Panel Seemingly Unrelated Regression on Employment in Tourism Sector: Evidence in Central Java Province

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ABSTRACT: Job opportunities are the main problem faced by Indonesia because of the large population, high population growth rate and large workforce. The tourism sector has a large multiplier effect on employment and become a potential sector as a source of income for a country or region. By combining cross-section and time-series data in 35 districts and cities in Central Java Province from 2016-2020 and the Seemingly Unrelated Regression Panel approach. The results showed that supporting infrastructure for the tourism sector, such as the number of hotel rooms and the number of restaurants, had an effect on employment in the tourism sector, and a positive effect was shown by the variable number of tourist objects and tourist visits. The coefficient value on the wage variable which is quite large indicates that the elasticity of employment related to wages is quite high. The implication of the research is increasing the quality and quantity of sustainable tourist objects can attract an increase in foreign and domestic tourist visits so as to increase the workforce through the tourism sector. The implication of the study to strengthen among government, private sector and local community to develop sustainable tourism sectors.

Keywords: Panel Seemingly Unrelated Regression, Multiplier Effect, Tourism Sector, Employment.

Kata Kunci: Panel Seemingly Unrelated Regression, multiplier effect, sektor pariwisata, tenaga kerja.
INTRODUCTION
The tourism sector is one of the potential sectors as the main source of income for a country or region. The tourism sector plays a major role in achieving advanced development, both in Indonesia and in the region, especially in terms of the economy. The role of the tourism sector will open up opportunities to create wider employment opportunities (Maulana, 2016). Job opportunities are the main problem faced by Indonesia because of the large population, high population growth rate and large workforce. Absorption of labor has an important role in the growth and development of the national economy in a country. Garsous et al (2017) stated that government intervention in the tourism sector there was a high increase in the tourism sector for labor absorption (multiplier effect). Another result from his study in the SUDENE area of Brazil that government intervention employment in the tourism sector increase around 30 percent compared without government intervention. Akrong (2019) explain that the tourism sector can play important role in socio-economic development.

Panjaitan & Gunnanto (2021) stated that the tourism potential of the province of Central Java is quite large, as can be seen from the districts/cities in Central Java Province which have various tourist objects, restaurants, hotels and other supporting infrastructure as well as more than half Regencies/cities in Central Java have increased productivity. Central Java has tourism potential that is different and unique and has aspects of availability, both in tourism facilities and infrastructure that are expected to be available around tourist areas including public infrastructure, tourist infrastructure. Central Java received appreciation as a large province in the tourism sector, the Indonesia Attractiveness Award (IAA) 2019 Gold for the category of a large province in the tourism sector because it has good tourist attractions and still has a lot of development potential and was awarded the Muslim Travel Index (IMTI) as a leading halal tourist destination. The central java provincial government classifies forms of tourism such as natural, cultural, artificial, special interest tourist attractions and other. The number of natural and artificial tourism made a large tourist attractions than other kind of tourism form.

Figure 1. Graphic The Total Employment and Employment in Tourism Sector

Figure 1 explains that there has been an increase in employment in Central Java Province, but in 2020 the increase in employment in the tourism sector has increased compared to absorption of labor as a whole, this shows that the development of the tourism sector in an area can increase employment opportunities, as well as provide a multiplier effects on business fields related to the tourism sector. The highest growth in the tourism sector for labor absorption in 2019 reached 16.98 percent and fall in 2020 to 8.38 percent due to the COVID-19. Subardini (2018) and Aliansyah & Hermawan (2021) states that the success of the tourism sector will encourage regional income, in which this sector is a major part by observing factors that can influence it which include tourist objects, tourist visits (domestic/foreign tourists), hotel/restaurant tax rates, hotel occupancy rates, per capita income, and the level of tourist attraction fees. Sun et al (2021) stated apart from having a multiplier effect on the labor absorption the tourism sector has particular vulnerabilities to the labor. Kartseva & Kuznetsova
explains that labor absorption on tourism sector has experiences for the highest vulnerability, caused the tourism sector is an informal sector, low wages, unskilled labor, there is formal contract, individual entrepreneur and include in the form of micro and small business. Based on report from Youth, Sports and Tourism Department that labor absorption in tourism sector decrease from 16.98 percent in 2019 to 8.38 percent in 2020. The number tourist attraction also fell from 20.52 percent in 2019 to 14.51 percent in 2020.

Earlier study from Leiper (1979) explained in term of tourism industry combine from government, private and local community can provide infrastructure that they can serve the desires and needs of tourist. Xiaojuan et al (2012) emphasize that individual who purpose for traveling seek pleasure and not to visit friends or families. Afandi & Alie (2015) state that visitors will determine what they want, such as taking a vacation where there are adequate facilities at their tourist destination. Supporting facilities in the tourism sector will increase the number of tourists which will have an impact on increasing employment. Nindita & Dewi (2018) state that the number of tourist visits will increase the workforce through residential locations, transportation and accommodation to consumption needs. The large multiplier effect from the impact of the tourism sector will attract investors who can make the ecosystem of employment more bigger. Maulana (2016) states that the main characteristics of the tourism sector are service, product and time. These three characteristics are related to the infrastructure of the tourism sector such as hotels, restaurants, transportation, tourist attractions to souvenirs. Herrero et al (2022) stated that ecosystem in the tourism sector is a complex ecosystem, caused relates to accommodation, restaurants, transportation and leisure activities. Become more complex if in area there are several destinations.

Tabel 1. Total Visits of Domestic and International Tourists in Central Java Province

<table>
<thead>
<tr>
<th>Tahun</th>
<th>Domestic Tourists</th>
<th>Foreign Tourists</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>36,899,755</td>
<td>578,924</td>
</tr>
<tr>
<td>2017</td>
<td>40,188,470</td>
<td>781,107</td>
</tr>
<tr>
<td>2018</td>
<td>48,943,607</td>
<td>677,168</td>
</tr>
<tr>
<td>2019</td>
<td>57,900,863</td>
<td>691,699</td>
</tr>
<tr>
<td>2020</td>
<td>8,776,257</td>
<td>53,399</td>
</tr>
</tbody>
</table>

Source: Youth, Sport and Tourism of Central Java Province

Table 1 explains that overall domestic and foreign tourist visits have increased every year until 2019 and decreased in 2020 due to the pandemic and several tourist destinations were closed to prevent the spread of Covid 19. There are significant differences in visits by domestic and foreign tourists in 2018 where domestic tourist visits increased by 8,825,137 people, while foreign tourist visits decreased by 103,939 people. The importance of supporting facilities for the tourism sector in absorbing labor, such as research developed by Lesmana & Purwanti (2017) that the number of hotel rooms has a positive effect on employment. Sanaubar et al (2017) stated that the tourism sector through the number of hotels, domestic and foreign tourists had a positive effect on employment in the hotel sector in 9 districts/cities of East Java. Infrastructure where tourists live requires large investments such as hotels and apartments and local wisdom such as tourist villages and simple lodgings, both of which have an effect on employment. The tourism sector has positive externalities such as increasing quality of local community, labor absorption, business opportunities, promoting local business and increasing investment in tourism sector and infrastructure (Archer et al., 2012). However, there are negative externalities from the development of the tourism industry such as congestion, parking problems, increasing criminality, vandalism, creating seasonal and low wages labor absorption and being able to relocate local resident for infrastructure in the tourism industry (Archer et al., 2012; Sirima & Backman, 2013).

There is still debate about the effect of wages on employment, this can occur through the demand and supply sides. From the supply side, when wages increase, someone’s motivation to look for work is higher and causes the supply of labor to increase. On the demand side, such as research by Sabihi et al (2021), which states that wage rates have a negative effect on employment in Manado,
where an increase in wages will decrease the demand for labor, because an increase in wages can increase production costs so that the demand for labor will decrease. This study aims to examine the effect of wages on employment in the tourism sector and investigate whether it is from the demand or supply side of labor. Sirima & Backman (2013) stated that increase in tourism industry and supporting infrastructure there are negative externalities such as creating seasonal and low wages labor absorption in the tourism sector. Central Java Province where the majority of tourist attractions are natural and artificial tourism is very vulnerable to the creation of seasonal workers, low skills and low wages. Brandt (2018) explains that uncompetitive wages in the tourism sector will hinder sustainable employment.

The use of data on the tourism sector in Central Java province can lead to a correlation in the disturbance term value which results in an inefficient estimator value. To bridge the gap between all previous studies and as a gap of research, the Panel Seemingly Unrelated Regression (SUR) is applied. Thus, the value of the disturbance term for Regency/City i for a certain period can be correlated with the disturbance term for the same Regency/City for different periods, because the data for the tourism sector are interrelated with data for year t and year t-1. Zellner (1962) stated that the SUR panel method can be applied to produce an efficient estimator even though there is a correlation between the disturbance terms in an equation. Research contribution to literature; a) investigate the determinants of employment through the tourism sector and b) apply the SUR method to produce an efficient value estimator so as to produce an unbiased model.

**METHODS**

The research combines cross-section and time-series data in 35 regencies and cities in Central Java Province and forms a time-series from 2016-2020. The data is sourced from the Central Java Province DISPORAPAR and the Central Bureau of Statistics (BPS). This study analyzes the heterogeneity of employment absorption rates in the tourism sector. So the equation can be written as follows:

\[
\text{Labor} = f(TA, NH, NR, Wage, TV)
\]

Where Labor are the number of workers in the tourism sector, TA is the number of attractions, NH is the total of hotel rooms, NR is the number of restaurants, Wage is the regional minimum wages and TV Total Visits of Domestic and International Tourists in Central Java Province. This study aims to explore labor absorption in tourism sector in government dimensions through TA, Wage and TV variables and ecosystem tourism dimesions through NH and NR variables. Durisin & Puzone (2009) states that success of program in tourism sectors can be through by strengthen the performance of government, private and local community. The equation of panel data as follows:

\[
\text{Labor}_{it} = \alpha_0 + \beta_1 TA_{it} + \beta_2 NH_{it} + \beta_3 NR_{it} + \beta_4 Wage_{it} + \beta_5 TV_{it} + e_{it}
\]

where \(\alpha_0\) is the constanta and \(\beta_1, \beta_2, \beta_3, \text{dan} \beta_4\) is the value of coefficient. Notation \(i\) express the value of cross-section from the city in central java and \(t\) is the time-series. Based from study Zellner (1962) and Al-Marshadi et al (2022) the equation for panel seemingly unrelated regression as follows:

\[
\gamma_j = X_j\beta_j + \mu_j
\]

where \(\gamma_j\) and \(\mu_j\) is the n for dimension vectors, \(\beta_j\) is the vector of parameters and \(X_j\) express the n x p\(_j\) for covariat matrixs. The equation for m use together, the explanation as follows:

\[
\begin{bmatrix}
\gamma_1 \\
\gamma_2 \\
\vdots \\
\gamma_m
\end{bmatrix} =
\begin{bmatrix}
X_1 & 0 & \ldots & 0 \\
\vdots & \ddots & \vdots & \vdots \\
0 & \ldots & X_m
\end{bmatrix}
\begin{bmatrix}
\beta_1 \\
\beta_2 \\
\vdots \\
\beta_m
\end{bmatrix} +
\begin{bmatrix}
\mu_1 \\
\mu_2 \\
\vdots \\
\mu_m
\end{bmatrix}
\]

Assume that disturbance have mean = 0 which exists independently of the various individual and homokedastic components, and \(\mu_j\) have assumptions, where mean of error terms: \(E(\mu_j|X) = 0;\) the
The tourism object variable with the increase in the number of tourists, attractions and workers in the tourism sector on average in the last five years with the number of hotel rooms by 6.38 percent and the number of and a minimum of 9.88 percent. Infrastructure supporting the tourism sector as a whole has increased number of domestic and foreign tourists. of 13.37 percent, the increase in the number of tourists where in the last 5 years there has been an increase in the of 5.39 percent in the number of workers in the tourism sector over the last 5 years, this is in line with the difference from the equation

\[ \hat{\beta} = \left( X' X \right)^{-1} X' y \]

The value of the cross-section can be tested on the value of the coefficient that is combined with the difference from the equation \( \hat{\beta} = \beta_j = 0 \) or the coefficient value of each respective cross-section like \( \hat{\beta} = \beta_j \). Another advantage of the SUR model are comprises a set of regression equations that are independent of one another (Al-Marshadi et al., 2022).

RESULTS AND DISCUSSIONS

All variables used are in logarithmic form except for tourist object variables, because the value of a tourist object is a unit. All the variables used show a mean value that is greater than the standard deviation which indicates that all variables have high variability, this cannot be separated from the use of panel data which will have heterogeneous data values because each cross-section in this case is the district and city in the province. Central Java has its own characteristics. The tourism object variable has a minimum value of 2 and a maximum of 95, meaning that there are changes or additions to at least 2 tourist objects, namely in Sukoharjo Regency and at most 95 tourist objects in Banyumas Regency, overall in Central Java Province every year there is an average increase an average of 22.34 new tourist objects.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>175</td>
<td>5.390</td>
<td>1.199</td>
<td>2.079</td>
<td>8.754</td>
</tr>
<tr>
<td>TA</td>
<td>175</td>
<td>22.337</td>
<td>15.889</td>
<td>2</td>
<td>95</td>
</tr>
<tr>
<td>NH</td>
<td>175</td>
<td>6.380</td>
<td>0.852</td>
<td>4.205</td>
<td>8.472</td>
</tr>
<tr>
<td>NR</td>
<td>175</td>
<td>3.906</td>
<td>1.097</td>
<td>2.079</td>
<td>6.915</td>
</tr>
<tr>
<td>Wage</td>
<td>175</td>
<td>14.330</td>
<td>0.150</td>
<td>14.051</td>
<td>14.814</td>
</tr>
<tr>
<td>TV</td>
<td>175</td>
<td>13.369</td>
<td>1.181</td>
<td>9.878</td>
<td>16.439</td>
</tr>
</tbody>
</table>

Source: Data processed

The Labor variable has an average value of 5.39, which means that there has been an increase of 5.39 percent in the number of workers in the tourism sector over the last 5 years, this is in line with the increase in the number of tourists where in the last 5 years there has been an increase in the number of domestic and foreign tourists. of 13.37 percent, with a maximum value of 16.44 percent and a minimum of 9.88 percent. Infrastructure supporting the tourism sector as a whole has increased on average in the last five years with the number of hotel rooms by 6.38 percent and the number of restaurants by 3.91 percent. The increase in supporting infrastructure for the tourism sector is in line with the increase in the number of tourists, attractions and workers in the tourism sector.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pooled</th>
<th>RE</th>
<th>FE</th>
<th>GLS</th>
<th>SUR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(8.329)</td>
<td>(5.000)**</td>
<td>(5.153)**</td>
<td>(4.008)*</td>
<td>(7.640)*</td>
</tr>
<tr>
<td>TA</td>
<td>0.026</td>
<td>0.024</td>
<td>0.023</td>
<td>0.033</td>
<td>0.026</td>
</tr>
<tr>
<td></td>
<td>(0.006)**</td>
<td>(0.004)**</td>
<td>(0.004)**</td>
<td>(0.003)**</td>
<td>(0.003)**</td>
</tr>
<tr>
<td>NH</td>
<td>0.188</td>
<td>0.031</td>
<td>-0.127</td>
<td>0.127</td>
<td>0.188</td>
</tr>
<tr>
<td></td>
<td>(0.120)</td>
<td>(0.142)</td>
<td>(0.187)</td>
<td>(0.070)*</td>
<td>(0.030)***</td>
</tr>
</tbody>
</table>
Panel Seemingly Unrelated Regression... (Khasanah and Kurniawan)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pooled</th>
<th>RE</th>
<th>FE</th>
<th>GLS</th>
<th>SUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>-0.127</td>
<td>-0.036</td>
<td>-0.040</td>
<td>-0.146</td>
<td>-0.127</td>
</tr>
<tr>
<td></td>
<td>(0.088)</td>
<td>(0.057)</td>
<td>(0.059)</td>
<td>(0.049)**</td>
<td>(0.044)**</td>
</tr>
<tr>
<td>Wage</td>
<td>1.014</td>
<td>0.965</td>
<td>1.068</td>
<td>0.635</td>
<td>1.014</td>
</tr>
<tr>
<td></td>
<td>(0.572)*</td>
<td>(0.349)***</td>
<td>(0.369)***</td>
<td>(0.271)***</td>
<td>(0.533)***</td>
</tr>
<tr>
<td>TV</td>
<td>0.317</td>
<td>0.091</td>
<td>0.073</td>
<td>0.174</td>
<td>0.317</td>
</tr>
<tr>
<td></td>
<td>(0.070)***</td>
<td>(0.043)**</td>
<td>(0.045)</td>
<td>(0.035)***</td>
<td>(0.060)***</td>
</tr>
</tbody>
</table>

Diagnostic Tools

| F-stat | 17.10 | 107.78 | 19.77 | 303.43 | 1213.74 |
| Chow Test | 0.000 | | | | |
| Hausman Test | | 0.608 | | | |
| Estimated Covariance | | 35 | 630 | | |

Source: Data processed

The results of the model specifications between the Chow test and the Hausman test show a random effect model, but there is a time-invariant effect on the regressor Li & Yang (2020) and the use of data in the tourism sector in Central Java province can cause a correlation to the disturbance term value which causes the estimator value to be inefficient, to overcome this, a Seemingly Unrelated Regression (SUR) Panel was implemented. Table 3 on the SUR model shows that the tourist object variable has a positive effect on employment in Central Java Province, this is in line with the research of Punarbawa et al (2016) that tourist attractions have a positive and significant effect, and in this study stated that tourist objects provide opportunities for some people who work in them. Study from Indah et al (2021) states that an increase in tourist attractions will result in an increase in the quantity of labor demanded. If the number of tourist objects increases, it will encourage employment. This encourages job opportunities in the tourism sector. Increasing the number of tourist attractions requires broad support from the government and private sector to create sustainable tourism conditions. (Archer et al., 2012; Durisin & Puzone, 2009).

Other infrastructure supporting the tourism sector, such as the number of rooms in hotels, shows that there is an influence on employment in Central Java Province in the tourism sector. A positive coefficient value means that the number of hotel rooms increases, the employment will increase. The increase in hotel rooms provides a reference for tourists in determining their tourist destinations. The more tourists who stay, the more labor is also needed at each hotel. Rachmania et al (2021) stated that the tourism industry, especially in the hotel sector, is labor-intensive, having a positive influence on creating job opportunities. Current investment developments in the tourism sector such as accommodation facilities such as hotels will require a lot of manpower. Lesmana & Purwanti (2017) state that hotel rooms have a positive and significant influence, so this research supports the research results that the more hotel rooms available, the more jobs are needed. The Indonesian Hotel and Restaurant Association (PHRI) stated that Central Java has recorded an increasingly rapid growth in hotels. The number of hotels in Central Java is due to good infrastructure and the many new destinations in Central Java. Herrero et al (2022) states the tourism sector has ecosystem is a complex sectors. To support the sustainable tourism and infrastructure need more development in accommodation and transportations for tourist (UNWTO, 2020). Baum et al (2016) stated that development of the tourism sector have a close relationship with its ecosystem such as accommodation, transportations and tourist attractions.

The variable number of restaurants has a negative effect on employment in Central Java Province, which means that every increase in the number of restaurants will result in a decrease in the workforce in the tourism sector. Based on BPS data showing that the average restaurant revenue in Central Java Province is experiencing a downward trend and the Covid-19 pandemic has exacerbated the condition of restaurant revenue, in 2018 the average revenue was 4,003 million rupiah and in 2020 it was 2,274 million. In line with the research developed by Rachmania et al (2021) that the number of restaurants has a negative effect on increasing the workforce. The tourist visit variable shows a positive influence on employment in the tourism sector. This is in line with research developed by Nindita &
Dewi (2018) which states that the number of tourist visits will increase the workforce through the location of residence, transportation and accommodation to consumption needs. Maulana (2016) states that foreign tourist visits have a positive influence on employment in the tourism sector in Indonesia.

The minimum wage is a form of reciprocity in the form of payment for services that have been provided in relation to employment. The effect of wages on employment absorption can occur through the demand and supply sides. From the demand side, if the wage rate in the area is higher, the demand for labor will decrease, this is inversely proportional to the supply side, if the wage rate is high, the labor supply will be high. The results of the study (Table 3) show that wages have a positive effect on employment in the tourism sector in Central Java Province. The coefficient value on the wage variable is 1.014, which means that the elasticity of employment related to wages is quite high. The researchers’ assumptions show that there is a correlation between wages and labor absorption from the supply side, so that when wages are high, people’s willingness to become workers in the tourism sector is high. Based on data from Disparpora, the tourism sector’s workforce is showing an increasing trend except in 2020 where it has decreased due to the pandemic. Shu et al (2022) states linkage to industrial theory, the tourism sector is part of economic system where the output of the tourism sector is determined by the cost of production factors and influenced by other sectors. This occurs because the tourism sector is depend on other sectors.

CONCLUSIONS
The panel seemingly unrelated regression is applied to produce an efficient estimator even though there is a correlation between the disturbance terms in an equation. The results showed that supporting infrastructure for the tourism sector, such as the number of hotel rooms, the variable number of tourist attractions and tourist visits, had a positive effect on employment in the tourism sector. While the number of restaurants has a negative effect, this can happen because BPS data shows that the average restaurant income in Central Java Province is experiencing a downward trend and the Covid-19 pandemic has exacerbated the condition of restaurant income. The coefficient value on the wage variable which is quite large indicates that the elasticity of employment related to wages is quite high. The implication of the research is that increasing the quality and quantity of sustainable tourist objects can attract an increase in foreign and domestic tourist visits so as to increase the workforce through the tourism sector.

Implications of the study that labor absorption in tourism sector is vulnerable and to strengthen the ecosystem of tourism sectors with appropriate central java provincial government policies especially in tourism development such as create more investment in tourism sectors. In the last 5 years central java province faced declining of investment. Central java have to encourage sustainable tourism ecosystem and setting competitive wage to encourage improvement in all aspects include the tourism sectors. A limitation of the study does not apply of fiscal policy variables especially for the tourism sectors due lack of data.

REFERENCES
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