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THE ECONOMIC IMPACT OF INVESTMENT, EXPENDITURE AND WAGES ON GRDP – A CASE STUDY OF 47 PREFECTURES OF JAPAN IN 2005

The object of the study is the Japan's economy, which has an upward trend after the COVID-19 pandemic. However, there are still several challenges to ensure sustainable growth and economic development. Gross Regional Domestic Product (GRDP) as an economic indicator measures the value of a country's total goods and services. There is controversy and different beliefs in economics as to whether or not a country's GRDP is positively affected. The objective of this research is to find out the most important variable which is responsible for economic progress (GRDP). The main problem which this paper will analyze is that sometimes it is difficult to understand about which factor is more important for economic growth in national and regional basis, gross domestic product, and gross regional domestic product, such as investment, government expenditure, employment, and wages. This paper analyzes investment; government expenditure and wage influence on gross regional domestic product (GRDP) for Japan in 2005 and find out the possible outcomes that are more responsible for the GRDP in the Japanese economy. The results show all three factors have the dominant influences during this time; however, investment is the most powerful indicator among the 47 prefectures. It means that government should give more focused-on investment rather than government expenditure, employment, and wages. In analyzing the data, a comprehensive empirical analysis is conducted using Stata to calculate the statistics on central tendency and the distribution shapes such as minimum and maximum quantiles, standard deviation, sleekness, test for mean difference, and graphical presentation.

Keywords: *gross domestic product, gross regional domestic product, investment, government expenditure, employment, wages.*

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1. Introduction

The aim of the study is to analyze factors in a scientific way that affect Gross Regional Domestic Product (GRDP) and to reveal the possible solution that is responsible the most. Moreover, the outcome will help to take initiative practically by the government and benefit to stimulate the overall gross domestic product of the country.

The object of the study is the Japan's economy, which has an upward trend after the COVID-19 pandemic.

The government of Japan invest capital for job creation, industrialization, technological development, infrastructure development and so on in different prefectures of the country. As a result, the overall gross regional domestic product increase gradually; however, the GRDP growth is not equal in all prefectures equally and there are many gaps that need to make up by setting a strong policy. To reach the solution, there are many models and methods; among them Descriptive Statistics is one of the effective analyses to find out the probable solution where the country will enjoy optimum level of GRDP and less regional GRDP gap among the prefectures.

Economic development of a nation depends on various factors and sectors of the economy and an economic growth is measured by per capita income, Gross domestic product (GDP) at national level and Gross regional domestic product (GRDP) at regional level. Economic development, an effort to ensure public welfare, safeguards numbers of income inequality between the persons, province, and possibilities. GDP is one of the various key macroeconomic indicators often utilized in research when analyzing the health of a country's economy [1–3] whereas GRDP measures the economic performance of a region. There is broad consensus that education, in particular, the development of skills and knowledge in labour forces, potentially affects economic growth, which consequently promotes improvement in educational levels [4–6].

GRDP which is directly related to expenditure and income is usually measured either by overall expenditures or entire income. Consider an island where two families exist, and one family depends on catching fish while other family relies on cultivation on foods. So, here both families produce and purchase goods. In one year within the

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island, family one sold total 1000 dollars (total 1000 fishes) whereas second family sold total 1000 dollars (in foods items) with each other. The GDP of island is 2000 dollars by using either income or expenditure approach. It is possible to measure the GRDP by either pursuing expenditures or income of a nation. In the expenditure approach, GDP can be expressed as an equation that sums up all its components: a nation's level of consumption expenditures (*C*), gross private investment (*I*), government purchase or spending on goods and services (*G*), and the difference in profit between exports and imports (*Ex–Im*).

There are several economic factors or indicators such as consumption expenditures, investment, government spending, trade surplus, employment, technology, human resources, infrastructure, and natural resources that measure the swiftness of economic growth [7]. GDP measures the monetary value of final goods and services produced in a country in a given period of time while GDP is the same measures within a specific reason.

2. Materials and Methods

The study has been conducted in a comprehensive empirical analysis with a view to develop the information regarding gross regional domestic product with related factors by statistical analysis, for instance, linier regression analysis, coefficient and correlation, central tendency, minimum mean and maximum quantiles, standard deviation, skewness, kurtosis, test for mean difference and graphical presentation [8].

Data used in this study are based on the secondary panel data comprised of investment, government expenditure and employment of forty-seven prefecture of Japan in 2005 (Table 1, Fig. 1).

The evolution of the Gross Domestic Product is highly influenced by the evolution of the final consumption [3]. Final consumption and gross investment had dominant influences on gross domestic product (GDP) for Romania from 1990–2014, whereas net exports had a minimal yet statistically significant effect [9–12]. Nevertheless, it is still a matter of debate that which factor is more elastic in response to GRDP growth in Japan. This study will try to find out the most elastic factor that affect GRDP in Japan.

Table 1

Descriptive Statistics Variables

Gross Regional Domestic Product Per Capita	Numerical Continuous
Investment	Numerical Continuous
Gov Spending	Numerical Continuous
Wages	Numerical Continuous
Province	Categorical Discrete

Fig. 1. Map shown 47 prefectures of Japan

3. Results and Discussion

In this study, the location the nation is very crucial as the country is surrounded by ocean. It is assumed that environmental factors like an earthquake, tsunami or flues have not affected the economy severely over the shown period and other factors like inflation, education, technological know-how, prefecture location, physical appearance are remained constant.

In addition, it is observed that Hokkaido, Saitama, Chiba, Tokyo, Kanagawa, Aichi, Osaka, Hyogo, and Fukuoka are the prefecture where GRDP is high. However, if to analyze the fact, let's found that each of the factors affect the growth of GRDP. The correlation coefficient is a statistical measure of the strength of a linear relationship among variables.

Population is one of the major indicators of GDP growth and it is found that the employment highly depends on the population rate (Fig. 2). It is found that where population is greater the percentage of employment is larger. The higher the rate of employment the bigger the GRDP in prefecture. It is also noticeable that in metro area the rate of population and employment is greater.

As GRDP measures domestic production of final goods and services it is closely related with some important inputs which we explained earlier. The expenditure approach calculates GDP using total spending on domestic goods; but the equation can lead to a misunderstanding of how imports affect GDP. More specifically, the expenditure equation seems to imply that imports reduce economic output.

In Fig. 3–5 it is obvious that which factors are more responsible and which factors are less. Moreover, it can easily show that how investment dominant here.

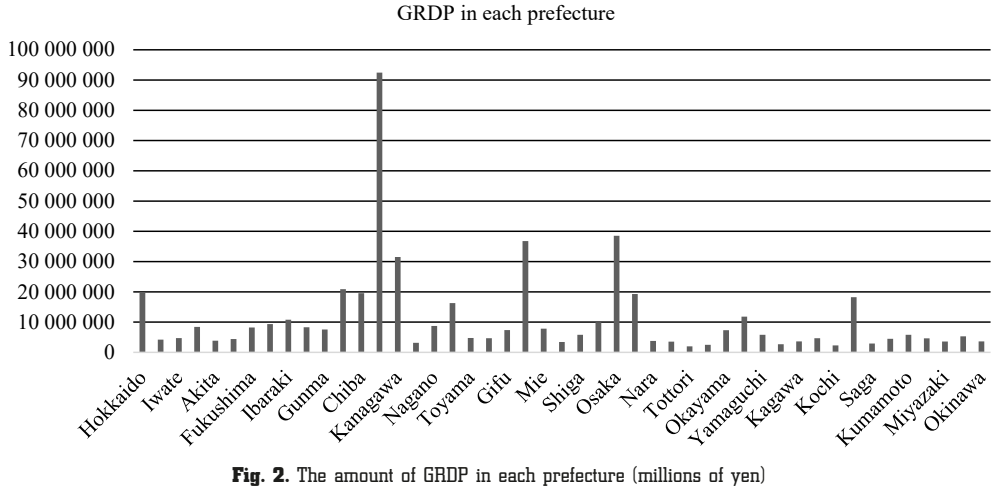

Fig. 2. The amount of GRDP in each prefecture (millions of yen)

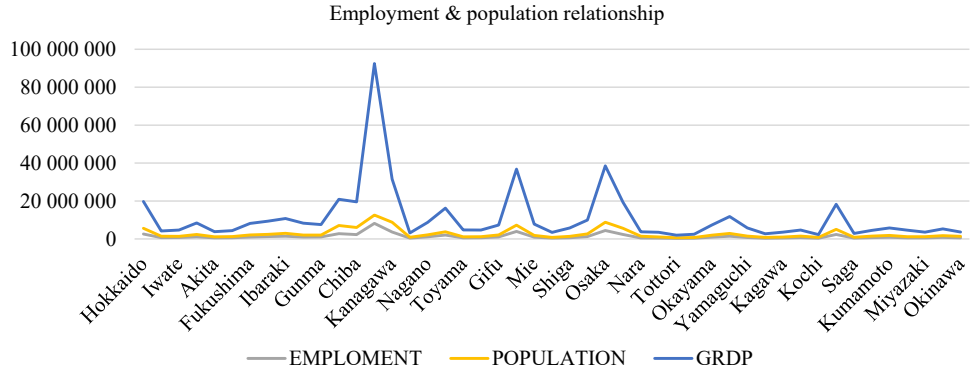

Fig. 3. Relationship among employment, population and GRDP (millions of yen)

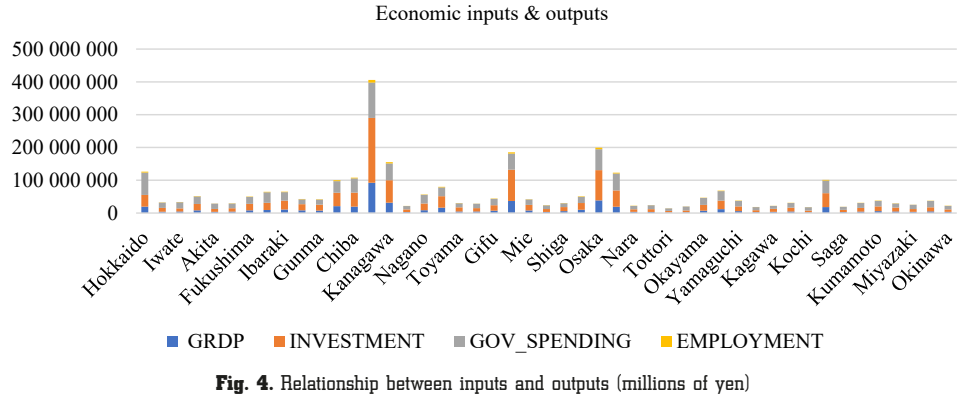

Fig. 4. Relationship between inputs and outputs (millions of yen)

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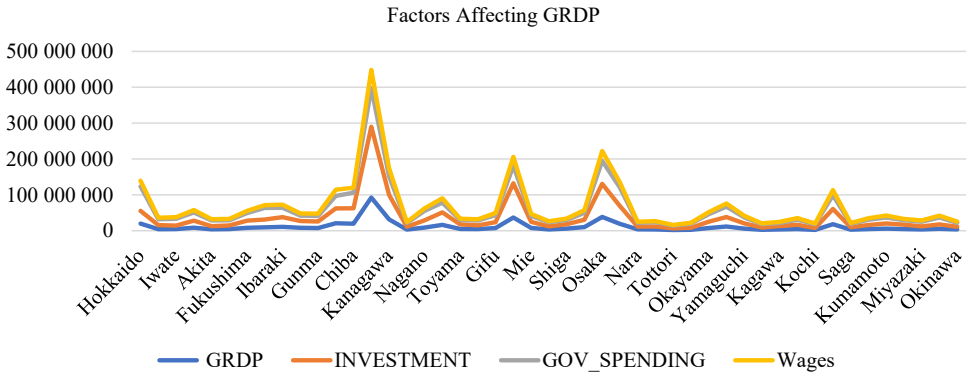

Fig. 5. Factors influences Japanese (millions of yen)

In Fig. 6, let's found that all three factors have positive correlation with GRDP; however, if to consider each factor separately investment and wages are more influential and strong linear relationship than government spending. The values can range from −1 to 1. A correlation coefficient of −1 describes a perfect negative, or inverse, correlation, with values in one series rising as those in the other decline, and vice versa. A coefficient of 1 shows a perfect positive correlation, or a direct relationship. A correlation coefficient of 0 means there is no linear relationship. It's clear that all three factors affect strongly to GRDP. It indicates that the more the government spends the greater the infrastructures develop results in additional job creation and private investment. This correlation is shown through a scatter plot between GRDP and other variables. It shows that when GRDP increase, Gov_spend, Investment and Wages also increase.

In Okun's Law regression model, it shows an inverse relationship between two variables (Fig. 7). The regression model is a determinant that can assist to focus the actual impact by considering investment:

$$lnGRDP=\alpha+\beta*lnInvestment+ei.$$

```
. corr GRDP Gov_Spend Investment Wages
(obs=47)
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	GRDP	Gov_Sp~d	Invest~t	Wages
GRDP	1.0000			
Gov_Spend	0.9268	1.0000		
Investment	0.9953	0.9199	1.0000	
Wages	0.9878	0.9538	0.9865	1.0000

Fig. 6. Correlation among GRDP, Gov_Spending, Investment and Wages

lnGRDP model describes that the regression coefficient of the variable *lnInvestment* is 1.01 with the corresponding *P*-value of 0.000. This means that the variable *lnInvestment t* has a positive effect on the dependent variable. In other words, if *Investment* increase 1 %, GRDP increases by 1.01 %. Moreover, Value *R*-squared=98 %, showing that the relationship between the variables is greater that proves the variable has significant impact on the GRDP variable.

The regression coefficient of the variable *lnWages* is 1.11 with the corresponding *P*-value of 0.000 (Fig. 8). This means that the variable *lnWages t* has a positive effect on the dependent variable. In other words, a 1 % increase in *lnWages* means a 1.11 % increase in GRDP:

$$lnGRDP=\alpha+\beta*lnWages+ei.$$

Value *R*-squared=98 %, showing that the relationship between the variables is greater that proves the variable has significant impact on the GRDP variable.

The regression coefficient of the variable *lnGov_Spend* is 1.30 with the corresponding *P*-value of 0.000 (Fig. 9). This means that the variable *lnGov_Spend t* has a positive effect on the dependent variable. In other words, a 1 % increase in *lnGov_Spend* means a 1.30 % increase in GRDP:

$$lnGRDP=\alpha+\beta*lnGov\_Spend+ei.$$

Value *R*-squared=98 %, showing that the relationship between the variables is greater that proves the variable has significant impact on the GRDP variable.

In summarize data it is obvious that *Investment* is more on average and government spending is less biased on the basis on prefectures (Figs. 10, 11).

```
. reg lnGRDP lnInvestment
```

Source	SS	df	MS	Number of obs	=	47
				F(1, 45)	=	4238.37
Model	31.978475	1	31.978475	Prob > F	=	0.0000
Residual	.339524667	45	.007544993	R-squared	=	0.9895
				Adj R-squared	=	0.9893
Total	32.3179997	46	.702565211	Root MSE	=	.08686

lnGRDP	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
lnInvestment	1.01334	.0155652	65.10	0.000	.9819905	1.04469
_cons	-1.064309	.2591177	-4.11	0.000	-1.586198	-.5424188

Fig. 7. Regression analysis of GRDP in respect of *Investment*

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. reg lnGRDP lnWages
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Source	SS	df	MS	Number of obs	=	47
				F(1, 45)	=	3646.34
Model	31.9240203	1	31.9240203	Prob > F	=	0.0000
Residual	.393979395	45	.008755098	R-squared	=	0.9878
				Adj R-squared	=	0.9875
Total	32.3179997	46	.702565211	Root MSE	=	.09357

lnGRDP	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
lnWages	1.110347	.0183878	60.38	0.000	1.073312	1.147382
_cons	-1.52907	.2870497	-5.33	0.000	-2.107218	-.950922

Fig. 8. Regression analysis of GRDP in respect of wages

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. reg lnGRDP lnGov_Spend
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Source	SS	df	MS	Number of obs	=	47
				F(1, 45)	=	422.78
Model	29.2090069	1	29.2090069	Prob > F	=	0.0000
Residual	3.10899282	45	.069088729	R-squared	=	0.9038
				Adj R-squared	=	0.9017
Total	32.3179997	46	.702565211	Root MSE	=	.26285

lnGRDP	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
lnGov_Spend	1.298496	.0631518	20.56	0.000	1.171302	1.42569
_cons	-5.993865	1.05989	-5.66	0.000	-8.128592	-3.859138

Fig. 9. Regression analysis of GRDP in respect of Gov_spending

```
. sum lnGRDP lnGov_Spend lnInvestment lnWages
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Variable	Obs	Mean	Std. dev.	Min	Max
lnGRDP	47	15.78479	.8381916	14.49709	18.34233
lnGov_Spend	47	16.77222	.6136757	15.85307	18.49637
lnInvestment	47	16.62729	.8228005	15.33862	19.10097
lnWages	47	15.59319	.7502758	14.46001	17.74161

Fig. 10. Summarize GRDP, Gov_spending, Investment and Wages

```
. correlate lnGRDP lnInvestment lnGov_Spend lnWages
(obs=47)
```

	lnGRDP	lnInve~t	lnGov_~d	lnWages
lnGRDP	1.0000			
lnInvestment	0.9947	1.0000		
lnGov_Spend	0.9507	0.9430	1.0000	
lnWages	0.9939	0.9877	0.9627	1.0000

Fig. 11. Correlation of all three factors

Finally, it is obvious that in Okun's Law regression model, the variable *lnInvestment t*, *lnWages* and *lnGov_Spend* where to increase 1 percent in GRDP it needs 1.01 % investment, 1.11 % wages and 1.30 % Gov spending. Moreover, each of the factors has value *R*-squared=98 %, showing that the relationship between the variables is greater that proves the variable has significant impact on the GRDP variable. In summarize data it is obvious that the impact of Investment is more in gross regional domestic product. To get the opportunities of more GRDP growth in 47 prefecture government and other private organization can contribute more to this regard. The practical application of this theory can make the country more stable and progressive in respect to economic situation.

The major limitation of the study is that the economic development of a country depends on various factors such as: the quality of education, fare, investment, capital, export and import, location, comparative advantage, wages and salaries, natural calamities and so on; however, here we did not consider all the factors. Moreover, it is assumed that the research is based on a closed economy therefore no exports and imports in the economy. This study conducts with Descriptive Statistics Variables and tries to explore the facts. All independent variables are counted as millions of yen. There are so many influential factors which should be counted and measured when further research is done. The appropriate measurement of these factors will make the research more accurate and applicable. Furthermore, primary data collection would ensure more accuracy of this research.

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4. Conclusions

This paper analyzes investment; government expenditure and wage influence on gross regional domestic product (GRDP) for Japan in 2005 and find out the possible outcomes that are more responsible for the GRDP in the Japanese economy. The results show all three factors have the dominant influences during this time; however, investment is the most powerful indicator among the 47 prefectures. It is obtained that the variable *lnInvestment t*, *lnWages* and *lnGov_Spend* where to increase 1 percent in GRDP it needs 1.01 % investment, 1.11 % wages and 1.30 % Gov spending. Moreover, each of the factors has value *R*-squared=98 %, showing that the relationship between the variables is greater that proves the variable has significant impact on the GRDP variable.

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Conflict of interest

I declare that there is no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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Data availability

Data will be made available on reasonable request.

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