The Effect of the Minimum Wage at District/City on the Open Unemployment Rate in Java Before and During the Covid-19 Pandemic

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ABSTRACT

This study aims to examine the effect of the minimum wage at the district/city level (MWD) on the open unemployment rate (OUR) before and during the Covid-19 pandemic on Java Island. In addition, this study also wants to see the impacts of other variables, namely the Human Development Index (HDI), Gross Regional Domestic Product (GRDP), and Labor Force Participation Rate (LFPR) on the OUR. This study applied a Geographically Weighted Regression (GWR) to data of all districts/cities in Java Island in 2019 and 2020. The results showed that before the Covid-19 pandemic, the change in MWD had a significant effect on OUR in 44 districts/cities, but during the pandemic, it affected OUR in 64 districts/cities. The estimated parameter coefficient for MWD is higher during the pandemic. Areas whose MWD coefficient is higher than before the pandemic are South Tangerang, Tangerang City, Serang city, Serang district, all DIY areas, all districts/cities in Central Java, and some areas in East Java. This study also found that the impacts of HDI, GRDP, and LFPR on OUR vary spacially before and during the Covid-19 pandemic.

Keywords: Geographically Weighted Regression, Minimum Wage, Open Unemployment Rate.

ABSTRAK

Penelitian ini bertujuan untuk mengkaji pengaruh dari upah minimum kabupaten/kota (UMK) terhadap tingkat pengangguran terbuka (TPT) sebelum dan saat pandemi Covid-19 di Pulau Jawa. Selain melihat pengaruh UMK , penelitian ini juga ingin melihat pengaruh peubah lain, yaitu Indeks Pembangunan Manusia (IPM), Produk Domestik Regional Bruto (PDRB), Tingkat Partisipasi Angkatan Kerja (TPAK) terhadap TPT. Penelitian ini menerapkan Geographically Weighted Regression (GWR) pada data tahun 2019 dan 2020. Hasil penelitian menunjukkan bahwa sebelum pandemi Covid-19, peubah UMK berpengaruh signifikan terhadap TPT pada 44 kabupaten/kota, namun saat terjadi pandemi UMK berpengaruh terhadap TPT di 64 kabupaten/kota. Estimasi koefisien parameter untuk peubah UMK lebih tinggi saat pandemi Covid-19. Wilayah dengan koefisien UMK lebih tinggi dibanding sebelum pandemi Covid-19 adalah Kota Tangerang Selatan, Kota Tangerang, Kota Serang, Kabupaten Serang, semua wilayah DIY, semua kabupaten/kota di Jawa Tengah dan beberapa wilayah di Jawa Timur. Hasil penelitian juga memperlihatkan bahwa peubah IPM, PDRB dan TPAK bervariasi dalam mempengaruhi TPT sebelum dan saat pandemi Covid-19.

Kata Kunci: *Geographically Weighted Regression, Tingkat Pengangguran Terbuka, Upah Minimum.*

INTRODUCTION

The Minimum Wage at District/City defined as the minimum wage that is applied in each district/city, which amount is set by the Governor annually. Susilawati (2012) implied that the minimum wage is an employment agreement between an employer and workers, including benefits, both for the worker himself and his family.. Workers certainly need adequate wages to meet their needs of living and to support their families. Nevertheless, the company's ability to pay workers also needs to be considered so that the business continuity could be maintained. The increase in labor costs, if not offset by the company's profits, has an impact on reducing the number of workers, in addition, if the company relocates the company to other regions, then more employees will lose their jobs in the region. Those will certainly increase unemployment.

A variety of researches that raises the issue of unemployment have been widely conducted, for example, open unemployment in Yogyakarta by Muslims (2014), unemployment in West Java Province by Septiyanto and Tusianti (2020), open unemployment in East Java Province by Muminin and Hidayat (2017), open unemployment in Central Java by Kurnia and Septiani (2021) and Irawati et al. (2020). The updated research known using the Geographically Weighted Regression (GWR) spatial model for unemployment data in Java was conducted by Amalia and Sari (2019). They identified open unemployment on java island in 2017. The advantage of the GWR model compared to the classic regression model is that it included territorial effects so that the model could be built locally (Cellmer et al., 2020).

During the Covid-19 pandemic, some business sectors made job cuts (layoffs) on their employees, based on the data from the Ministry of Manpower, until July 2020 there were more than 3.5 million workers affected by layoffs, thus increasing the number of unemployed. Based on the data of the Central Bureau of Statistics (BPS), in 2020 there were 138.22 million workers, of which 9.77 million were unemployed, of these 9.77 million unemployed, 65 percent were in Java. BPS also noted that the provincial Open Unemployment Rate (OUR) in Java Island from 2019 to 2020 increased by more than 30 percent. Furthermore, in East Java and DKI provinces, the upsurge was more than 50 percent.

Although many types of researches regarding unemployment have been conducted, it is a fact that unemployment is one of the important macroeconomic indicators in the development of a region. In addition, the number of unemployed workers also changes every time, therefore this research is become very essential to be realized. Putri et al. (2021) examined the factors that influenced OUR before and during the Covid-19 pandemic, but the investigation was only up to the provincial level and did not include regional effects. On the contrary, using GWR, spatial analysis can be done up to the district/city level so that this research's output can be useful for regional's policymaking.

The purpose of this study is to investigate the influence of MWD on OUR before and during the Covid-19 pandemic on Java Island. In addition to explore the influence of MWD, this study also wants to identify the influence of the Human Development Index (HDI), Gross Regional Domestic Product (GRDP), and Labor Force Participation Rate (LFPR) on OUR in Java Island.

METHODS

This study used secondary data in cross section form to examine the conditions before the Covid-19 pandemic in 2019, and also the conditions during the Covid-19 pandemic in 2020, which covered 119 districts/cities in Java Island. The variables used in this study are described in Table 1.

Table 1. Description of Variables

Variable Dependent: OUR is the Open Unemployment Rate in August, unit of percent	
Variable Independent:	
MWD	Minimum wage at district/city set through the Governor's Decree, the unit is million rupiahs.
HDI	Human Development Index by the unit of percent
GRDP	Natural logarithm of Gross Regional Domestic Product based on constant prices
LFPR	August Labor Force Participation Rate, unit percent

Geographically Weighted Regression (GWR) model is the development of regression model, while the parameter value in the regression model is identical for each region. Meanwhile, in the GWR model, each region's parameter is calculated individually so that each region has a different parameter value (Fotheringham et al., 1998). Dependent variables in the GWR model are chosen from the independent variables whose regression coefficients each depend on the location where the data is observed (Lu et al., 2011). The GWR model can be stated in the following way:

$$y_i = \beta_0(u_i, v_i) + \sum_{k=1}^{p} \beta_k (u_i, v_i) x_{ik} + \varepsilon_i$$

y_i = Dependent variables on location to -i ($i = 1,2, \dots, n$)
x_{ik} = Independent variables to-k on location to-i ($i = 1,2, \dots, n$)
$(u_i v_i)$ = Latitude and longitude coordinates from point to- i at a geographical location
β_k = Parameter coefficient value to-k ($k = 1,2, \dots, p$)
ε_i = Error at the point of observation to-i

Estimation parameters at each location to- i use Weighted Least Square (WLS) with the following formula:

$$\hat{\beta}(u_i, v_i) = [\boldsymbol{X}^T \boldsymbol{W}(u_i, v_i) \boldsymbol{X}]^{-1} \boldsymbol{X}^T \boldsymbol{W}(u_i, v_i) \boldsymbol{y}$$

Where $\boldsymbol{W}(u_i, v_i)$is a matrix of n x n with a diagonal spatial weighting at location -i. The spatial weighting used in this study is the Gaussian Adaptive Kernel function.

$$\boldsymbol{w}_{ij} = exp\left(-\left(\frac{d_{ij}}{b_i}\right)^2\right)$$

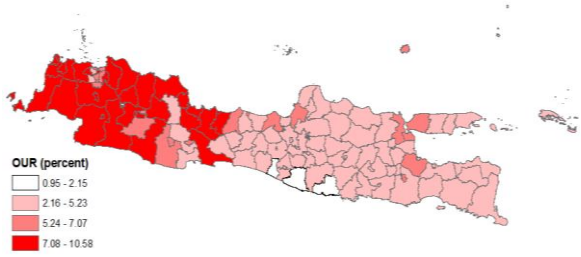
With $d_{ij=}\sqrt{(u_i - u_j)^2 + (v_i - v_j)^2}$ where u_i is the latitude coordinate at the location to -i and v_i is the longitude coordinate at the location to -i, b is the known non-negative parameter and is usually known as the smoother (bandwidth). Adaptive Gaussian Kernel is a function that has a different bandwidth for each point of observation location. On the one hand, if each locations are nearby, it will provide a small bandwidth. On the other hand, if the distance between locations is far apart it will produce a large bandwidth value.

The good criteria of the model used to compare models are the value Coefficient of determination R^2, Root Mean Square Error (RMSE), and Mean Absolute Percentage Error (MAPE). The best models are the models with the largest R^2values and the smallest RMSE and MAPE.

RESULTS AND DISCUSSIONS

The Open Unemployment Rates (OUR) for all districts/cities in Java island have enlarged after the Covid-19 pandemic. The average district/city tax rate in Java In 2019 amounted to 5.27 percent, while in 2020 it was 7.34 percent. In 2020, the region with the highest OUR numbers is Bogor Regency and Cimahi City at 14.29 and 13.30 percent sequentially, and the region with the lowest OUR is Gunung Kidul Regency at 2.16 percent.

Before The Covid-19 Pandemic



During The Covid-19 Pandemic

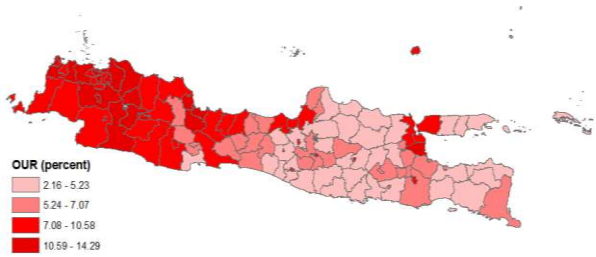


Figure 1. OUR in Java Before and During The Covid-19 Pandemic
Source: Calculated from The Central Bureau of Statistics Data, 2020

Based on Figure 1, it can be seen that during the Covid-19 pandemic there was a fairly high increase in OUR. In addition, there are several districts/cities in Java island that before the Covid-19 pandemic had OUR below the national OUR number, where the national OUR in 2019 approached 5.23. Meanwhile, when there was a Covid-19 pandemic, it became above the national OUR in 2020, which reached 7.07. Before or during the Covid-19 pandemic, areas that have OUR numbers above the national OUR number are dominated by the western part of Java Island, which are the districts/cities located in West Java Province, Banten Province, and DKI Jakarta Province. While the eastern part of Java island has a lower OUR number. The grouping of OUR numbers in Java island shown in Figure 1 can be used as early detection of spatial influences which are further studied by testing spatial effects.

Table 2. Estimated Parameters Ordinary Least Square

Variables	Coefficient		Standard Error		P-value	
	2019	2020	2019	2020	2019	2020
Intercept	27,61	18,20	4,33	4,78	0,00*	0,00*
MWD	0,77	0,999	0,27	0,28	0,049*	0,00*
HDI	-0,076	0,03	0,03	0,03	0,01*	0,32
GRDP	0,16	0,32	0,195	0,22	0,39	0,15
LFPR	-0,31	-0,31	0,04	0,04	0,00*	0,00*

Note: *significant alpha 0,05
Source: Calculated from The Central Bureau of Statistics Data, 2019 and 2020

The initial stages carried out in this study were the formation of linear regression models and the checking of classical assumptions from linear regression estimation methods, namely assumptions of normality, homoscedasticity, and non-multicollinearity. The normality assumption test using the Shapiro Wilk test resulted in p-value of 0.68, this value is greater than 0.05, so it can be assumed that residual data is the normal distribution. In non-multicollinearity testing, it was concluded that there was no multicollinearity because the VIF value of each variable was less than 5. In homoskedasticity testing at once to find out spatial diversity using the Breusch-Pagan test can be seen in the results of spatial effect testing.

Spatial Effect Testing

Testing of spatial effects used to determine the presence of spatial diversity and spatial dependence. In spatial diversity testing using the Breusch-Pagan test, The Breusch-Pagan test was able to find out spatial diversity in Observations (Fotheringham et al. 2002). The Breusch-Pagan value produced in the 2020 regression model is 22.03 with the degree of freedom is 4 and a p-value of 0.00, so it is concluded that there is diversity between regions. Spatial dependency testing can use Moran's I values (Lee and Wong, 2001). In 2020, the variable OUR obtained moran's I value of 0.39 and p-value of 0.00, so it can be concluded that there is spatial dependence. The results of spatial diversity and dependence tests indicate that there is a spatial effect on the data so it is best to incorporate region influences into regression models.

Estimated Parameters of GWR Model

The estimated parameters on the GWR model will produce different regression coefficients in each region. A summary of the estimated value of parameters in districts/cities in Java Island can be seen in Table 3.

Table 3. Summary of GWR Model Parameter Estimation

Variables	Minimum		Maximum		Mean		Standard Deviation	
	2019	2020	2019	2020	2019	2020	2019	2020
Intercept	0,75	-19,68	41,67	41,31	15,93	7,56	12,75	14,96
MWD	0,26	-0,38	1,97	8,65	0,85	2,13	0,49	2,12
HDI	-0,24	-0,35	0,056	0,30	-0,05	0,07	0,097	0,18
GRDP	-0,34	-1,37	0,31	1,35	0,016	0,07	0,18	0,59
LFPR	-0,41	-0,54	0,24	0,31	-0,13	-0,17	0,17	0,15

Source: Calculated from The Central Bureau of Statistics Data, 2019 and 2020

In 2020, the estimated intercept parameters at OUR observation sites in Java island ranged from -19.68 to 41.31. Independent variables of MWD, HDI, GRDP, and LFPR are vary spacially at each location, meaning that in certain regions the change of independent variables will decrease the number of OUR, while in other regions it will increase. Table 4 compares linear regression models and GWR models in 2020 by looking at the values of R^2 Sum Square Error (SSE), and Mean Absolute Percentage Error (MAPE). The GWR model can increase the value of R2 also lowers SSE and MAPE, meaning that the value of the resulting residual diversity is getting smaller so that the estimate is closer to the actual data.

Table 4. Compared Model in 2020

Model	R^2	SSE	MAPE
Regression	61,92	368,78	21,96
GWR	90,83	88,77	10,66

Source: Calculated from The Central Bureau of Statistics Data, 2020

GWR Model Parameter Significance Testing

Significance testing on parameters aims to find out independent variables that have a significant effect on OUR in each district/city in Java Island. The results of the model parameter significance test are presented in the form of a thematic map in Figure 2 for conditions before the Covid-19 pandemic, and Figure 3 for the current conditions of the Covid-19 pandemic. Some differences affect OUR in each district/city between before and during Covid-19. Some variables did not have a significant effect on OUR before the Covid-19 pandemic, but when the Covid-19 pandemic the variables had a significant effect and vice versa.

In the period before the Covid-19 pandemic, MWD had a significant effect on OUR in 44 districts/cities in Java Island, namely in all districts/cities in West Java, 4 cities in DKI, 11 districts/cities in Central Java, and Lebak and Pandeglang districts in Banten Province. At the period of the Covid-19 pandemic, MWD had a significant effect on OUR in 64 districts/cities, namely in 14 districts/cities in West Java, in all districts/cities in Central Java, DIY, 6 districts/cities in East Java, and 4 city districts in Banten.

Before the Covid-19 pandemic, HDI significantly affected OUR in 49 districts/cities, while during the pandemic had a significant effect in 84 districts/cities. For DKI and Banten districts/cities, HDI affected OUR both before and during the Covid-19 pandemic. HDI affected OUR in all districts/cities in West Java before the Covid-19 pandemic, but when there is a pandemic Covid-19, HDI only had a significant effect in 5 districts/cities. In the contrast to West Java, for districts/cities in Central Java, HDI was initially influential in 11 districts/cities before the Covid-19 pandemic, when the pandemic expanded to as many as 22 districts/cities. Before the Covid-19 pandemic, HDI had no significant effect

on OUR in DIY and East Java, but during the Covid-19 pandemic, HDI had a significant effect on OUR in all districts/cities in DIY and East Java.

GRDP does not have a significant effect on OUR in all districts/cities in Java island before the Covid-19 pandemic, but when there is a Covid-19 pandemic, GRDP affects OUR in 21 districts/cities in Java Island. Before the Covid-19 pandemic, LFPR had a significant effect on OUR in 79 districts/cities, but when there is a pandemic Covid-19 LFPR affects OUR only in 55 districts/cities. LFPR did not affect OUR in the DKI region before or during the Covid-19 pandemic.

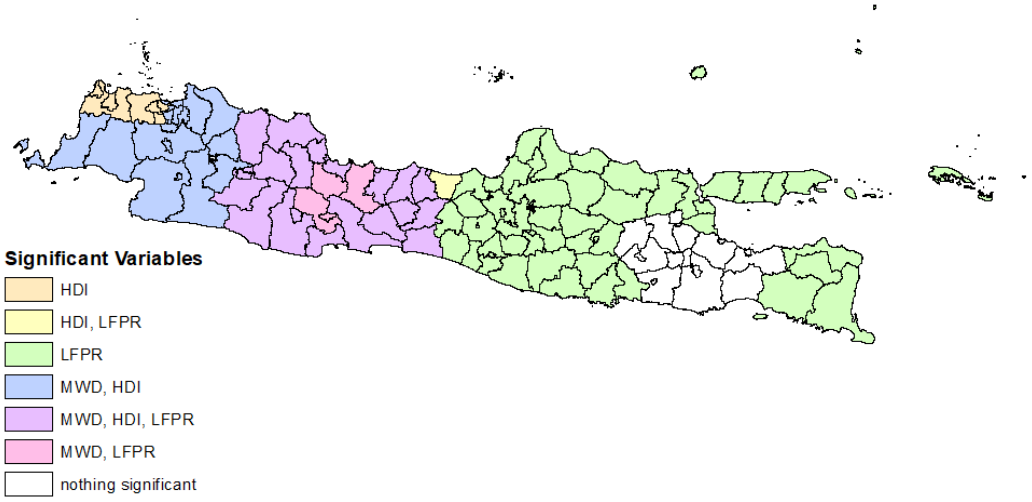


Figure 2. Significant Variables Before The Covid-19 Pandemic

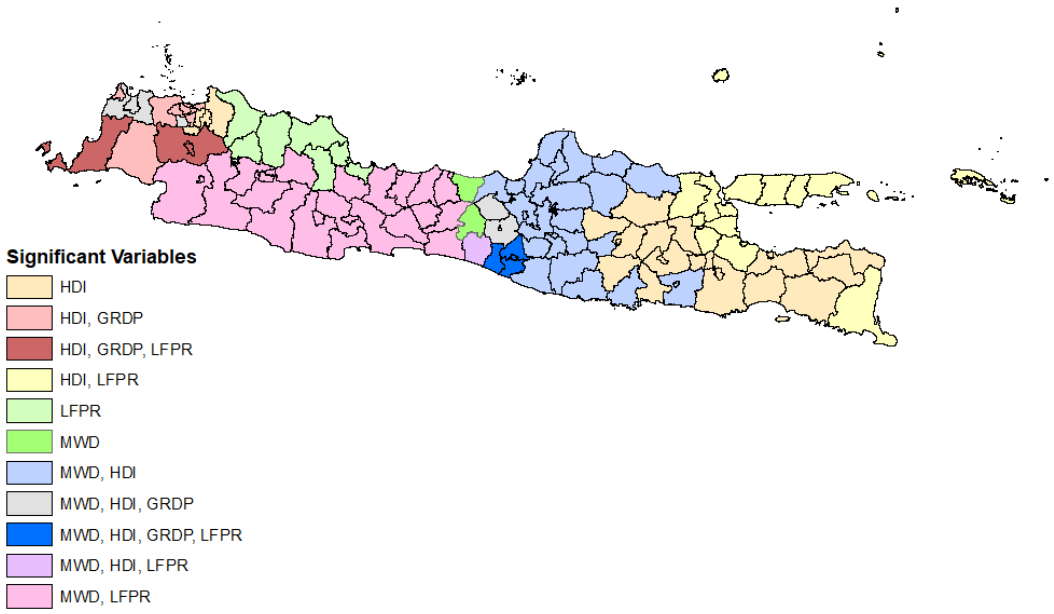


Figure 3. Significant Variables During The Covid-19 Pandemic

Assumption Check

To determine the normality of the remainder by looking at the results of the Shapiro-Wilk normality test, Shapiro-Wilk values in 2019 and 2020 amounted to 0.99 with a p-value of more than 0.05, which means that it meets the assumptions of modeling. To see if GWR can address the problem of spatial dependence can be seen through Moran's I value on residual GWR models. The resulting Moran's I value is close to zero which means the residual GWR model no longer contains spatial dependence. In addition, the p-value of the Breusch-Pagan Test results is more than 0.05. Therefore it can be assumed that the GWR model can address spatial diversity issues.

Parameter Coefficient Comparison

Before and during the Covid-19 pandemic, the MWD significantly positively affected OUR in several districts/cities in Java Island, this is in line with the research by Rofik et al. (2018) where the minimum wage has a positive effect on unemployment in West Kalimantan, and also the research by Septiyanto and Tusianti (2020) where MWD has a positive effect on West Java OUR.

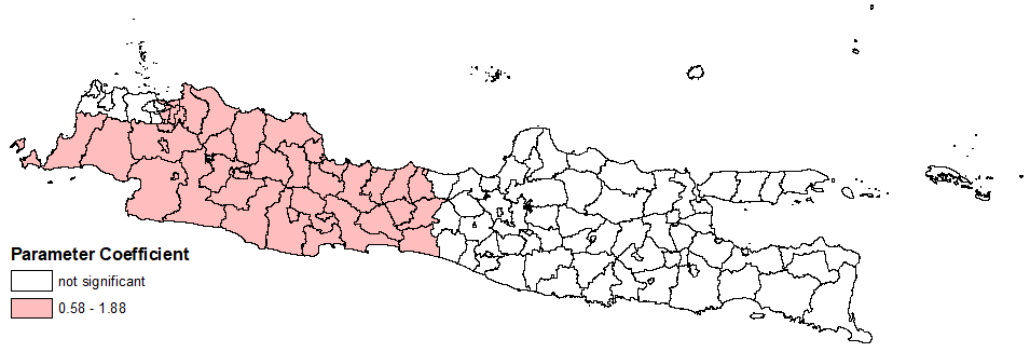


Figure 4. MWD Parameter Coefficient Before The Covid-19 Pandemic

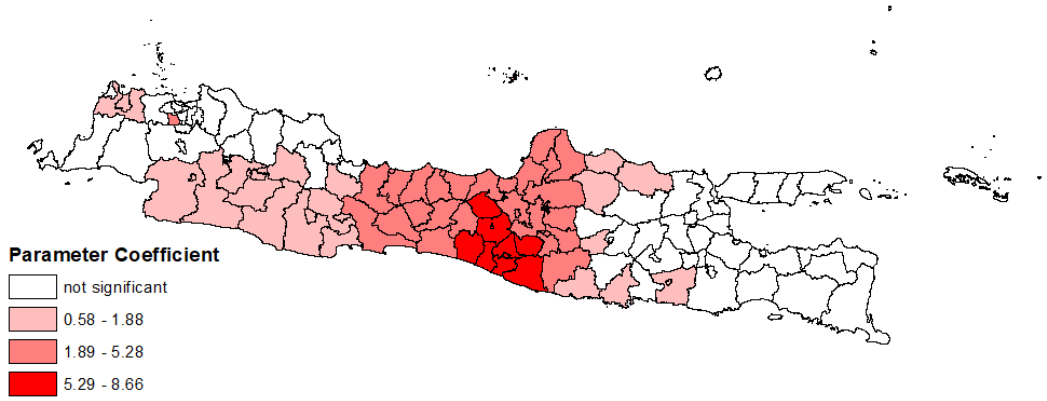


Figure 5. MWD Parameter Coefficient During The Covid-19 Pandemic

At the period of the Covid-19 pandemic, most MWD parameter coefficient values had higher numbers. It occurs in some areas in Java, even there are some areas whose MWD initially has no significant effect on OUR, but during the covid-19 pandemic, the effect becomes significant. This means that the influence of MWD on OUR in districts/cities in Java Island when the Covid-19 pandemic is stronger than before the Covid-19 pandemic. Areas that have stronger MWD influence include South Tangerang City, Tangerang City, Serang Regency, Serang City, all districts/cities in DIY, all districts/cities in Central Java, and some regions in East Java. Here is an example of the GWR model in South Tangerang City before dan during the Covid-19 pandemic:

GWR model before Covid-19 pandemic is

$$\widehat{OUR} = 5.74 + 0.8MWD + 0.221HDI + 0.02GRDP + 0.24LFPR$$

and GWR model during Covid-19 pandemic is

$$\widehat{OUR} = 12.52 + 3.09MWD + 0.35HDI + 0.97GRDP + 0.08LFPR.$$

The interpretation of both models can be seen from the influence of the MWD variable. In 2019, the MWD effect is not significant so MWD does not affect OUR in south Tangerang city, but by 2020 an increase of 1 million MWD will increase OUR by 3.09 percent. OUR's influence on TPT in districts/cities in Java during the Covid-19 pandemic was stronger than before the Covid-1 pandemic due to many layoffs during the Covid-19 pandemic. Research conducted by Napitupulu and Nainggolan (2021) and Juaningsih (2020) implied that during the Covid-19 pandemic many companies made job cuts (layoffs) to their workers to reduce the fixed cost which they had to pay monthly. The cause of these layoffs is the central government's policy towards the implementation of large-scale social

restrictions (PSBB) resulting in the closure of some companies that are forced to did that due to losses which impacting to their inability to pay their employees salaries (Putri et al., 2021).

Figures 6 to Figure 11 of the appendix describe the parameter coefficient values for the other three variables, namely HDI, GRDP and LFPR. The coefficient values of HDI, GRDP, and LFPR parameters in the period of the Covid-19 pandemic are more diverse, even some coefficient values are greater which means that these variables have a stronger influence on OUR.

CONCLUSIONS

Before and during the Covid-19 pandemic, the MWD variable significantly positively affected TPT in some areas in Java Island, however, during the Covid-19 pandemic, the influence of MWD was more widespread and the effect was stronger on OUR. Before the Covid-19 pandemic, MWD had a significant effect on OUR in 44 districts/cities, while during the Covid-19 pandemic MWD had a significant effect on OUR in 64 districts/cities. Areas that have the influence of MWD against OUR are stronger, namely, South Tangerang City, Tangerang City, Serang Regency, Serang City, all DIY areas, all districts/cities in Central Java, and some areas in East Java. This study also found that the impacts of HDI, GRDP, and LFPR on OUR are varying spacially before and during the Covid-19 pandemic.

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