Global Economic Shocks and National Income in COVID-19 Pandemic

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Abstract: The COVID-19 pandemic has resulted in global economic shock, prompting many countries around the world to implement active stimulus measures. In this study, we focused on the national income indicator to analyze the effects of stimulus measures promoted by various countries around the world. We present and discuss the global economic shocks and national income indicators in relation to the COVID-19 pandemic. We analyze effects of stimulus measures in five major countries (United States, South Korea, Japan, United Kingdom, and Germany) during the COVID-19 pandemic. We anticipate that the results of this study will be useful in the study of stimulus measures.

Keywords: Global economic shocks, national income, COVID-19 pandemic, economic stimulus package.

1. INTRODUCTION

The COVID-19 pandemic has prompted many countries around the world to actively respond to different levels of quarantine by implementing economic stimulus measures and pushing for expansionary fiscal policies to cope with the economic crisis. Unlike the existing economic crisis, the COVID-19 crisis occurred at the same time as the health crisis and economic crisis. It has affected not only the real economy but also the financial markets, so it is considered a serious crisis in which supply has decreased due to the collapse of the global value chain. It is not due to the inherent problem of the economic system, but to the huge external impact of the COVID-19 pandemic. The COVID-19 pandemic has thus caused the already existing issues that many nations are currently experiencing to worsen further. It has shown weaknesses in the socio-economic systems of many countries around the world. The COVID-19 pandemic's most concerning effect on the global economy is the resurgence of the stagflation phenomenon. Foreign raw materials such as crude oil, rare earth metal, gold, and cotton are being weaponized in the same way advanced technologies such as semiconductors, electronic parts, and automobile parts are being weaponized. From the standpoint of the national economy, the economic pain index rises sharply as prices rise amid a decrease in income. It may be more alarming when all policy measures against the COVID-19 pandemic are implemented. It is possible that the normal recovery of the global economy may have been delayed due to excessive liquidity supply and increased national debt due to fiscal deficits. Each country's fiscal deficit increased due to the expansion of fiscal spending to cope with the COVID-19 pandemic, and the increase was further expanded, especially in advanced countries. Global economic activity has resumed and economic recovery is rapidly emerging as a result of each country's efforts to respond to the COVID-19 pandemic. However, some countries are still uncertain about growth due to the resurgence of the COVID-19 pandemic. It can be seen that fiscal expenditure in response to the COVID-19 pandemic has increased economic growth and contributed to the global economic recovery. Despite the promotion of expansionary fiscal policies, the pace of economic recovery by country is expected to vary depending on the COVID-19 pandemic damage situation and economic conditions of each country. While the global economy has been hit hard by the pandemic, advanced countries have suffered more serious economic losses. The global economic growth risk has risen due to the surge in debt in each country accompanying the COVID-19 pandemic response process. In the case of developing countries, private debt is expected to increase sharply. In this study, we present and discuss COVID-19 pandemic global economic shocks and national income during the COVID-19 pandemic. We analyze the effects of stimulus measures in five major countries (US, Korea, Japan, UK, and Germany) during the COVID-19 pandemic.

2. LITERATURE REVIEW

While the existing literature has found that negative economic sentiment depresses support for international economic integration, economic anxiety appears to be positively related to support for integration in the COVID-19 era (Obermeier, 2021). The Covid-19 pandemic risks causing a major collapse in 'economic confidence' – *i.e.* the beliefs of firms and households that all other firms and households will maintain their economic activity – and hence in aggregate demand (Meade, 2022). Debt burdens are growing steadily in Low- and Middle-Income Countries (LMICs), compounded by the COVID-19 economic recession, threatening to

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crowd out essential health spending (Federspiel *et al.*, 2022). It is argued that the Covid-19 crisis is a critical juncture for the EU. As a result, EU economic governance ceases to be limited to its regulatory function and is now complemented by a redistributive function as well (Ladi and Tsarouhas, 2020). EU countries agreed on July 21, 2020 to develop, for the first time, countercyclical fiscal transfers financed by common debt issuance (Camous and Claeys, 2020). Major government emergency interventions demand, and generally receive, independent scrutiny (Wilkins *et al.*, 2020). The rapid emergence of the COVID-19 crisis has challenged both private and public firms, requiring them to reshape their internal processes and external linkages in the fight against the virus, but also to survive the disrupting economic impact of the pandemic on their activities (Battaglia *et al*., 2020). The COVID-19 pandemic pressured local governments to employ creative and untested economic development strategies to stabilize private businesses (Johnson *et al*., 2022). The COVID-19 pandemic has had severe economic consequences across the globe, and it does not look like any country will be unaffected (Donthu and Gustafsson, 2020). 'Social distancing' has long become an accompanying feature of globalisation and the crisis threatens to deepen social, economic and political divisions and to herald a retreat to more divisive measures (Pentini and Lorenz, 2020). The COVID-19 pandemic has proved itself to be the most disastrous global phenomenon for economies and societies all across the world (Junfeng *et al*., 2022). The crisis caused by COVID-19 differs from previously crises due to its particularities (Faura, 2021). The next wave of the COVID-19 shock will trigger another or more protracted recession in many countries, with annual growth projected to fall below recessionary thresholds (Morgan *et al.*, 2021). The COVID-19 induced crisis has revamped the reform process in the European Economic and Monetary Union, prompting a new wave of policy and institutional changes in the Economic and Monetary Union of the European Union (EMU) (Angelis, 2022). COVID-19 has taught us that, when inadequately addressed, preexisting policy problems exacerbate the cost of crises and make policy responses more difficult (Amri and Drummond, 2021).

3. GLOBAL ECONOMIC SHOCKS IN COVID-19 PANDEMIC

The COVID-19 pandemic has spread very quickly and continuously around the world. Major global organizations predicted a global economic recession and a global economic shock. The COVID-19 pandemic threatens the health of mankind and has a serious impact on the economy, the administration, the budget, the policy, and the diplomacy of countries around the world. The social distancing policy implemented to prevent the spread of the COVID-19 pandemic has reduced consumption, which subsequently wreaked enormous damage to the global economy. Governments around the world have implemented various stimulus measures to prevent the spread of the COVID-19 pandemic and to overcome the sluggish economy. South Korea has implemented an economic stimulus package that provides cash to its people several times by creating disaster relief funds. In 2020, the United States cut its interest rate to zero in five years, and in 2021, it implemented the largest-ever stimulus package worth $1.9 trillion. Major European countries have also implemented large-scale economic stimulus measures from 2020, and the EU has decided to temporarily suspend fiscal rules that constrain member countries' fiscal deficit ratios to a certain level until 2022. Pandemic shocks aggregate demand and supply at the same time. In response to the risk of exposure to the virus, the total demand effect for consumers to reduce consumption and the total supply effect for suppliers to reduce labor supply occurs at the same time. The global economic crisis caused by the pandemic depends not on the structural combination within the economy, but on the development of treatments and vaccines. Depending on the vaccine development period, an economic downturn is inevitable and the recovery scenario depends on the policy response. During the COVID-19 pandemic, the central axis of the international economic order shifts from efficiency to resilience. As the world faces a pandemic due to excessive globalization, the cost of globalization based on existing efficiency has been incurred. Recently, the outbreak cycle of the pandemic has been accelerating, and the world has recognized the limitations of efficiency-focused economic operating principles and started paying attention to resilience. Resilience refers to the ability of various economic entities such as individuals, enterprises, cities, and governments to prevent or improve disasters. It includes the ability of the system to transition and adapt to the new environment.

4. RESEARCH METHODOLOGY AND MECHANISM

In this study, we present and discuss COVID-19 pandemic global economic shocks and national income during the COVID-19 pandemic. We analyze the effects of stimulus measures in five major countries during the COVID-19 pandemic and target the United States, South Korea, Japan, the United Kingdom, and Germany. For the study, we used OECD's per capita GDP (2010-2021) data, per capita gross national income (2010-2021) data, household expenditure (2010-2021) data, and average worker tax (2010-2021) data. In this study, per capita GDP was set as a dependent variable, while per capita gross national income, household expenditure, and average worker tax were set as independent variables. We used multiple regression analysis to examine the effects of stimulus measures in five major countries during the pandemic. Multiple regression analysis is an extension of simple regression analysis to examine the relationship between two or more independent variables and one dependent variable. In general, social phenomena are rarely explained or predicted as a single variable. Therefore, it is possible to develop a model that effectively and accurately explains and predicts the variance of dependent variables using two or more independent variables. Methods for estimating multiple regression equations include the enter method and the stepwise method. The enter method is a method of analyzing all independent variables considered by the researcher at once. Using this method, the influence of a specific independent variable can be known while other independent variables are controlled. The stepwise method is a method that only includes variables influencing the dependent variable in the regression equation when other variables exist in the regression equation. This method is useful in discovering a regression equation consisting only of variables in explaining the dependent variable. In this study, anal-

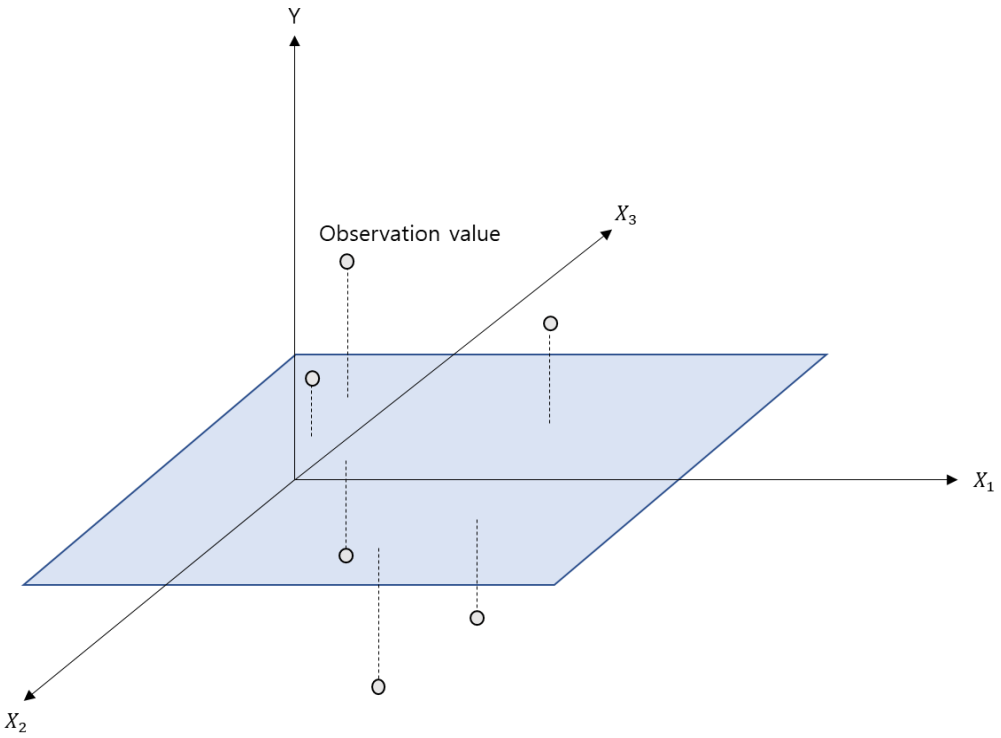

Fig. (1). The principle of multiple regression.

ysis is conducted using the enter method. The equation for multiple regression analysis is as follows.

$$\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 \mathrm{X}_1 + \hat{\beta}_2 \mathrm{X}_2 + \cdots\cdots + \hat{\beta}_k \mathrm{X}_k$$

The regression equation used in this study is as follows.

$$\hat{Y}_0 = \hat{\beta}_0 + \hat{\beta}_1 \mathrm{X}_1 + \hat{\beta}_2 \mathrm{X}_2 + \hat{\beta}_3 \mathrm{X}_3$$

The principle of multiple regression is described in Fig. (**1**). It shows the principle of calculating a regression equation that predicts and explains the dependent variable using three independent variables. The regression equation calculated using three independent variables is called a regression plane rather than a regression line. The regression equation values defined by three independent variables can be obtained for all combinations that can be made using a specific independent variable, so these values form a plane. When the independent variable is K, a k-dimensional regression value is formed on the space of the k+1 dimension.

In the regression model derived from multiple regression equations, statistical significance verification is performed using an ANOVA table. ANOVA tables can be expressed as equations. Here, 'n' indicates the number of observations and 'k' refers to the number of independent variables. The equations for regression, residuals, and total sum in the sum of squares (SS) are as follows.

$$SSR = \sum(\hat{y}_i - \bar{y})^2, SSE = \sum(y_i - \hat{y}_i)^2,$$

$$SSE = \sum(y_i - \bar{y})^2$$

The equations for regression, residuals, and total sum at the degree of freedom (DF) are as follows.

$$(\mathrm{k}+1) - 1, \quad n - (\mathrm{k}+1), \quad n - 1$$

The equations for regression and residuals at the mean square are as follows.

$$\mathrm{MSR} = \frac{SSR}{(\mathrm{k}+1)-1}, \quad \mathrm{MSE} = \frac{SSE}{n-(\mathrm{k}+1)}$$

The equations for regression and residuals from the test statistic F are as follows.

$$\frac{MSR}{MSE}$$

5. RESEARCH RESULTS AND INTERPRETATION

In this study, we present and discuss global economic shocks and national income indicators during the COVID-19 pandemic. The effects of stimulus measures implemented by five major countries (United States, South Korea, Japan, United Kingdom and Germany) during COVID-19 pandemic are examined. We conduct a comparative analysis of per capita gross domestic product, per capita gross national income, household expenditure, the average tax of worker data during the pre-COVID-19 pandemic period (2010-2019), and per capita gross national income, the household expenditure, and the average tax of worker data during the COVID-19 pandemic period (2010-2021). In this study, per capita gross domestic product was set as a dependent variable, and per capita gross national income, the household expenditure, and the average tax of worker were set as independent variables. We used multiple regression analysis to analyze the stimulus measure effects of five major countries during the COVID-19 pandemic.

○ Analysis of the economic situation during the pre-COVID-19 pandemic period (2010-2019)

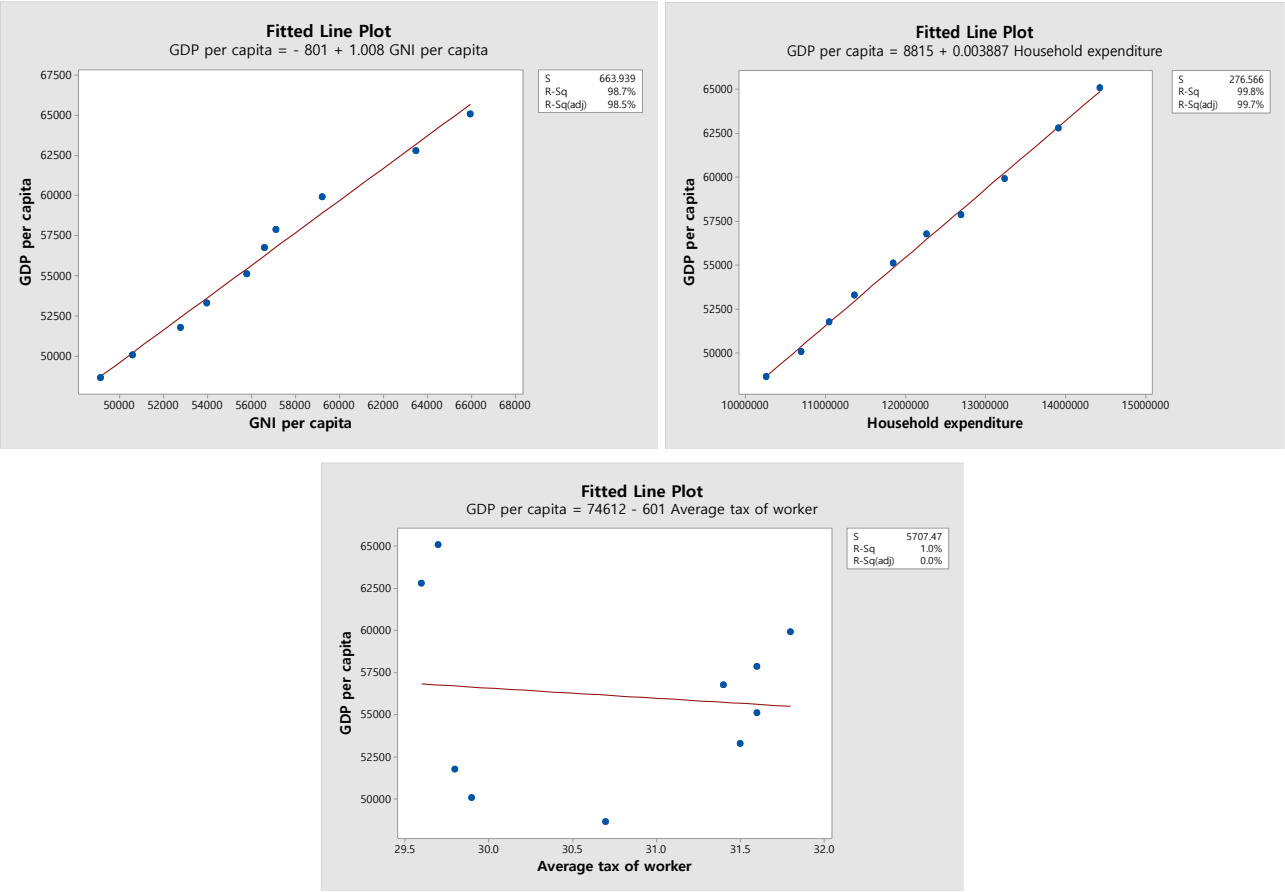

Fig. (2). The type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United States through plotting.

We analyzed the type of data on the economic situation during the pre-COVID-19 pandemic period (2010-2019) in the United States through plotting. Results showed that as per capita gross national income and the household expenditure increased, per capita gross domestic product also increased, but the average tax of worker did not increase. Fig. (**2**) shows the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United States analyzed through plotting.

The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in the United States is presented in Table **1**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.001, 0.000, and 0.009, respectively, which are all significant at the 0.05 significance level. R-sq (adj) is 99.95%, and the variation explained by the regression equation is 99.95% of the total variation. In the variance analysis, the p-value is 0.000, so the regression equation is significant at the 0.05 significance level. Based on the analysis of the economic indicators, there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019) in the United States. The estimated regression equation is as follows.

GDP per capita = -1012 + 0.3670 X_1 (GNI per capita) + 0.002508 X_2 (Household expenditure) + 191.2 X_3 (Average tax of worker)

We plotted the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in South Korea. Results of the analysis showed that as per capita gross national income, the household expenditure, and the average tax of worker increased, per capita gross domestic product also increased. Fig. (**3**) shows the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in South Korea analyzed through plotting.

The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in South Korea is presented in Table **2**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.105, 0.983, and 0.963, respectively, all of which are not significant at the 0.05 significance level. R-sq (adj) is 90.35%, and the variation explained by the regression equation is 90.35% of the total variation. Results of the analysis of the economic indicators showed there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019) in South Korea, but economic indicators have a significant impact on each other in terms of interaction. In the variance analysis, the p-value is 0.553, so the regression equation is significant at the 0.05 significance level. The estimated regression equation is as follows.

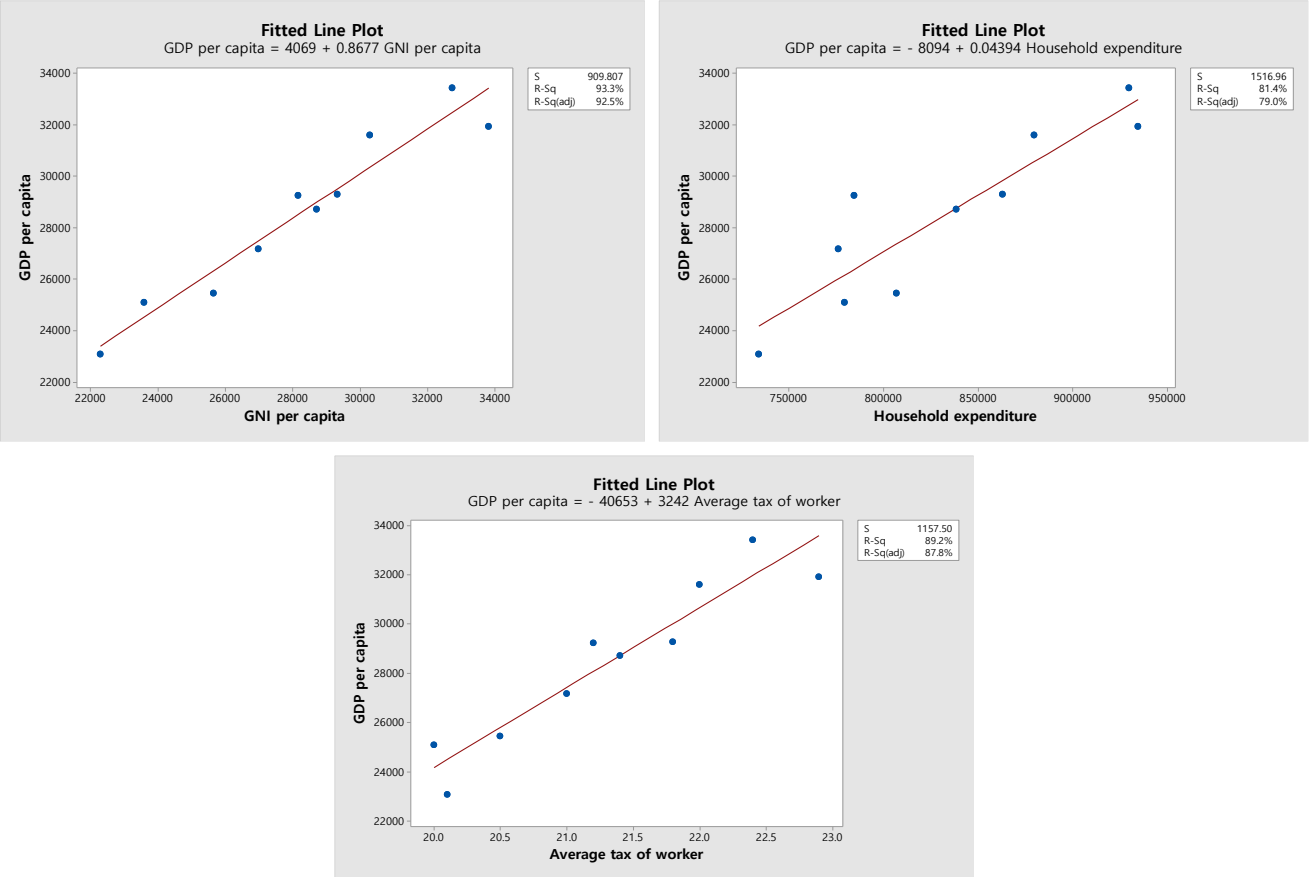

Fig. (3). The type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in South Korea through plotting.

Table 1. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in the United States.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	263254740	87751580	6341.16	0.000
GNI per capita	1	525084	525084	37.94	0.001
Household expenditure	1	1706857	1706857	123.34	0.000
Average tax of worker	1	194980	194980	14.09	0.009
Error	6	83031	13838		
Total	9	263337771			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
117.637	99.97%	99.95%	99.93%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-1012	2038	-0.50	0.637	
GNI per capita	0.3670	0.0596	6.16	0.001	65.58
Household expenditure	0.002508	0.000226	11.11	0.000	64.10
Average tax of worker	191.2	50.9	3.75	0.009	1.42

Table 2. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in South Korea

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	92460111	30820037	29.08	0.001
GNI per capita	1	3869899	3869899	3.65	0.105
Household expenditure	1	551	551	0.00	0.983
Average tax of worker	1	259011	259011	0.24	0.639
Error	6	6359320	1059887		
Total	9	98819430			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
1029.51	93.56%	90.35%	83.08%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	19221	30583	0.63	0.553	
GNI per capita	1.149	0.601	1.91	0.105	41.80
Household expenditure	-0.0003	0.0144	-0.02	0.983	8.13
Average tax of worker	-1069	2163	-0.49	0.639	37.00

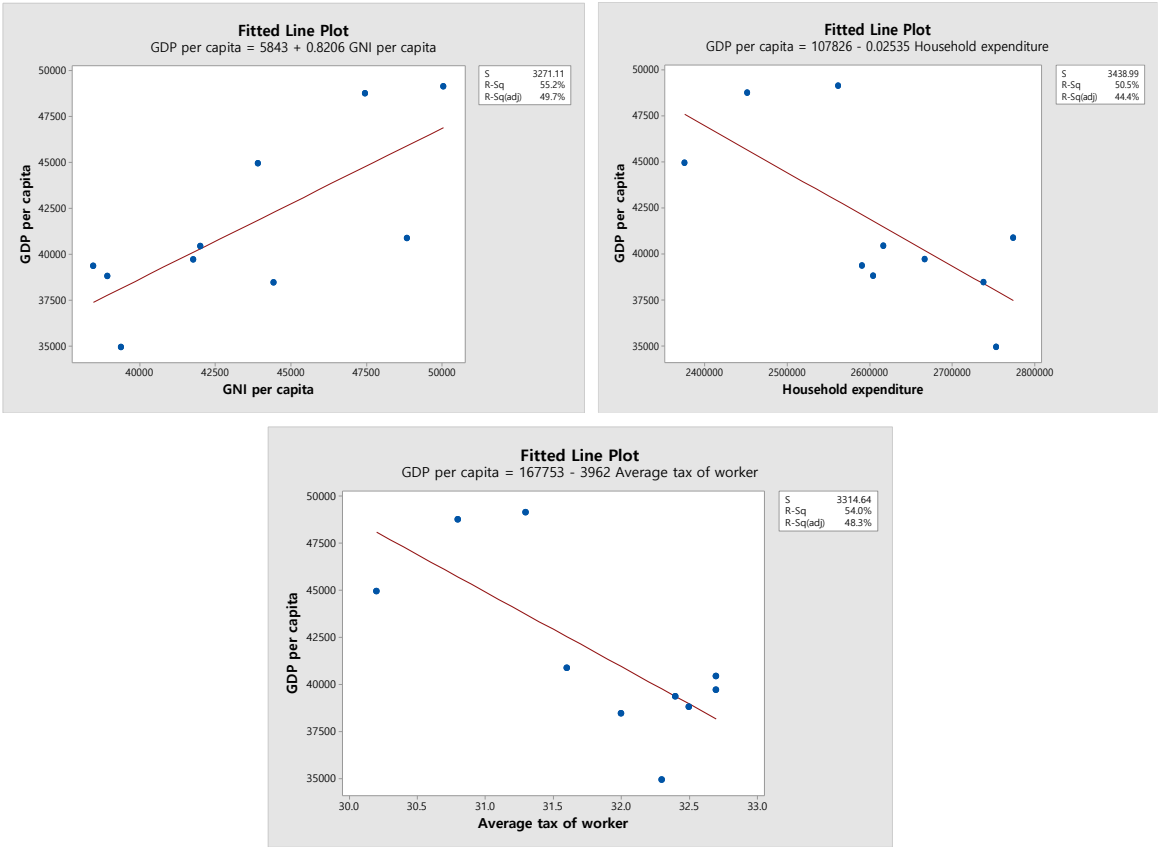

Fig. (4). The type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Japan through plotting.

Table 3. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in Japan.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	186056365	62018788	71.41	0.000
GNI per capita	1	65856232	65856232	75.83	0.000
Household expenditure	1	57136082	57136082	65.79	0.000
Average tax of worker	1	6511929	6511929	7.50	0.034
Error	6	5210865	868477		
Total	9	191267230			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
931.921	97.28%	95.91%	87.52%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	16921	20127	0.84	0.433	
GNI per capita	0.949	0.109	8.71	0.000	2.15
Household expenditure	-0.03000	0.00370	-8.11	0.000	2.37
Average tax of worker	1938	708	2.74	0.034	3.80

GDP per capita = 19221 + 1.149 X_1 (GNI per capita) - 0.0003 X_2 (Household expenditure) - 1069 X_3 (Average tax of worker)

We plotted the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Japan. Results of the analysis showed Japan's per capita gross domestic product increased as per capita gross national income increased, but the household expenditure and the average worker tax decreased as per capita gross national income decreased. Fig. (**4**) shows the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Japan analyzed through plotting.

The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in Japan is presented in Table **3**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.000, 0.000, and 0.034, respectively, which are all significant at the 0.05 significance level. R-sq (adj) is 95.91%, and the variation explained by the regression equation is 95.91% of the total variation. In the variance analysis, the p-value is 0.433, so the regression equation is not significant at the 0.05 significance level. Based on the analysis of the economic indicators, there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019) in Japan. The estimated regression equation is as follows.

GDP per capita = 16921 + 0.949 X_1 (GNI per capita) - 0.03000 X_2 (Household expenditure) + 1938 X_3 (Average tax of worker)

We plotted the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom. Results of the analysis showed the United Kindom's per capita gross domestic product increased as per capita gross national income increased. The household expenditure had no effect as per capita gross national income decreased. As per capita gross national income decreased, the average tax of worker decreased. Fig. (**5**) shows the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom analyzed through plotting.

The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom is presented in Table **4**.

Table 4. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	27768486	9256162	2.74	0.135

GNI per capita	1	5198694	5198694	1.54	0.261
Household expenditure	1	478084	478084	0.14	0.719
Average tax of worker	1	168214	168214	0.05	0.831
Error	6	20233075	3372179		
Total	9	48001562			

Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
1836.35	57.85%	36.77%	0.00%

Coefficients

Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	11670	140524	0.08	0.937	
GNI per capita	1.30	1.05	1.24	0.261	4.18
Household expenditure	-0.00304	0.00807	-0.38	0.719	5.62
Average tax of worker	-629	2817	-0.22	0.831	10.53

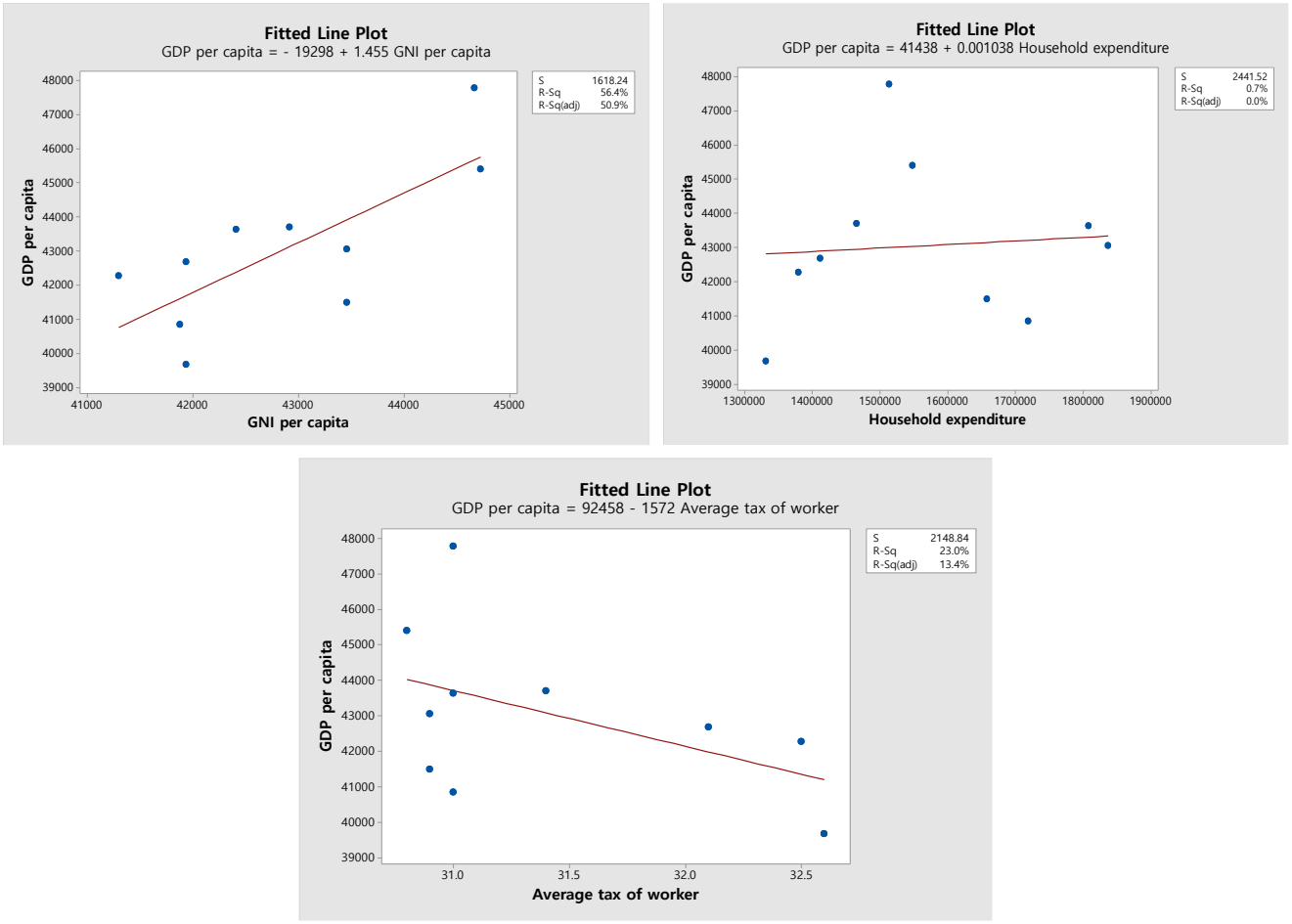

Fig. (5). The type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom through plotting.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.261, 0.719, and 0.831, respectively, all of which are not significant at the 0.05 significance level. R-sq (adj) is 36.77%, and the variation explained by the regression equation is 36.77% of the total variation. In the variance analysis, the p-value is 0.937, so the regression equation is not significant at the 0.05 significance level. Based on the analysis of the economic indica-

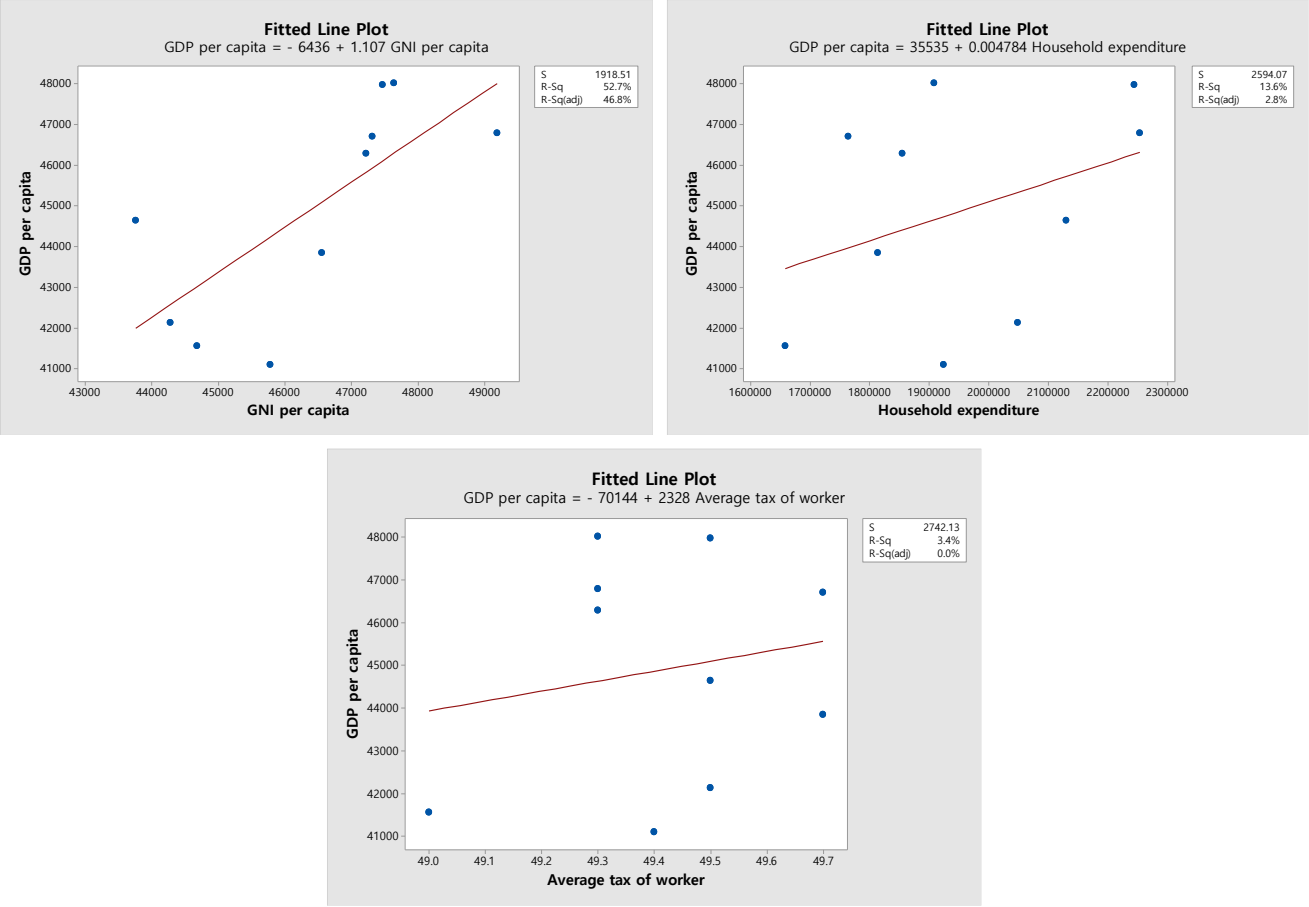

Fig. (6). The type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Germany through plotting.

tors, it can be seen that in the United Kingdom, there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019), but economic indicators have a significant impact on each other in terms of interaction. The estimated regression equation is as follows.

GDP per capita = 11670 + 1.30 X_1 (GNI per capita) - 0.00304 X_2 (Household expenditure) - 629 X_3 (Average tax of worker)

We identified the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Germany through plotting. Based on the results of the analysis, Germany's per capita gross domestic product, the household expenditure, and the average tax increased as per capita gross national income increased. Fig. (**6**) shows the type of data on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Germany analyzed through plotting.

The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in Germany is presented in Table **5**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.045, 0.476, and 0.664, respectively, all of which are not significant at the 0.05 significance level. R-sq (adj) is 38.42%, and the variation explained by the regression equation is 38.42% of the total variation. In the variance analysis, the p-value is 0.630, so the regression equation is not significant at the 0.05 significance level. For Germany's economic indicators, there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019), but the household expenditure and the average tax of worker have a significant impact on each other in terms of interaction. The estimated regression equation is as follows.

GDP per capita = -83026 + 1.031 X_1 (GNI per capita) + 0.00267 X_2 (Household expenditure) + 1515 X_3 (Average tax of worker)

The comprehensive analysis of the economic situation during the pre-COVID-19 pandemic period (2010-2019) is as follows. In the case of the United States and Japan, there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019). In the case of Korea and the United Kingdom, there was no significant impact or impact on the economy in the pre-COVID-19 pandemic period (2010-2019), but economic indicators have a significant impact on each other in terms of interaction. In the case of Germany, there was no significant impact or impact on the economy during the pre-COVID-19 pandemic period (2010-2019), but the household expenditure and the average tax of worker have a significant impact on each other in terms of interaction.

○ Analysis of the economic situation during the COVID-19 pandemic period (2010-2021)

We plotted the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in the United States. As per capita gross national income and the household expenditure increased, per capita gross domestic product also increased, but the average tax of worker did not increase. The United States indicators were similar to those from the pre-COVID-19 pandemic period (2010-2019) despite the global economic shock caused by COVID-19 pandemic and the government's economic stimulus measures. Fig. (**7**) shows the type of data on the economic situation for the COVID-19 period (2010-2021) in the United States analyzed through plotting.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.000, 0.025, and 0.016, respectively, all of which are significant at the 0.05 significance level. R-sq (adj) is 99.62%, and the variation explained by the regression equation is 99.62% of the total variation. In the variance analysis of the results of multiple regression analysis, the p-value is 0.02600, so the regression equation is significant at the 0.05 level. The United States economic indicators are not different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by COVID-19 pandemic. There is no significant impact on the economy. The estimated regression equation is as follows.

GDP per capita = -13127 + 0.8157 X_1 (GNI per capita) + 0.000803 X_2 (Household expenditure) + 191.2 X_3 (435 Average tax of worker)

We plotted the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in South Korea. Based on the results, as per capita gross national income, the household expenditure, and the average tax of worker increased, and per capita gross domestic product also increased. Through plotting, it was determined that South Korea's indicators were similar to those during the pre-COVID-19 pandemic period (2010-2019) despite the global economic shock caused by the pandemic and the government's economic stimulus measures. Fig. (**8**) shows the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in South Korea analyzed through plotting.

The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in the United States is presented in Table **6**.

The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in South Korea is presented in Table **7**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.016, 0.972, and 0.458, respectively, all fo which are not significant at 0.05 significance level. R-sq (adj) is 93.09%, and the variation explained by the regression equation is 93.09% of the total variation. South Korea's economic indicators are slightly different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by COVID-19 pandemic. There was no significant impact on the economy in the pre-COVID-19 pandemic period (2010-2021). In the variance analysis of the results of multiple regression analysis, the p-value is 0.323, so the regression equation is not significant at the 0.05 level. The estimated regression equation is as follows.

Table 5. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2019) in Germany.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	36726188	12242063	2.87	0.126
GNI per capita	1	27197072	27197072	6.38	0.045
Household expenditure	1	2466529	2466529	0.58	0.476
Average tax of worker	1	887375	887375	0.21	0.664
Error	6	25574567	4262428		
Total	9	62300756			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
2064.56	58.95%	38.42%	0.00%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-83026	163849	-0.51	0.630	
GNI per capita	1.031	0.408	2.53	0.045	1.05
Household expenditure	0.00267	0.00351	0.76	0.476	1.07

Average tax of worker	1515	3321	0.46	0.664	1.02

Table 6. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2021) in the United States

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	449092440	149697480	968.45	0.000
GNI per capita	1	23229091	23229091	150.28	0.000
Household expenditure	1	1161004	1161004	7.51	0.025
Average tax of worker	1	1413229	1413229	9.14	0.016
Error	8	1236597	154575		
Total	11	450329037			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
393.160	99.73%	99.62%	97.10%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-13127	4817	-2.72	0.026	
GNI per capita	0.8157	0.0665	12.26	0.000	13.46
Household expenditure	0.000803	0.000293	2.74	0.025	13.14
Average tax of worker	435	144	3.02	0.016	1.09

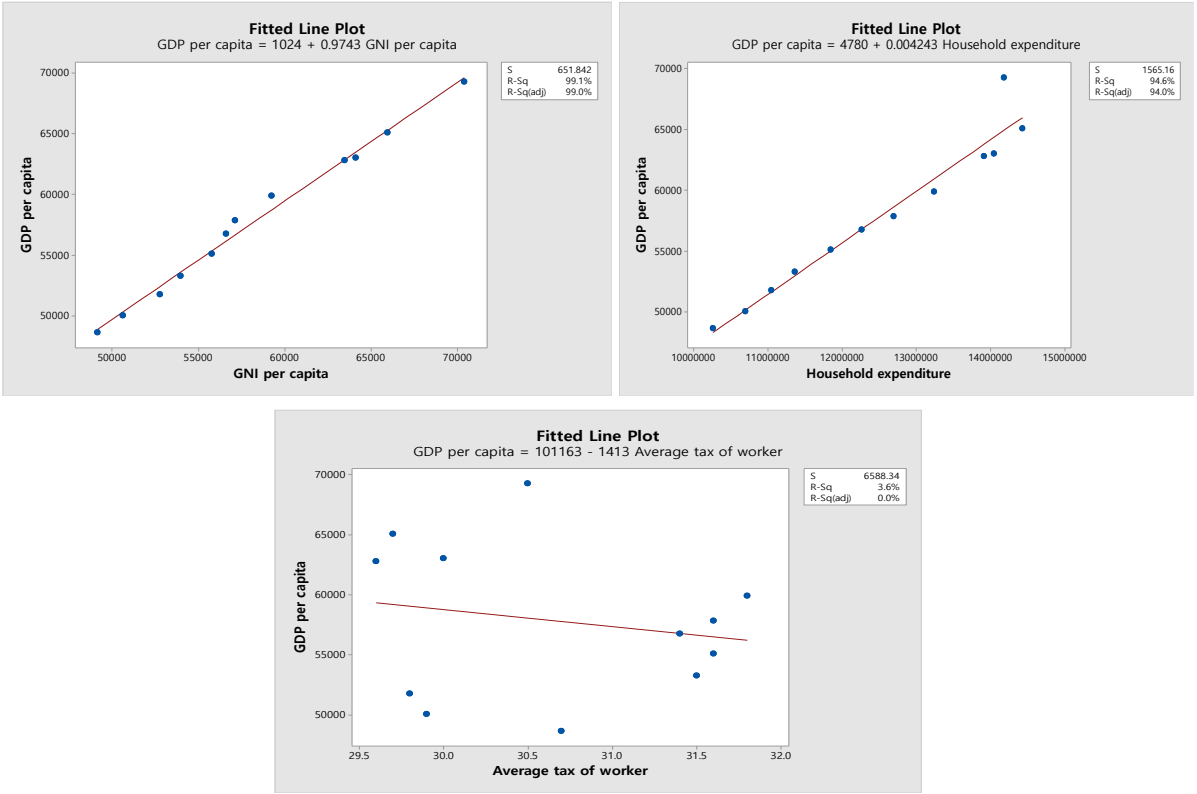

Fig. (7). The type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in the United States through plotting.

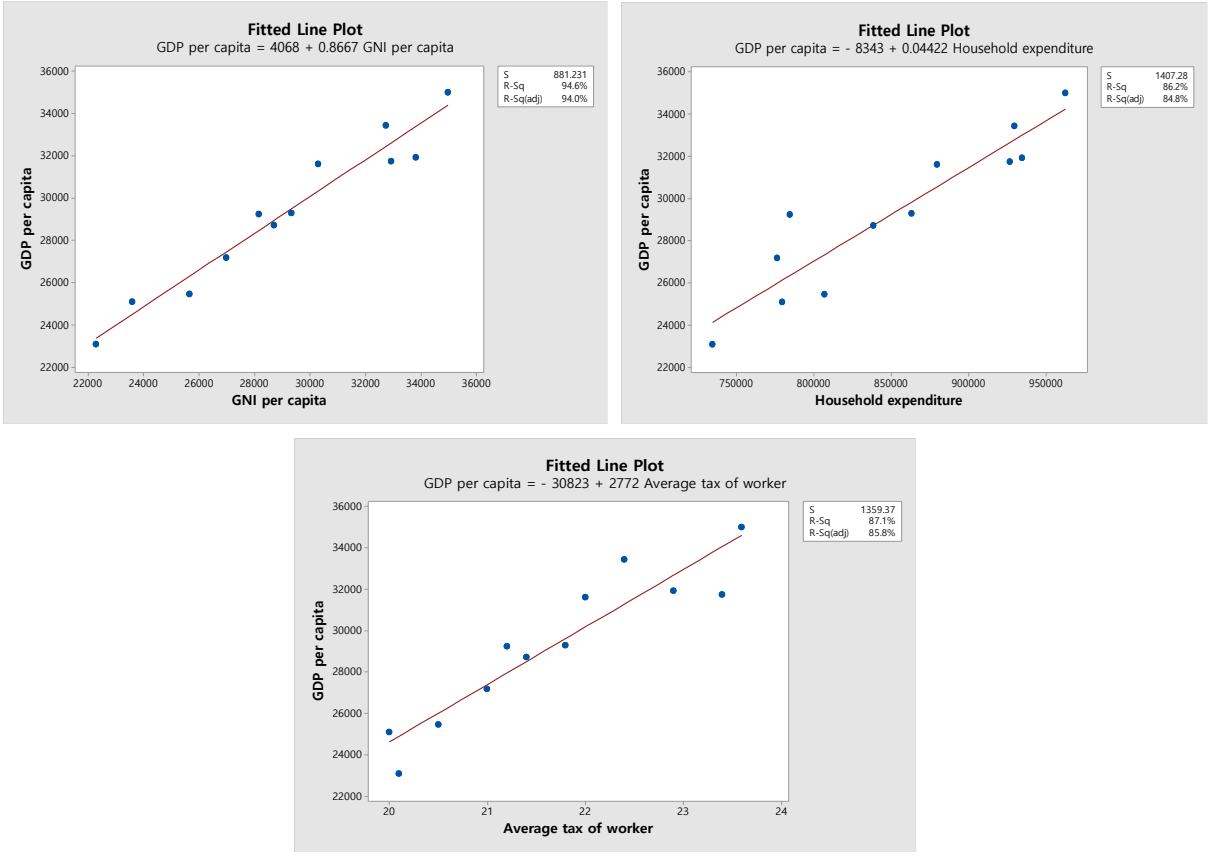

Fig. (**8**). The type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in South Korea through plotting.

Table 7. The multiple regression analysis result on the economic situation of the pre-COVID-19 pandemic period (2010-2021) in South Korea.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	136150604	45383535	50.36	0.000
GNI per capita	1	8318175	8318175	9.23	0.016
Household expenditure	1	1216	1216	0.00	0.972
Average tax of worker	1	546682	546682	0.61	0.458
Error	8	7209358	901170		
Total	11	143359962			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
949.300	94.97%	93.09%	89.67%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	14780	14019	1.05	0.323	
GNI per capita	1.099	0.362	3.04	0.016	26.22
Household expenditure	0.0005	0.0132	0.04	0.972	12.28
Average tax of worker	-825	1059	-0.78	0.458	20.23

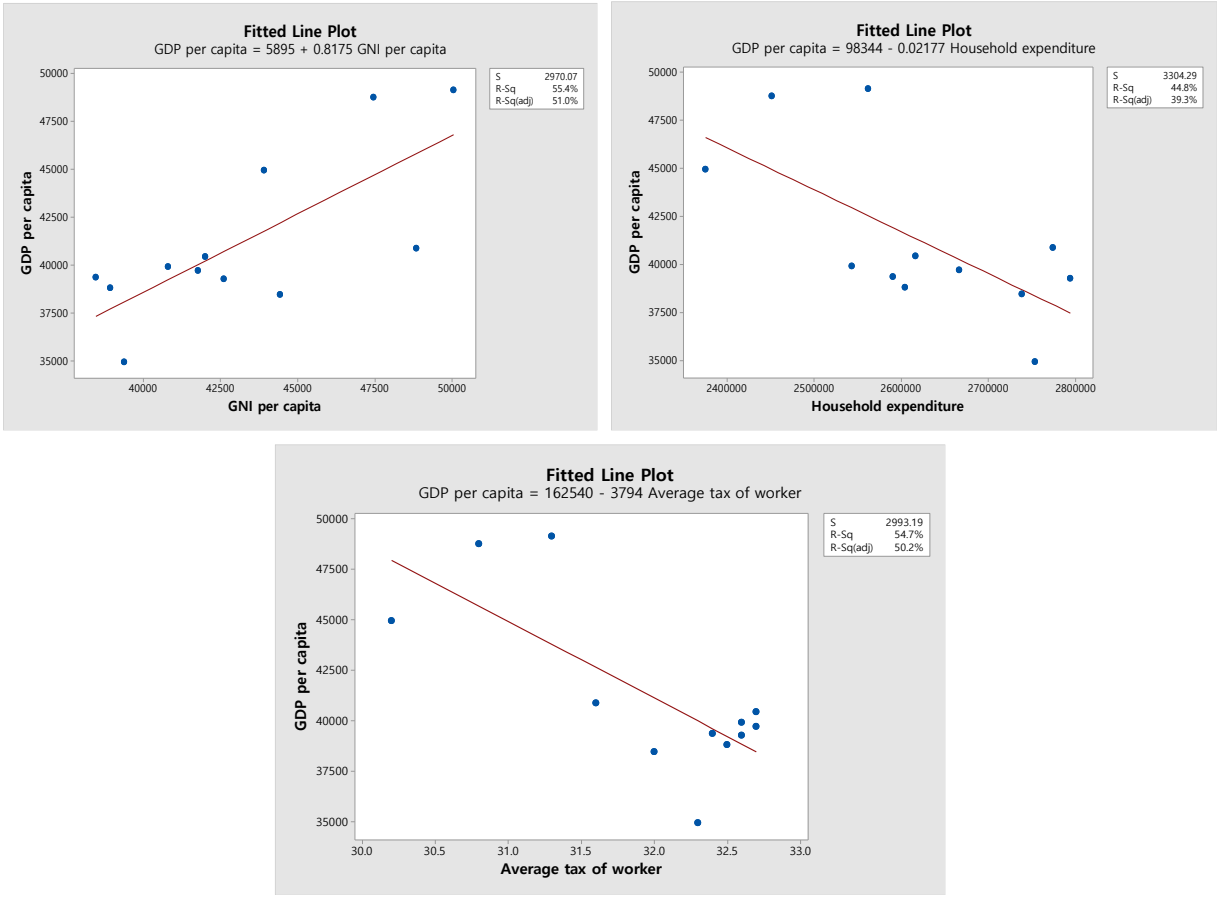

Fig. (9). The type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in Japan through plotting.

GDP per capita = 14780 + 1.099 X_1 (GNI per capita) + 0.0005 X_2 (Household expenditure) - 825 X_3 (Average tax of worker)

We plotted the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in Japan. Per capita gross national income increased gross national income per capita increased or per capita gross national income decreased as the household expenditure and the average tax of worker decreased. In the plotting, Japan's indicators were similar with the pre-COVID-19 pandemic period (2010-2019) despite the global economic shock caused by COVID-19 pandemic and the government's economic stimulus measures. Fig. (**9**) shows the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in Japan as plotted.

The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in Japan is presented in Table **8**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.000, 0.001, and 0.252, respectively. At a significance level of 0.05, GNI per capita and the household expenditure are significant. R-sq (adj) is 89.76%, and the variation explained by the regression equation is 89.76% of the total variation. Economic indicators in Japan are slightly different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by COVID-19 pandemic. There was no significant impact on the economy in the pre-COVID-19 pandemic period (2010-2021). In the variance analysis of the results of multiple regression analysis, the p-value is 0.337, so the regression equation is not significant at the 0.05 level. The estimated regression equation is as follows.

GDP per capita = 28160 + 0.892 X_1 (GNI per capita) - 0.02357 X_2 (Household expenditure) + 1137 X_3 (Average tax of worker)

We plotted the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in the United Kingdom. Gross national income per capita increased as per capita gross national income increased. The household expenditure had no effect as per capita gross national income decreased. Per capita gross national income decreased as the household expenditure and the average tax of worker decreased. Per capita gross national income decreased as the average tax of worker decreased. In the plotting analysis, the United Kingdom situation was no different from the pre-COVID-19 pandemic period (2010-2019) despite the global economic shock caused by COVID-19 pandemic and the government's economic stimulus measures. Fig. (**10**) shows the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in the United Kingdom analyzed through plotting.

The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in the United Kingdom is presented in Table **9**.

Table 8. The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in Japan.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	183129609	61043203	33.15	0.000
GNI per capita	1	60363855	60363855	32.78	0.000
Household expenditure	1	49706699	49706699	26.99	0.001
Average tax of worker	1	2813121	2813121	1.53	0.252
Error	8	14732141	1841518		
Total	11	197861750			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
1357.03	92.55%	89.76%	81.13%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	28160	27590	1.02	0.337	
GNI per capita	0.892	0.156	5.73	0.000	2.16
Household expenditure	-0.02357	0.00454	-5.20	0.001	2.09
Average tax of worker	1137	920	1.24	0.252	3.45

Table 9. The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in the United Kingdom.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	45262236	15087412	4.95	0.031
GNI per capita	1	36246706	36246706	11.89	0.009
Household expenditure	1	165992	165992	0.05	0.821
Average tax of worker	1	447417	447417	0.15	0.712
Error	8	24394246	3049281		
Total	11	69656482			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
1746.22	64.98%	51.85%	10.52%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	7213	50935	0.14	0.891	
GNI per capita	1.234	0.358	3.45	0.009	1.15
Household expenditure	-0.00104	0.00444	-0.23	0.821	2.29
Average tax of worker	-483	1261	-0.38	0.712	2.47

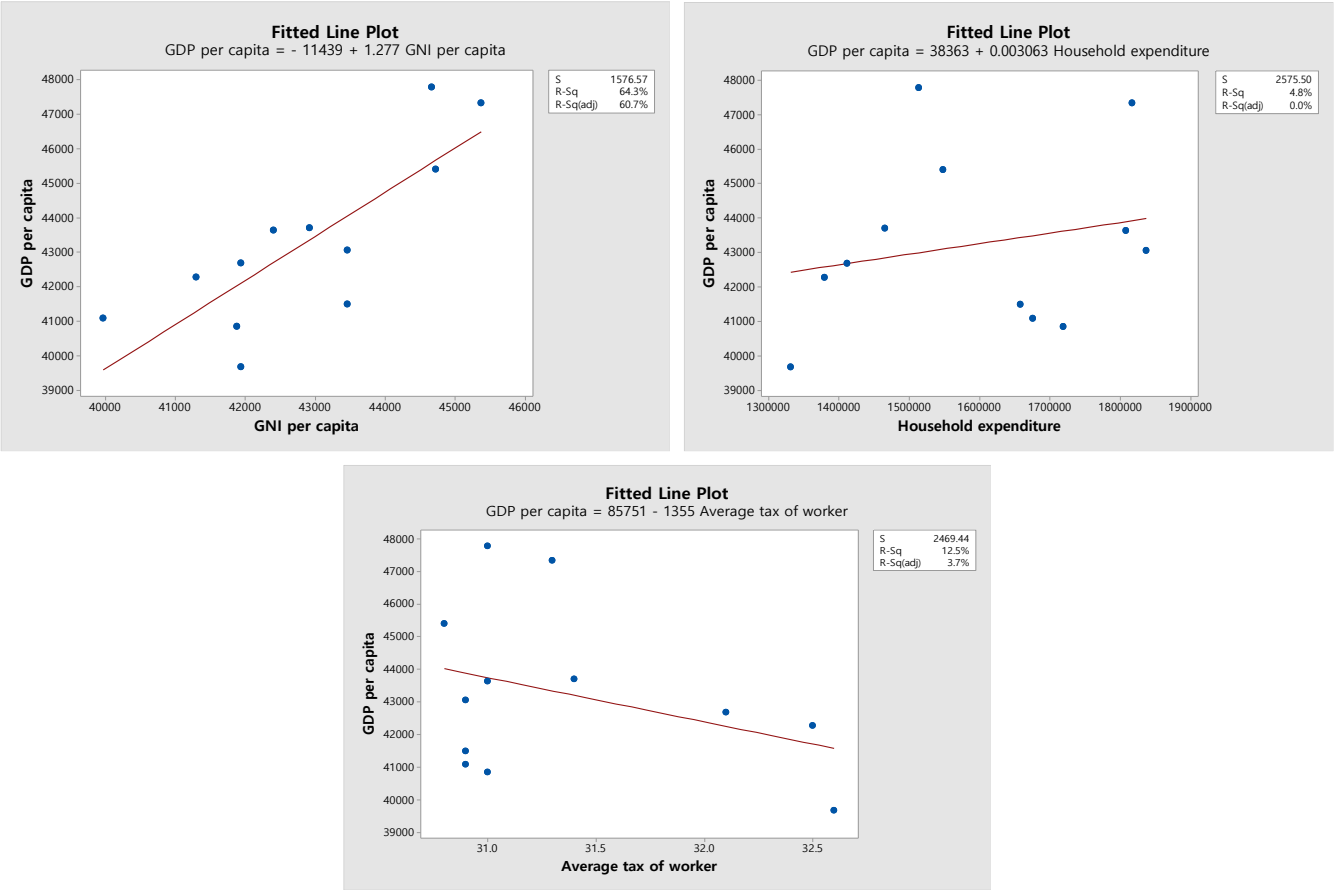

Fig. (10). The type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in the United Kingdom.

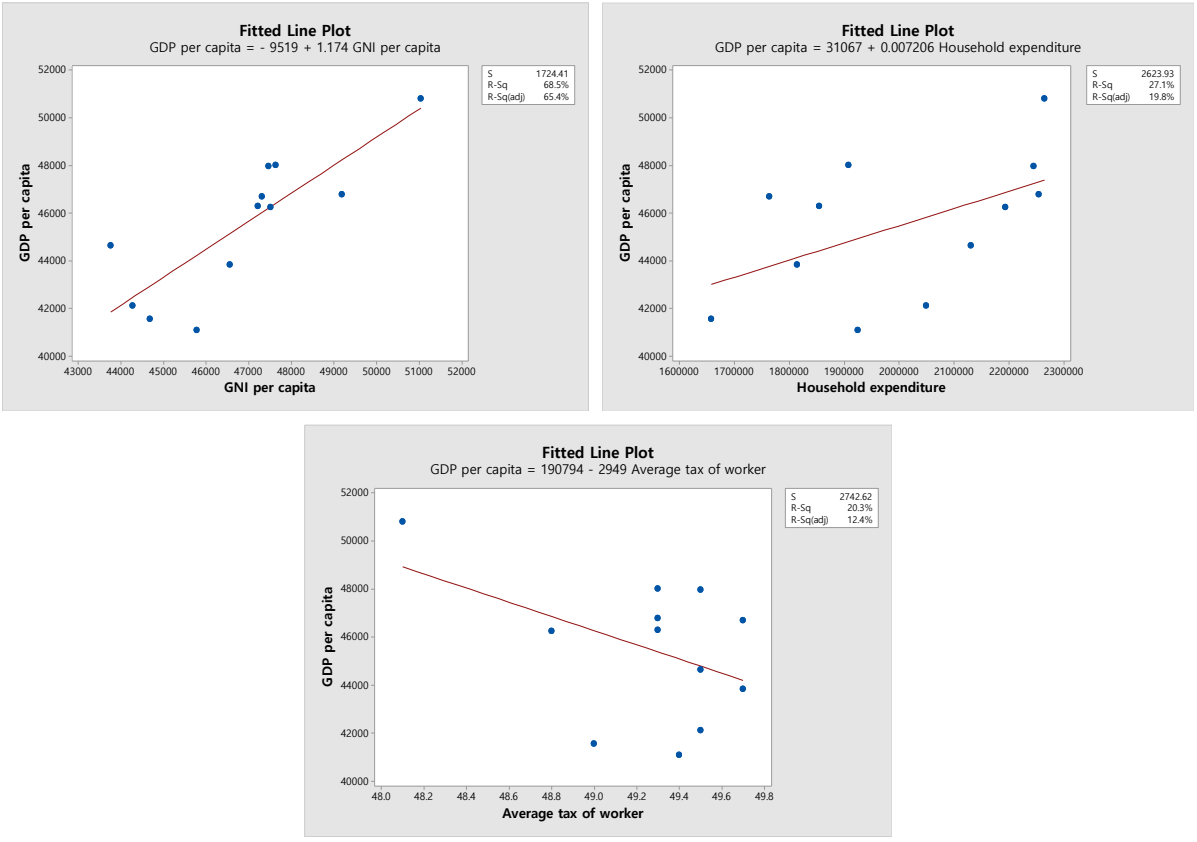

Fig. (11). The type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in Germany.

Table 10. The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in Germany.

Analysis of Variance					
Source	**DF**	**Adj SS**	**Adj MS**	**F-Value**	**P-Value**
Regression	3	67973975	22657992	6.85	0.013
GNI per capita	1	35389801	35389801	10.70	0.011
Household expenditure	1	3238726	3238726	0.98	0.351
Average tax of worker	1	268557	268557	0.08	0.783
Error	8	26462292	3307786		
Total	11	94436267			

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
1818.73	71.98%	61.47%	41.53%

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	-32914	83836	-0.39	0.705	
GNI per capita	1.098	0.336	3.27	0.011	1.60
Household expenditure	0.00290	0.00293	0.99	0.351	1.28
Average tax of worker	430	1508	0.28	0.783	1.52

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.009, 0.821, and 0.712, respectively. At a significance level of 0.05, GNI per capita is significant. R-sq (adj) is 51.58%, and the variation explained by the regression equation is 51.58% of the total variation. Economic indicators in the United Kingdom are slightly different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by the COVID-19 pandemic. There was no significant impact on the economy in the pre-COVID-19 pandemic period (2010-2021). In the variance analysis of the results of multiple regression analysis, the p-value is 0.891, so the regression equation is not significant at 0.05 level. The estimated regression equation is as follows.

GDP per capita = 7213 + 1.234 X_1 (GNI per capita) - 0.00104 X_2 (Household expenditure) - 483 X_3 (Average tax of worker)

We plotted the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in Germany. According to the results, gross national income per capita increased as per capita gross national income and household expenditure increased. The household expenditure had no effect as per capita gross national income decreased. As per capita gross national income decreased as the average tax of worker decreased. Germany showed a decrease in average tax of worker in comparison to the pre-COVID-19 pandemic period (2010-2019) despite the global economic shock caused by COVID-19 pandemic and the government's economic stimulus measures. Fig. (**11**) shows the type of data on the economic situation for the COVID-19 pandemic period (2010-2021) in Germany analyzed through plotting.

The multiple regression analysis result on the economic situation of the COVID-19 pandemic period (2010-2021) in Germany is described in Table **10**.

The p-values of GNI per capita, the household extension, and the average tax of worker are 0.011, 0.351, and 0.783, respectively. At a significance level of 0.05, GNI per capita is significant. R-sq (adj) is 61.47%, and the variation explained by the regression equation is 61.47% of the total variation. Economic indicators in Germany are similar to those from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by COVID-19 pandemic. There is no significant impact on the economy. The estimated regression equation is as follows. In the variance analysis of the results of multiple regression analysis, the p-value is 0.705, so the regression equation is not significant at the significance level 0.05. The estimated regression equation is as follows.

GDP per capita = -32914 + 1.098 X_1 (GNI per capita) + 0.00290 X_2 (Household expenditure) + 430 X_3 (Average tax of worker)

The following is a detailed analysis of the economic situation during the COVID-19 pandemic period (2010-2021). Economic indicators in the United States and Germany are similar to those from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused

by COVID-19 pandemic. There is no significant impact on the economy. In the case of South Korea, Japan, and the United Kingdom, economic indicators are slightly different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures as well. There was no significant impact on the economy in the pre-COVID-19 pandemic period (2010-2021).

6. RESEARCH DISCUSSION

The global economy is suffering from a severe economic recession as a consequence of the global spread of the COVID-19 pandemic and social distancing in each country. In response to the economic crisis caused by the COVID-19 pandemic, many countries have implemented economic stimulus measures and continue their expansionary fiscal policy. Effective COVID-19 pandemic prevention can also be considered as a requirement for each country's economic growth. Due to the expansion of fiscal expenditure in response to the COVID-19 pandemic, each country's fiscal deficit increased and expanded further, notably in advanced countries. Economic activities around the globe have restarted and economic recovery is rapid economic recovery is emerging as a result of each country's efforts to respond to the pandemic, but uncertainties in growth remain in some countries due to the pandemic's resurgence. Fiscal spending in each country in response to COVID-19 pandemic is increasing economic growth and contributing to the global economic recovery, but its practice effects must also be examined. Due to large-scale international liquidity, volatility in the international financial market is likely to increase while inflation concerns are likely to materialize. The pace of economic recovery in each country is expected to vary depending on the damage from the COVID-19 pandemic and each country's economic conditions despite the expansionary fiscal policy implemented by each country. For the global economy, the most alarming issue resulting from the COVID-19 pandemic is that the stagflation phenomenon is likely to happen. The pandemic is expected to change the behavior of households, enterprises, and the government. In the case of households, savings incentives will increase due to unemployment, while income reduction and restrictions on economic and social activities strengthen the tendency to hedge. Enterprises are expected to give greater value to resilience and flexibility against uncertainty rather than efficiency-promoting efforts such as reducing inventory costs. The government is expected to strengthen policies to support its own interests and the social safety net. Countries are expected to pursue economic activities with their own priorities as vulnerabilities in global supply chains are highlighted by production disruptions and lack of key materials caused by the COVID-19 pandemic. In the process of responding to the COVID-19 pandemic, the transition to the digital economy is expected to accelerate as economic and social activities resume. Since the structural changes in the global economy from the pandemic are not carried out independently, but affect each other instead, they can appear differently in various directions and at varying pace for each country.

7. CONCLUSIONS

In this study, we presented and discussed global economic shocks and national income indicators in relation to the COVID-19 pandemic. We focused on national income indicators to analyze the effects of economic stimulus measures implemented by many countries. Specifically, we analyze the effects of stimulus measures in five major countries (United States, South Korea, Japan, United Kingdom, and Germany) during the COVID-19 pandemic. Per capita GDP was set as a dependent variable, while per capita gross national income, household expenditure, and average worker tax were set as independent variables. Multiple regression analysis was used to analyze the effects of stimulus measures in the five countries. Comprehensive analysis of the economic situation during the pre-COVID-19 pandemic period (2010-2019) is as follows. In the case of the United States and Japan, it can be seen that there was no significant impact or impact on the economy during the pre-COVID-19 pandemic period (2010-2019). In the case of Korea and the United Kingdom, there was no significant impact or impact on the economy during the pre-COVID-19 pandemic period (2010-2019), but economic indicators have a considerable impact in terms of interaciton. In the case of Germany, there was no significant impact on the economy during the pre-COVID-19 pandemic period (2010-2019), but the household expenditure and the average tax of worker have a considerable impact in terms of interaction. The comprehensive analysis for the economic situation during the COVID-19 pandemic period (2010-2021) is as follows. In the case of the United States and Germany, economic indicators are not different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by the COVID-19 pandemic. There is no significant impact on the economy. In the case of South Korea, Japan, and the United Kingdom, economic indicators are slightly different from the pre-COVID-19 period (2010-2019), and the government has actively pursued economic stimulus measures in response to the global economic shock caused by the COVID-19 pandemic. There was no significant impact on the economy during the pre-COVID-19 pandemic period (2010-2021). We anticipate that the results of this study can contribute to the further study of stimulus measures.

APPENDIX

○ The Analysis Summary on the Economic Situation for the Pre-COVID-19 Pandemic Period (2010-2019)

In the results of multiple regression analysis in the United States, the normal probability plot shows a normal distribution, and in versus fits, it is random around 0 or less. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United States is described in Fig. (**1**). In the results of multiple regression analysis in South Korea, the normal probability plot shows a normal distribution, and in versus fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the *versus* order, the residuals do not exceed the management limit line and show a partially constant pattern. Results of multiple regression analysis on the economic situation

for the pre-COVID-19 pandemic period (2010-2019) in South Korea is described in Figure 2. In the results of multiple regression analysis in Japan, the normal probability plot shows a normal distribution, and in versus fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the *versus* order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Japan is described in Fig. (**3**). In the results of multiple regression analysis in the United Kingdom, the normal probability plot shows a normal distribution, and in versus fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the *versus* order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom is described in Fig. (**4**). In the results of multiple regression analysis in Germany, the normal probability plot shows a normal distribution, and in versus fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Germany is described in Fig. (**5**).

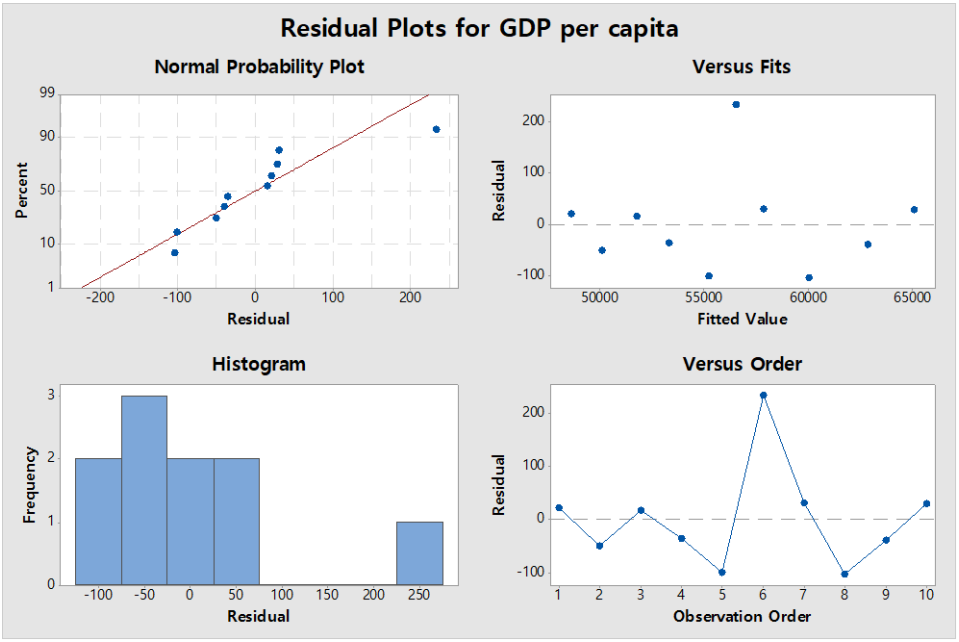

Fig. (1). Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United States.

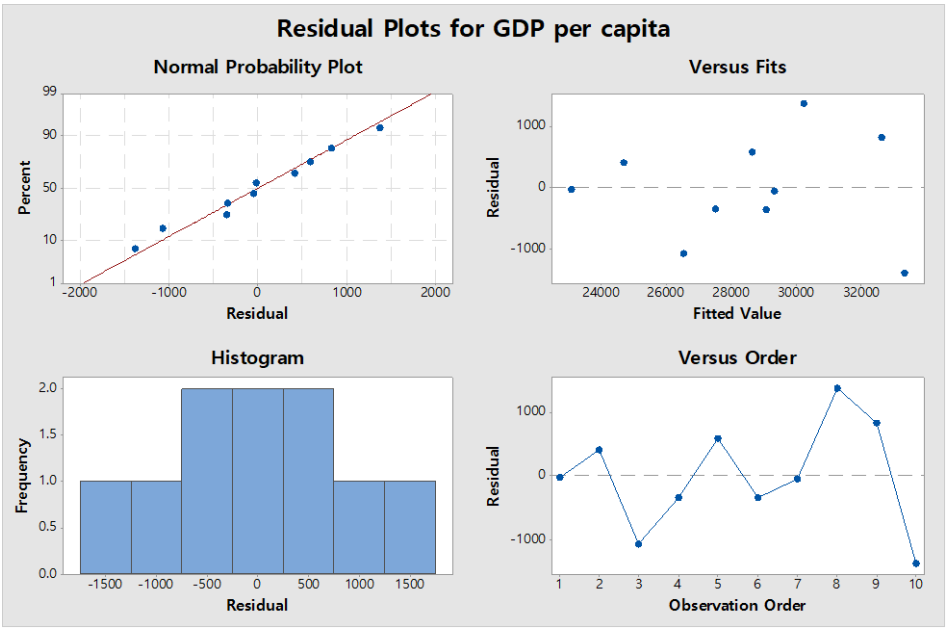

Fig. (2). Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in South Korea.

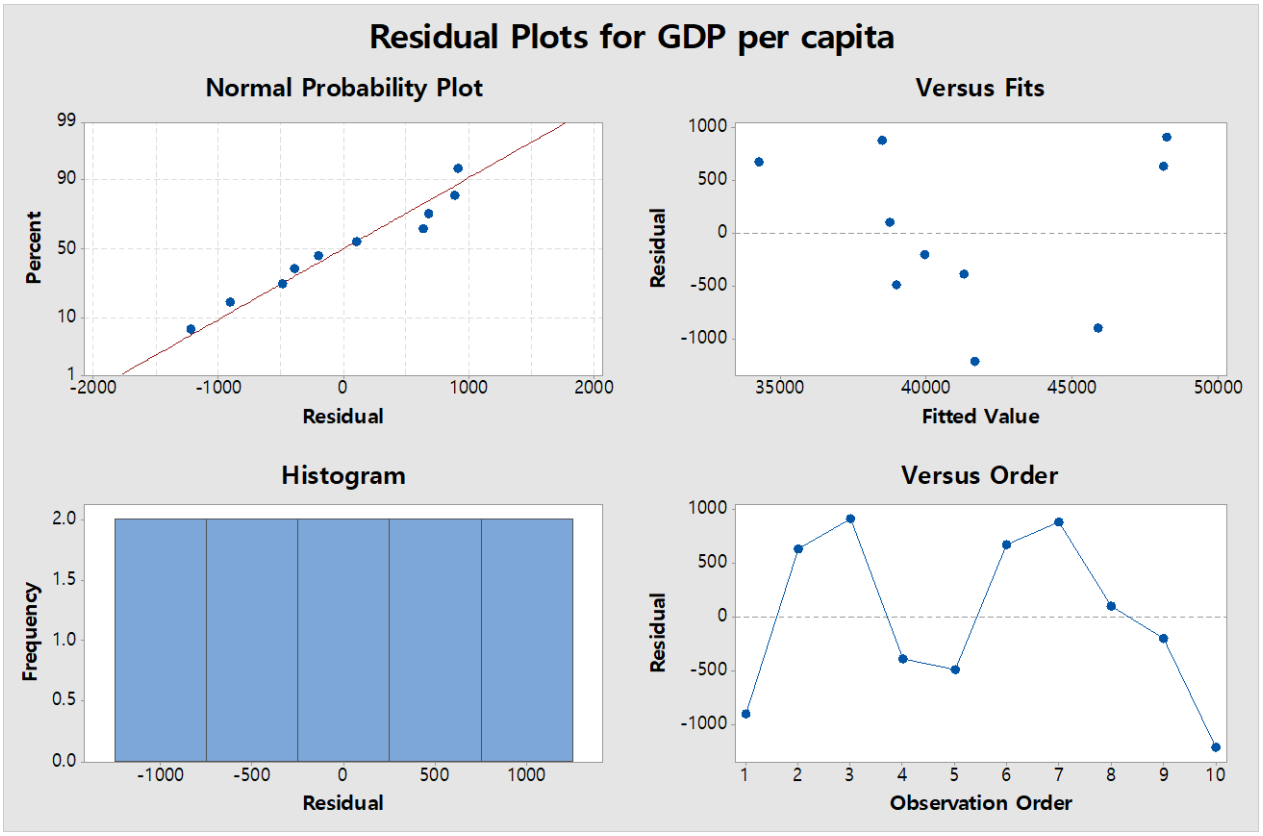

Fig. (3). Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Japan.

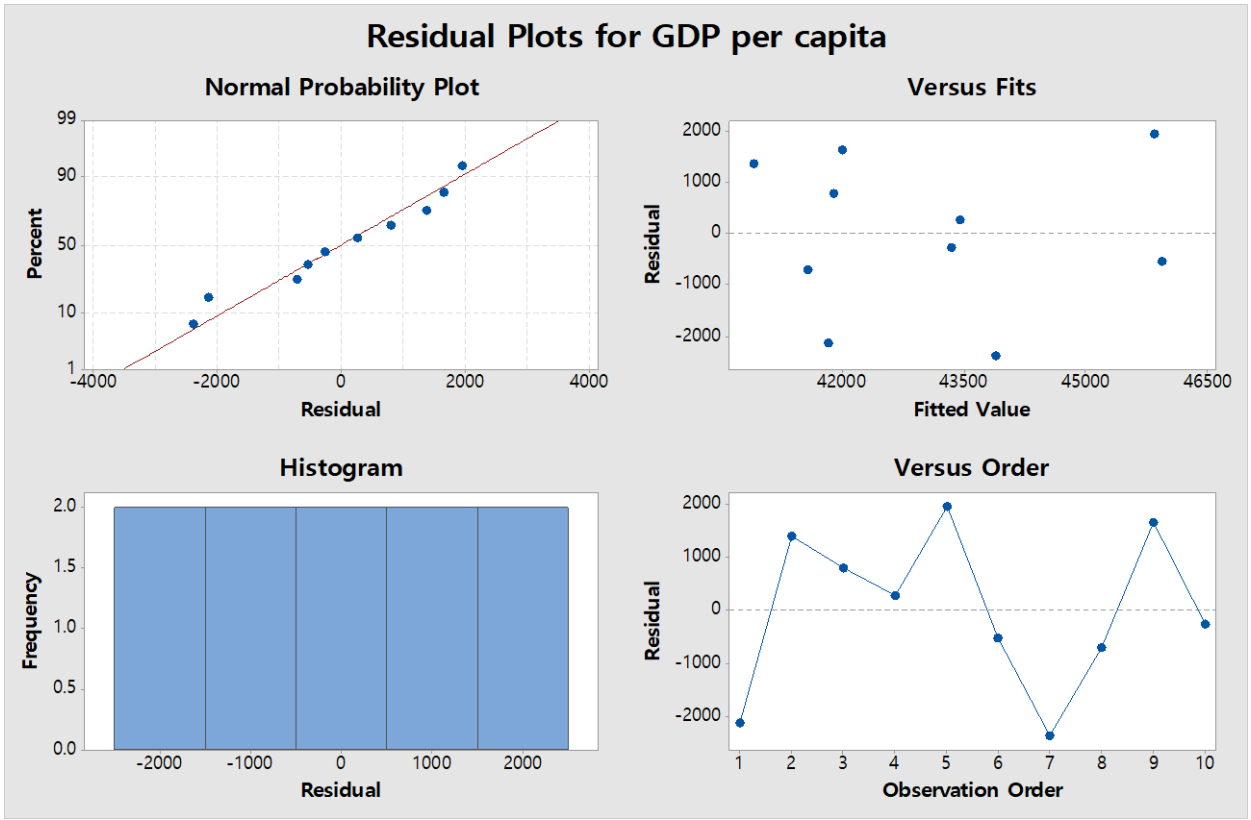

Fig. (4). Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in the United Kingdom.

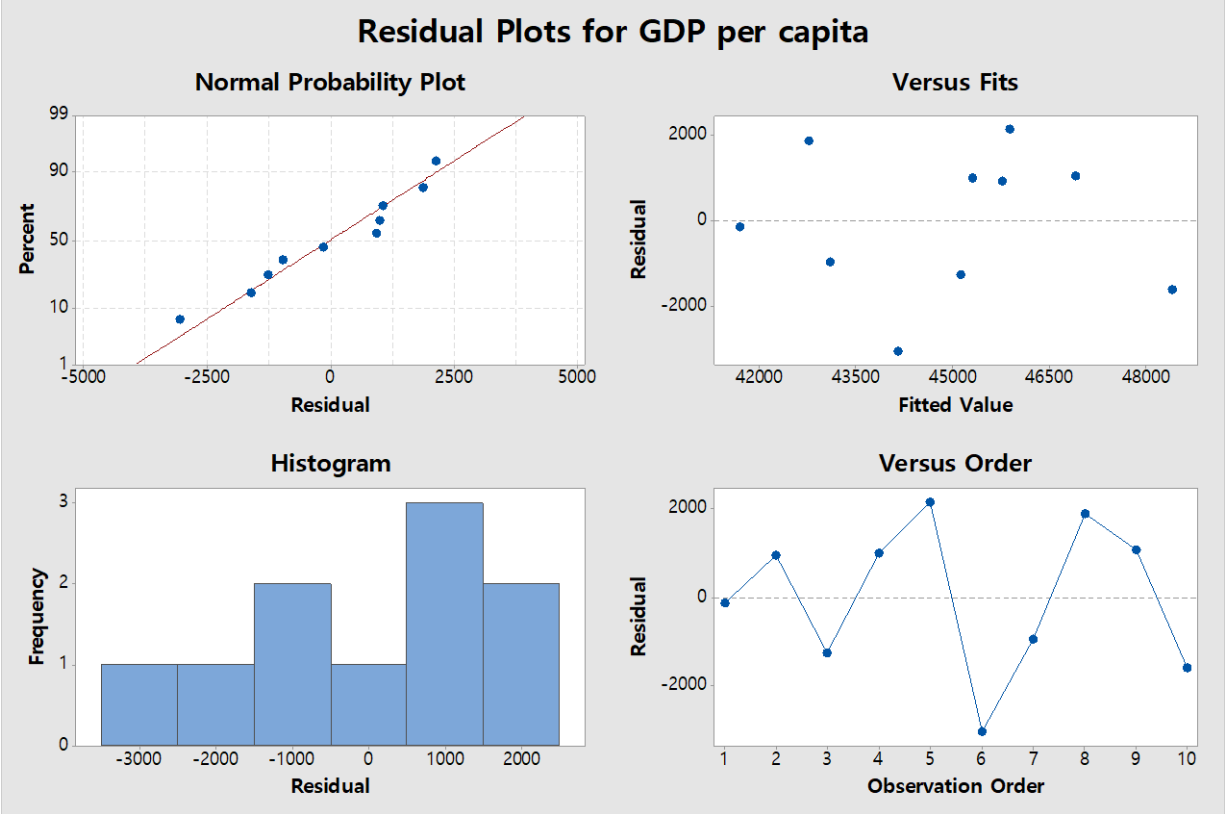

Fig. (5). Results of multiple regression analysis on the economic situation for the pre-COVID-19 pandemic period (2010-2019) in Germany.

○ The analysis summary on the economic situation for the COVID-19 pandemic period (2010-2021)

In the results of multiple regression analysis in the United States, the normal probability plot shows a normal distribution, and in versus fits, most of them are random at 0 or higher. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in the United States is described in Fig. (**6**). In the results of multiple regression analysis in South Korea, the normal probability plot shows a normal distribution, and in versus fits, it is random near zero. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and show a partially constant pattern. Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in South Korea is described in Fig. (**7**). In the results of multiple regression analysis in Japan, the normal probability plot shows a normal distribution, and in *versus* fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in Japan is described in Figure 8. In the results of multiple regression analysis in the United Kingdom, the normal probability plot shows a normal distribution, and in versus fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and do not show a constant pattern. Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in the United Kingdom is described in Fig. (**9**). In the results of multiple regression analysis in Germany, the normal probability plot shows a normal distribution, and in versus fits, it is random, away from zero. In the histogram, the residuals can be seen, and in the versus order, the residuals do not exceed the management limit line and show a partially constant pattern. Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in Germany is described in Fig. (**10**).

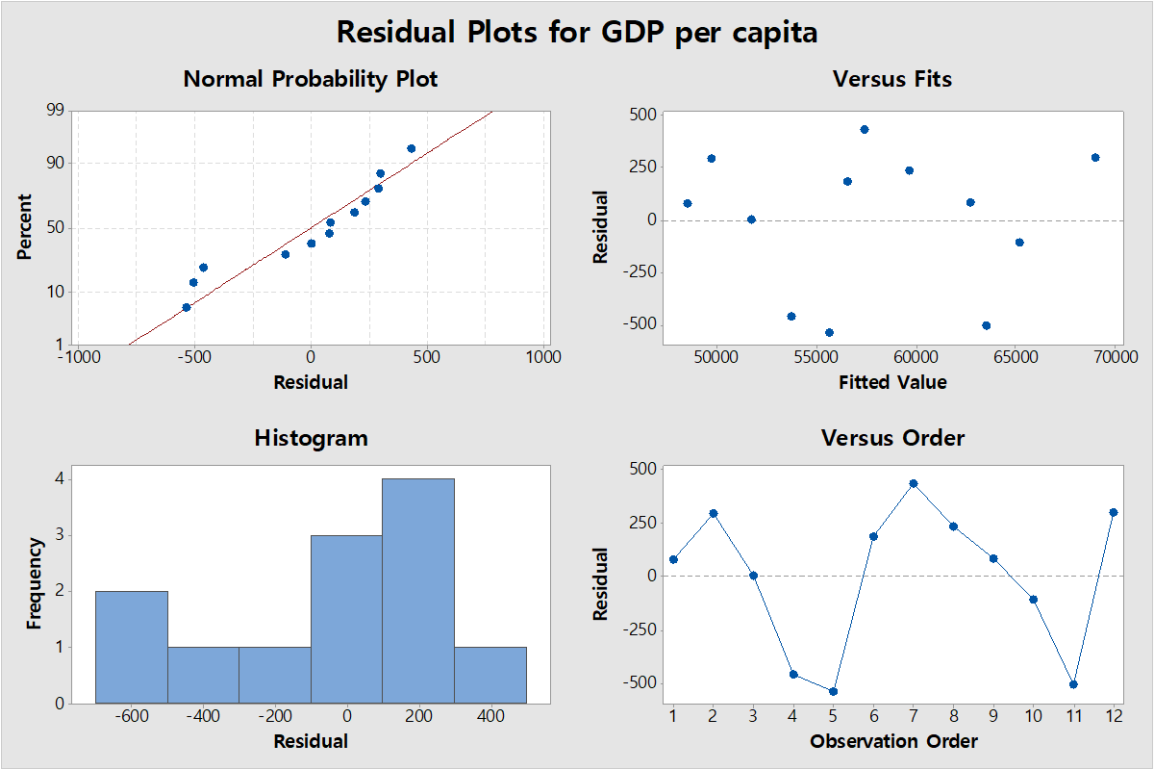

Fig. (6). Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in the United States.

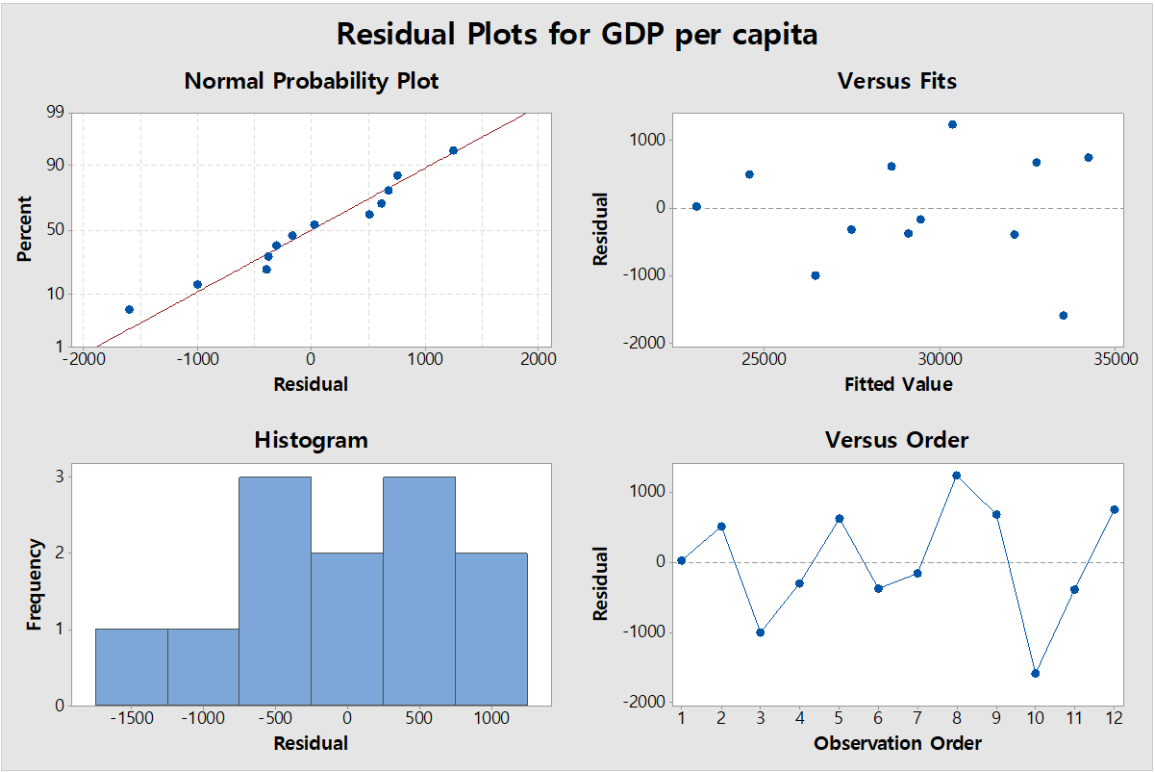

Fig. (7). Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in South Korea.

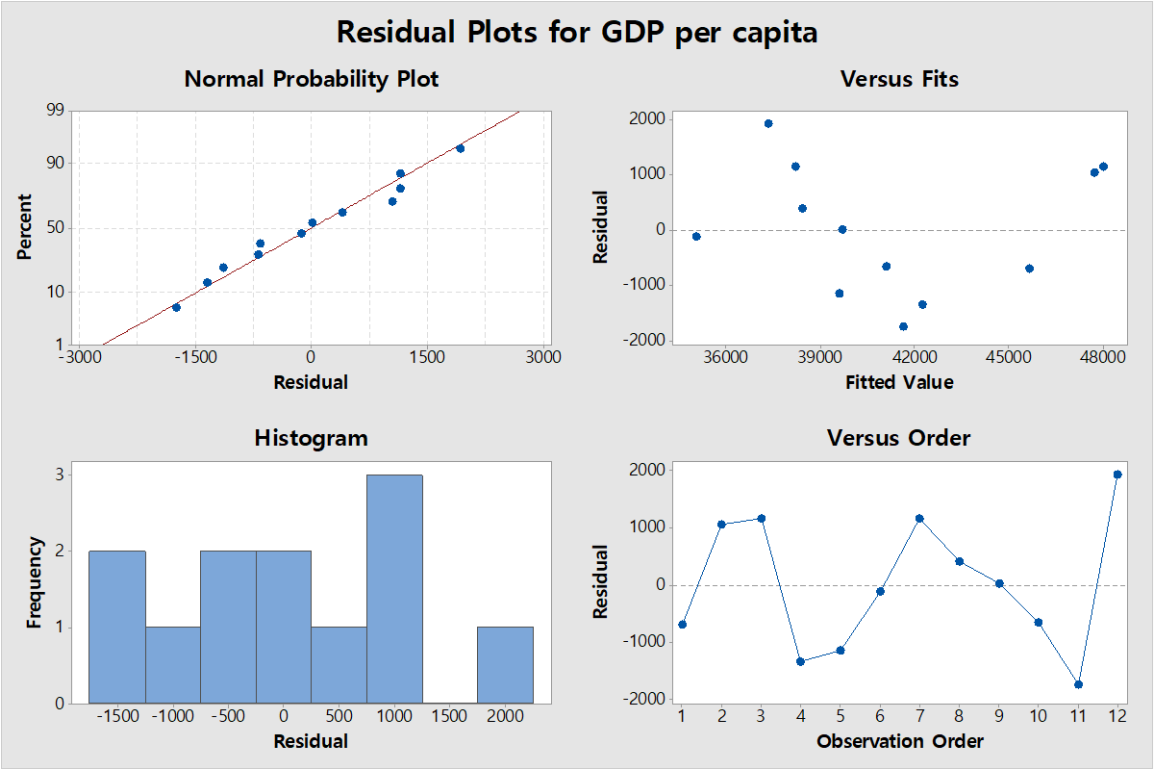

Fig. (8). Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in Japan.

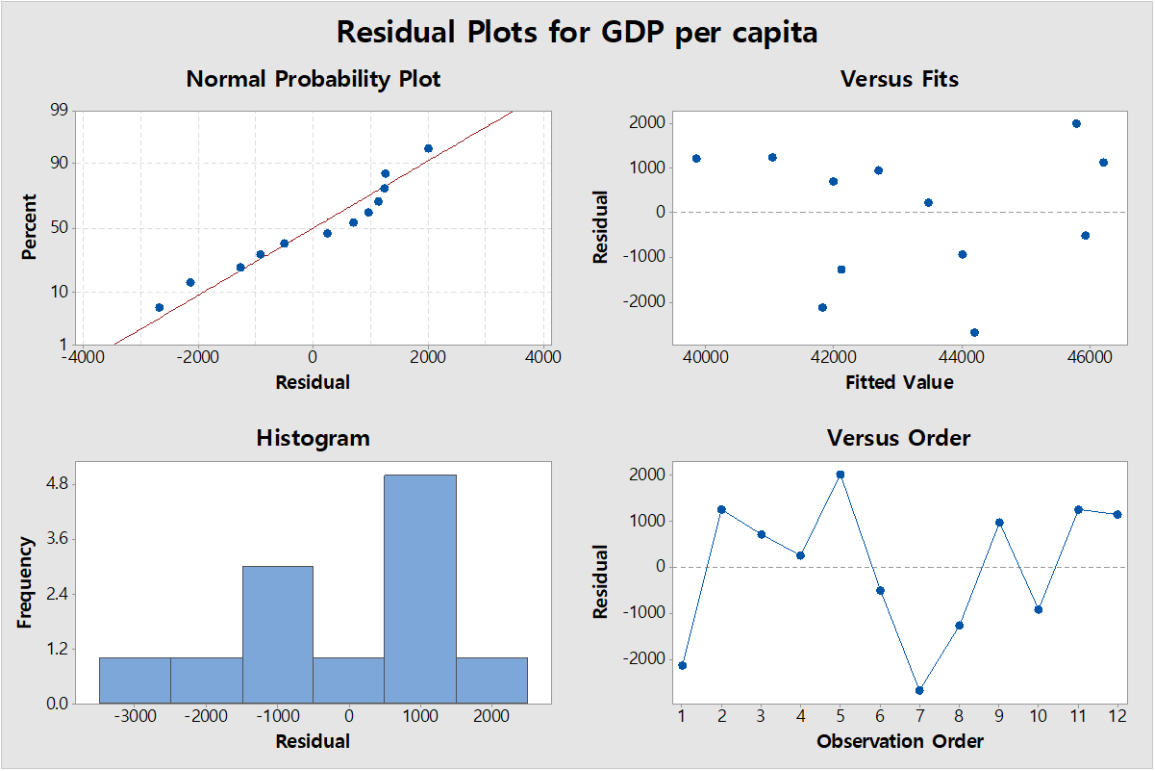

Fig. (9). Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in the United Kingdom.

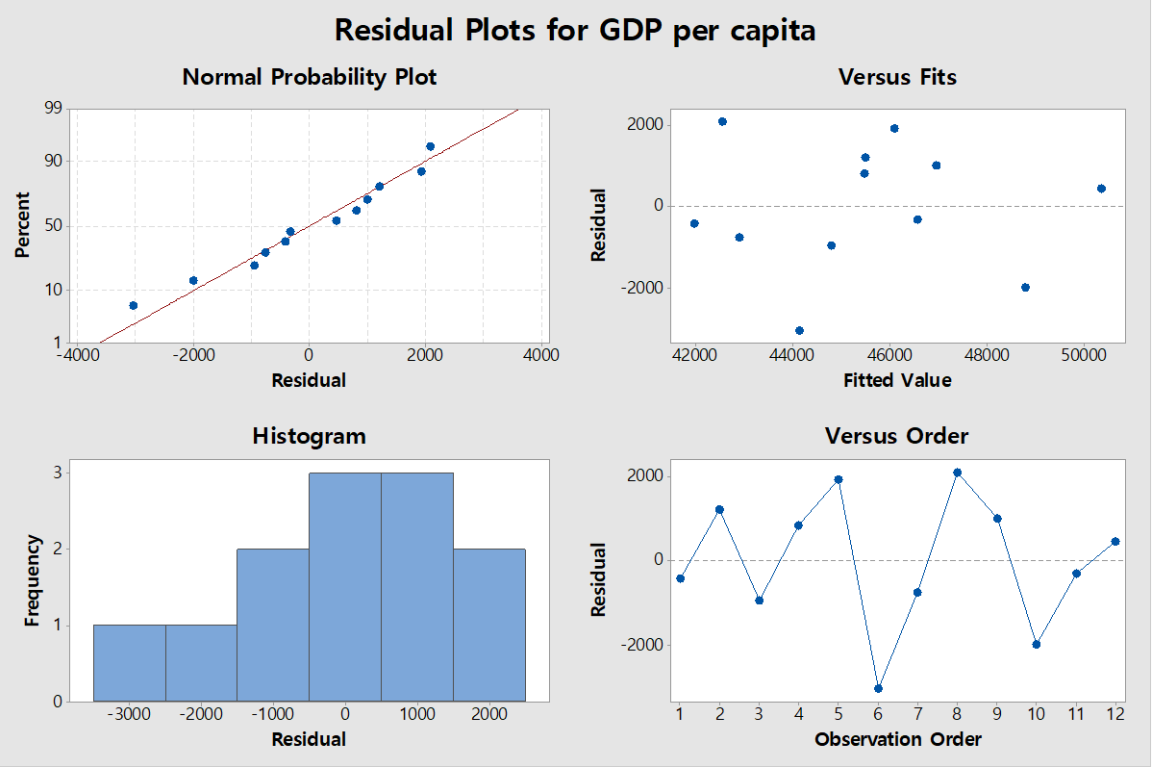

Fig. (10). Results of multiple regression analysis on the economic situation for the COVID-19 pandemic period (2010-2021) in Germany.

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