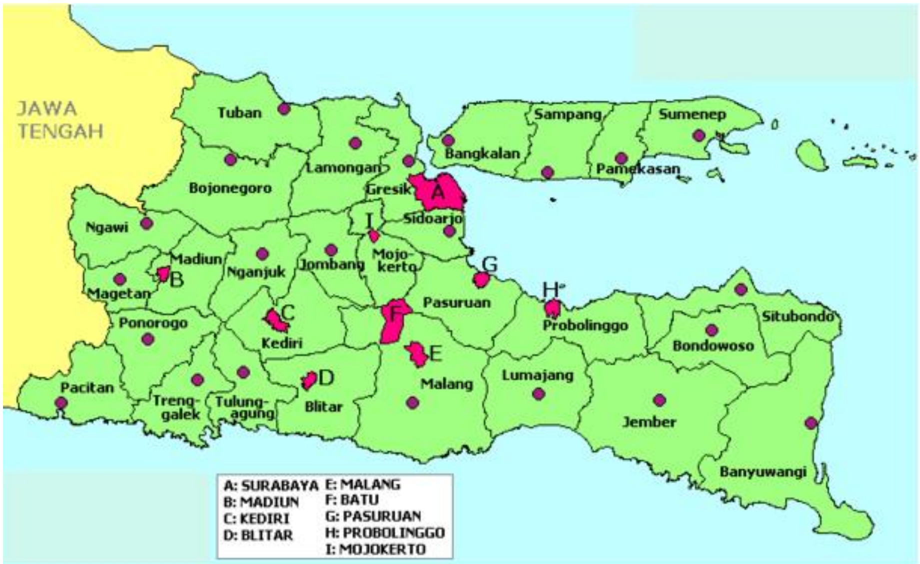

Fig. 1 - Map of East Java Province
Source: https://id.wikipedia.org/ wiki/Daftar_kabupaten_dan_kota_di_Jawa_Timu

In general, the panel regression model equation can be written as follows.

$$Y_{it} = \beta_{0it} + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \varepsilon_{it} \quad (14)$$

1. Checking for multicollinearity cases. If there is one, it will be overcome by Principal Component Regression.
2. Performing CEM panel data regression analysis.
   a. Obtaining an estimate of the CEM model
   b. Testing the significance of simultaneous and partial parameters.
3. Performing regression analysis of individual FEM panel data and time.
   a. Obtaining individual FEM model estimation and time.
   b. Testing the significance of simultaneous and partial parameters.
4. Conducting REM panel data regression analysis.
   a. Obtaining the REM model estimation.
   b. Testing the significance of simultaneous and partial parameters.
5. Choosing the best panel regression model and model interpretation.

4. Results and Discussion

4.1 Relationship Between Constant GRDP and the Use of ICT

The relationship between GRDP and the use of ICT, which includes cell phone, computer, internet access, internet use for goods/services purchase/sale, and internet use for financial facilities, is shown by the matrix plot in Figure 2.

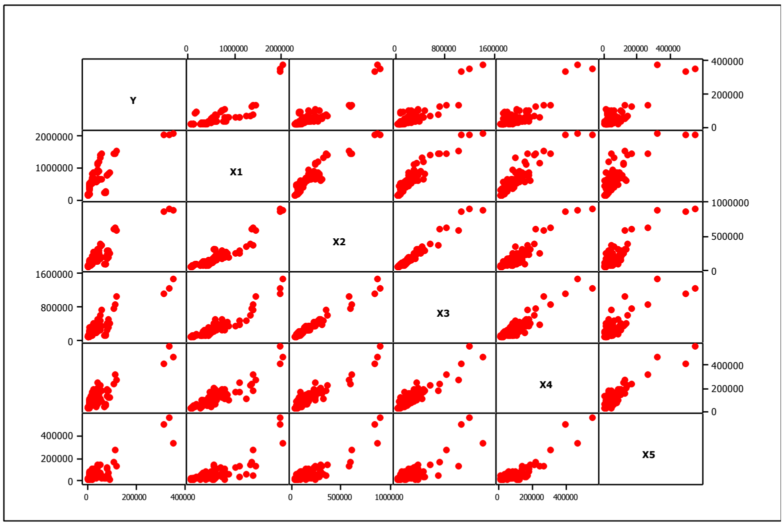

Fig. 2 - Matrix Plots for GRDP Constant Prices with the Use of ICTs

Figure 2 shows the matrix plot between Y variables. The constant price GRDP with each predictor variable shows that there is a positive relationship in it. Meanwhile, the plot matrix formed between predictor variables also shows a positive relationship so that it can cause a case of multicollinearity. To determine the existence of multicollinearity cases, an analysis was carried out in the following sub-chapters.

4.2 Multicollinearity Detection and Principal Component Regression (PCR)

The detection of multicollinearity can be seen from the value of the Inflation Factor (VIF). If the VIF value is more than 10, then there is multicollinearity. The VIF values of each predictor variable can be seen in Table 2 below.

Table 2 - VIF

Variable	VIF
X_1	8.828
X_2	53.589
X_3	40.806
X_4	11.388
X_5	8.754

As Table 2 indicates, several variables used for panel data regression analysis have a VIF value of more than 10. It can be said that there are cases of multicollinearity. To handle multicollinearity cases, Principal Component Regression (PCR) can be used. The results of variable dimension reduction can be seen in Table 3 as follows.

Table 3 - Eigenvalue of the Main Component Formed

Component	PC1	PC2	PC3	PC4	PC5
Eigenvalue	238574	7307	2511	657	268
Proportion	0.957	0.029	0.01	0.003	0.001
Cumulative	0.957	0.986	0.996	0.999	1

Table 3 shows that the PC1 component has a proportion of eigen value of 96% which means that one component formed can explain the predictor variable of 96%. Then, one component is sufficient to represent the existing predictor variables.

In the multicollinearity assessment, it was found that there were cases of multicollinearity. Therefore, the next step is estimating the Common Effect Model (CEM) parameter model, Individual Fixed Effect Model (FEM), Fixed Effect Model (FEM), and Random Effect Model (REM) using Principal Component Regression (PCR). Table 4 presents the PC1 component of each predictor variable.

Table 4 - Component PC1

Variable	PC1
X_1	0.794
X_2	0.318
X_3	0.472
X_4	0.163
X_5	0.135

Based on Table 4, the main components formed are in equation (17) as follows.

$$PC1 = 0{,}794x_{1i} + 0{,}318x_{2i} + 0{,}472x_{3i} + 0{,}163x_{4i} + 0{,}135x_{5i} \tag{15}$$

4.3 Hybrid Least Square Panel Regression And Principle Component Analysis

As explained in 4.2, there are cases of multicollinearity. Therefore, the Common Effect Model (CEM) parameter model, Individual Fixed Effect Model (FEM), Fixed Effect Model (FEM), and Random Effect Model (REM) using Principal Component Regression (PCR) and the main components formed in equation (17) should be estimated. Selection of the best model between CEM, FEM Individual, FEM Time and REM that has been formed using the Chow test, Hausman Test, and Lagrange Multiplier test if the FEM model is not selected. In table 5, the results of the comparison of the coefficient of determination (R-Sq) are presented from each model.

Table 5 - Comparison of the value of R-Sq

Estimasi	Model	R-Sq
PCA + CEM	$\ln(\hat{y}) = 8{,}96 + 0{,}00164PC1$	0.68
PCA + FEM Individual	$\ln(\hat{y}) = 10,6 + 0,000831PC1 - 1,67D_1 - 1,58D_2 - 1,59D_3 - 1,03D_4 - 1,13D_5 + -1{,}17D_6 - 0{,}835D_7 - 1{,}1D_8 - 0{,}798D_9 - 0{,}576D_{10} - 1{,}49D_{11} - 1,5D_{12} - 1,05D_{13} + 0,136D_{14} - 0,394D_{15} - 0,329D_{16} - 1,06D_{17} + -1,37D_{18} - 1,57D_{19} - 1,54D_{20} - 1,57D_{21} - 0,19D_{22} - 0,471D_{23} + -1,07D_{24} + 0,047D_{25} - 1,22D_{26} - 1,47D_{27} - 1,74D_{28} - 0,99D_{29} + +0,488D_{30} - 2,35D_{31} - 0,53D_{32} - 1,85D_{33} - 2,16D_{34} - 2,31D_{35} + -1{,}61D_{36} - 1{,}52D_{37}$	0.999
PCA + FEM Time	$\ln(\hat{y}) = 8{,}94 + 0{,}00164PC1 + 0{,}034D_1 + 0{,}017D_2$	0.68
PCA + REM	$\ln(\hat{y}) = 9{,}39 + 0{,}000949PC1$	0.5821

Table 5 shows the value of the determinant coefficient of each model approach that is formed and can be used as a reference for testing the best model selection as follows.

1. Individual Chow Effect Test

Individual effect chow tests are conducted to select the best model between individual CEM and FEM. The hypothesis used is as follows.

H_0 : Common effect model

H_1 : Fixed effect model

With a significant level of 5% and the rejection area, H0 is rejected if $F_{test} > F_{0.05;\,37;\,75}$. The calculation result of F_{test} of 13.2877 is obtained using equation (14). So, H_0 is rejected because the value of F_{test} is 13.2877 greater than the value of $F_{0.05;\,37;\,75}$ of 1.568. It can be concluded that the model with the FEM approach of selected individuals

2. Time Effect Chow Test

The time effect chow test is done to choose the best model between CEM and FEM time. The hypothesis used is as follows.

H_0 : Common effect model

H_1 : Fixed effect model

With a significant level of 5% and the rejection area, H_0 is rejected if $F_{test} > F_{0.05;\,37;\,75}$. To obtain the calculation results of F_{test} of 0.00, equation (15) is used. Thus, H_0 is rejected because the value of F_{test} is 0.00 greater than the value of $F_{0.05;\,37;\,75}$ of 1.568. It can be concluded that the model with the CEM approach is selected.

3. Hausman Test

Hausman test is done to choose the best model between REM and individual FEM. The hypothesis used is as follows.

H_0 : Random effect model

H_1 : Fixed effect model

With a significant level of 5% and a rejection area, H_0 is rejected if $W > \chi^2_{(k-1,\alpha)}$ or the *p-value* < 0.05. The results of the calculation are as follows.

Table 6 -Hausman Test Results

W	$\chi^2_{(4;0,05)}$	**p-value**
16.164	9.48	0.0001

Notes: *p < 0.05.

Table 6 shows that the decision obtained is that H0 is rejected because the W value of 16.164 is greater than the value of $\chi^2_{(4;0,05)}$ of 9.48 and is strengthened by the p-value of 0.00 smaller than the value of a significant level of 0.05. So, it can be concluded that the model with an approach FEM selected individuals. From the results of the above analysis, the selection of the best model using the Lagrange Multiplier test does not need to be done because the individual FEM approach model has been selected. The following is an analysis of the Modeling of the Use of ICTs on Economic Growth in East Java Province.

***4.* Analysis of the Effect of Using ICTs on Economic Growth in East Java Province using Fixed Effect Model (FEM) for Individuals**

The results of the analysis show that the best model that describes the effect of the use of ICT in economic growth in East Java Province is to use an individual FEM approach. The following are the results of the final estimation model of the FEM Individual Parameters of the Influence of ICT on Economic Growth in East Java Province which has fulfilled the residual assumption test which is identical, independent, and normally distributed (IIDN).

$$
\begin{aligned}
In(\hat{y}) = {} & 10,6 + 0,000264x_1 + 0,000264x_2 + 0,000392x_3 + 0,00011x_5 - 1,67D_1 - 1,5D_2 - 1,6D_3 + \\
& -1,03D_4 - 1,13D_5 - 1,17D_6 - 0,35D_7 - 1,1D_8 - 0,798D_9 - 0,576D_{10} - 1,49D_{11} - 1,5D_{12} + \\
& -1,05D_{13} + 0,136D_{14} - 0,394D_{15} - 0,329D_{16} - 1,06D_{17} - 1,37D_{18} - 1,57D_{19} - 1,54D_{20} + \\
& -1,57D_{21} - 0,19D_{22} - 0,471D_{23} - 1,07D_{24} + 0,047D_{25} - 1,22D_{26} - 1,47D_{27} - 1,74D_{28} + \\
& -1,57D_{21} - 0,19D_{22} - 0,471D_{23} - 1,07D_{24} + 0,047D_{25} - 1,22D_{26} - 1,47D_{27} - 1,74D_{28} + \\
& -0,99D_{29} + 0,488D_{30} - 2,35D_{31} - 0,53D_{32} - 1,85D_{33} - 2,16D_{34} - 2,31D_{35} - 1,61D_{36} + \\
& -1,52D_{37}
\end{aligned}
$$

The best model formed as the equation above shows that every increase in the number of cellphone owners (X_1) is as many as one thousand people; the value of GRDP constant prices increases by 0.00066% provided that they do not pay attention to other variables and districts/cities in East Java Province. For each increase in the number of computer users (X_2) as many as one thousand people, the value of GRDP constant prices increases by 0.000264% with the condition of not considering other variables and districts/cities in East Java Province. Each increase in the number of internet access (X_3) by one thousand people, the value of GRDP constant price increases by 0.000392% provided that they do not pay attention to other variables and regencies/cities in East Java Province. Every increase in the number of internet usage for goods/services purchase/sale (X_4) as many as one thousand people, the value of GRDP constant prices increases by 0.000135% provided that they do not pay attention to other variables and regencies/cities in East Java Province. Each increase in the number of internet usage for financial facilities (X_5) as many as one thousand people, the value of GRDP constant prices increases by 0.00011% provided that they do not pay attention to other variables and Regencies / Cities in East Java Province. In addition, it is known that the constant price GRDP in Pacitan Regency has decreased by 1.67% compared to Surabaya City, the constant GRDP of Ponorogo Regency has decreased by 1.58% compared to Surabaya City, and Regency / City of Kota Batu has decrease 1.52% compared to Surabaya City.

5. Conclusion

The formed matrix shows that there is a positive relationship between the use of ICT and that it can cause multicollinearity cases. The best model that illustrates the influence of the use of ICT on economic growth in East Java Province is the individual FEM approach with a determination coefficient of 99.9% with forming variables the model, namely ln constant price GDP as a response variable and as a predictor variable is the result of the analysis of the main components.

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