Vol. 9, No. 2, 2023, pp. 818-829
DOI: https://doi.org/10.29210/020232728

Contents lists available at Journal IICET

JPPI (Jurnal Penelitian Pendidikan Indonesia)
ISSN: 2502-8103 (Print) ISSN: 2477-8524 (Electronic)

Journal homepage: https://jurnal.iicet.org/index.php/jppi

Convergence of regional GDP Percapita among the big islands in Indonesia

Murbanto Sinaga[1*)], Rika Surianto Zalukhu[2], Rapat Piter Sony Hutauruk[2], Daniel Collyn[3]
[1]Program Studi Ekonomi Pembangunan, Universitas Sumatera Utara, Indonesia
[2]Program Studi Akuntansi, STIE Bina Karya, Indonesia
[3]Program Studi Manajemen, STIE Bina Karya, Indonesia

Article Info

Article history:

Received Mar 25th, 2023
Revised Apr 08th, 2023
Accepted May 07th, 2023

Keyword:

Convergence,
Regional GDP Percapita,
Population growth,
Investment,
Capital expenditure

ABSTRACT

Uneven economic development raises inequality on five big islands in Indonesia. Because of that, it's necessary to be analyzed to acknowledge the current economic tendency, whether it is convergent or not. This research aims to analyze the regional GDP per capita convergence on the big five islands in Indonesia, which is Sumatera, Java, Borneo, Celebes, and Moluccas and Papua during period 2012-2021. Analyzed convergence included Sigma Convergence, Absolute Beta Convergence, and Conditional Beta Convergence. Data that is used in this research is Panel Data. Data analysis technique is Panel Data Analysis Method with Fixed Effect Model (FEM) approach. Results of the analysis show that the convergence the regional GDP per capita convergence on the big five islands in Indonesia is happened during period 2012-2021, meaning there is an indication that income dispersion between Sumatera, Java, Borneo, Celebes, and Moluccas and Papua is becoming smaller. Next, the results show that the beta absolute and conditional convergence is happened, which indicates that income growth per capita for the underdeveloped islands is higher than the advanced economic development islands, pushing for a convergent economic. Population growth and capital expenditure are variables that significantly affect in accelerating this convergence. This research implicates on policy formularization to accelerate income per capita from every big islands in Indonesia.

Corresponding Author:

Murbanto Sinaga,
Univesitas Sumatera Utara, Indonesia
Email: sinagamurbanto@gmail.com

Introduction

Indonesia is known as the biggest archipelago country in the world. From thousands of islands that existed, there are five big islands (Sumatera, Java, Borneo, Celebes, and Moluccas and Papua) that served as the foundation of the national economic. The island of Java gives the biggest contribution to Gross Domestic Product (GDP), indicating the role of Java as the central of Indonesia's economic. Large contribution of Java cannot be separated from the existence of Special Capital Region (DKI) Jakarta Province as the capital of Indonesia and center of national economic activities. After Java, the island of Sumatera is the second biggest contributor, followed by Borneo, Celebes, and Moluccas and Papua.

Regional GDP contribution rates among these big five islands to the national economic is very unequal. According to the Central Statistical Agency (BPS), the island of Java's contribution reached 57,89 percent of

GDP in 2021. Contribution of Sumatera Island is 21,70 percent. Contribution of Borneo Island is 8,26 percent. Contribution of Celebes Island is 6,89 percent. Meanwhile the island of Moluccas and Papua gives the smallest contribution, which is 2,48 percent. Variance of contribution between each region shows how successful their economic development is. The island of Papua's contribution is very little compared to Java Island. This condition shows the development gap that is very wide between these two islands. This unequal development impacts on the larger gap of economic inequality and people prosperity.

Development inequality or development disparity between regions in Indonesia is very high, either before or after the implementation of regional autonomy (Ahmad, 2011; Yanuar, 2017). Before the implementation, the growth rate on the western part of Indonesia is faster than the eastern part. And after the implementation, development in every region is still not equal. Several regions are succeeded with their development strategy, while others are failed to reach prosperity improvement. Harmadi & Adji (2020) found that even after the implementation of regional autonomy, income per capita disparity tends to rise. One of the reasons is the corruptive behavior of authorities in the government. This condition cause lower economic growth (Gupta et al., 1998). Because of that, the disparity of development between regions is becoming higher, which is shown from the income per capita inequality (Harmadi & Adji, 2020; Narayan & Sharmila, 2019). The result from human development has not describe equality, especially gender equality (Zalukhu & Collyn, 2021).

According to Central Statistical Agency (BPS), DKI Jakarta is the province with highest GDP per Capita in Java Island and Indonesia on 2021, reached IDR 274.709.590. Meanwhile the lowest Regional GDP per Capita is held by East Nusa Tenggara Province, with the amount of IDR 20.581.130. If classified by each big island, the highest regional GDP per Capita in Sumatera Island is held by Riau Archipelago Province, with the amount of IDR 130.125.230. In Borneo Island, it is held by East Borneo Province with regional GDP per Capita value of IDR 182.540.820. In Celebes Island, it is held by Middle Celebes Province, with the amount of IDR 81.773.040. Meanwhile in Papua Island, it is held by West Papua Province with regional GDP per Capita value of IDR 73.539.000. Interesting part is the gap between DKI Jakarta Province income per capita is relatively higher than other regions. DKI Jakarta income per capita is 3,7 times higher than West Papua, 3,3 times higher than Middle Celebes, 2,1 times higher than Riau Archipelago and 1,5 times higher than East Borneo.

Developed region with high regional GDP per Capita like DKI Jakarta will finally experience a slow and constant economic growth. Economic slowdown happened because the developed region has reached a full employment condition. On this stage, economic condition of the developed region has been in a maximum level that is hard to increase growth massively. On the other side, developing region have an opportunity to reach the highest point of growth through maximizing labor, capital, and technology. Developing region will experience high economic growth because it doesn't reach full employment condition yet (Kuncoro, 2015). In conclusion, on a certain point developing region will catch up with the developed, thus creating a convergence process.

Convergence is a phenomenon that head toward a confluence point (Barro & Sala-I-Martin, 2004). Convergence process is closely related with the development of an area or region. Convergence consists of two types, which is Sigma Convergence and Beta Convergence (Barro & Sala-I-Martin, 1992); (Arsyanti & Nugrahadi, 2021). Sigma Convergence (α) indicates the process of smaller development gap or inequality between regions on a specific period. Meanwhile, Beta Convergence (β) indicates income growth per capita of poorer area is faster than the richer. Beta Convergence is classified by two types, which is Absolute Convergence and Conditional Convergence. In Absolute Convergence concept, measurement is done only on income per capita variable, meanwhile other variables that can determine economic autonomy achievement is ignored. This is the opposite than Conditional Convergence that accommodate economic heterogeneity by adding some control variables. Control variables that can be added are variables that have significant effect on economic growth.

Previous research about development convergence in Indonesia had been done many times. (Arsyanti & Nugrahadi, 2021) analyze economic convergence between region in Western Part of Indonesia (KBI) and the Eastern Part (KTI). One of the findings is that during period 2011-2018, an improvement of income per capita dispersion on KTI level did occur, while it did not on the KBI level. Another finding is Absolute and Conditional Beta Convergence happened on KBI, KTI, and the national level. Similar finding is presented by (Yuniasih et al., 2013), related to the occurrence of regional disparity between KTI and KBI during period 1987-2011. Regional disparity of aggregate labor productivity is more unequal in KTI than KBI. They predicted that it needs about 11 years to cover for that inequality gap.

Some regions in Indonesia experience convergence, indicating that there is an increasing speed rate of poorer regions to catch up with the richer. Java Island is experiencing a Spatial Beta Conditional Convergence

and needs about 5,206 years to cover half of the gap (Yudistira & Sohibien, 2020). It means that underdeveloped regions in Java Island have an opportunity to catch up with the developed. To reach that condition, it requires control and intervention from each regional government. (Purwandari & Wahyuni, 2016) states that Special Region Yogyakarta (DIY) – a region with the lowest development achievement in Java Island – needs government intervention to control several variables like Real Regional Income (PAD), good category road length, working population number, and average school duration to reach a convergent income per capita. Convergence is hard to reach if those variables is not being control, because each area in DIY has not reach a steady state condition.

Several regions in Sumatera Island also experiencing convergence, which is South Sumatera (Nurhamidah & Suhartini, 2014) and North Sumatera (Septian, 2018). According to Nurhamidah and Suhartini, income inequality between cities/municipalities in South Sumatera tends to be high, in addition the convergence process is running slow and needs 22 years to fill half of the gap that is existed. Compared to South Sumatera, North Sumatera Province needs shorter time, that is about six years to cover half of the gap (Septian, 2018). Nurhamidah and Suhartini states that the deceleration of convergence in South Sumatera is caused by the contribution of relatively short road length to the regional GDP per capita. Because of that, they argue that human capital and physical capital like the length of road must be optimized to accelerate the convergence. In contrast with South Sumatera and North Sumatera Province, Aceh (Mahrizal et al., 2014) and Lampung Province (Emalia, 2012) did not experience either Absolute Beta or Conditional Convergence. It means that Income per Capita growth for poorer areas in both regions are not faster than the richer, so that there is no tendency for the poorer areas to catch up with the richer. There is a decrease of Income per Capita Dispersion in Aceh Province but an increase in Lampung Province. Though Income per Capita on several provinces in Sumatera Island tends to be divergent, generally Sumatera Island experience Sigma and Beta Convergence from year 2014 to 2019 (Yeniwati, 2021).

Income per Capita Convergence also occurred on several regions in Borneo Island. According to (S. Kurniawati & Suratman, 2009), during period 2001-2007, Beta Absolute Convergence was happened in West Borneo and East Borneo Province with 4,46 percent Absolute Convergence speed rate per year. Development Expenditure Ratio, Workforce Participation Labor, and Education significantly affect the Income per Capita Convergence in both regions. West Borneo is successful in implementing an equitable development. This condition is proved with very low economic inequality between regions (Ismail, 2020). In contrast with East Borneo, economic development is unequal. Adequate economic development is not accompanied by equitable Regional GDP per Capita. However, Income per Capita Dispersion in East Borneo is decreasing and there is a tendency for poorer areas to catch up with the richer through growth per capita acceleration. As stated by (Wulandari & Istiqomah, 2021), East Borneo Province is experiencing Sigma and Conditional Beta Convergence with 45,73 percent convergence rate per year and needs about two years to cover half of the gap that currently happened.

East Borneo and other provinces in KBI are known for having better economic development compared to provinces in KTI area. Because of that, it is not strange if the income per capita dispersion in KBI is getting lower and tends to become convergent, indicating the reduction of regional disparity in that area. However, government effort to create fair and equal development through massive infrastructure procurement in KTI has brought significant impact to economic activities in that area (Kusumawati & Purmiyati, 2020). Infrastructure procurement expedites product distribution chain supply and increases production effectivity and efficiency, that it pushes for economic growth. This condition opens an opportunity for underdeveloped regions in KTI to catch up from where they have left behind. (Kumara et al., 2021) stated that regional disparity in KTI tends to decrease toward equality. Their research also found that there is a Beta Absolute Convergence in KTI with the rate of 9,24 percent per year. Meaning, two big islands in KTI which is Celebes and Papua Island, tend to experience income per capita convergence.

Massive infrastructure development in KTI, which is Celebes and Papua Island, will push the economic activities in those regions to grow rapidly. Likewise, moving the capital to Borneo Island will bring a significant impact to economic development in that region. In the future, the development lag of Papua and Celebes Island from Java, Borneo, and Sumatera Island will probably decrease more. Next, contribution of these three islands to the national GDP will increase. In this case, economic convergence between these five big islands in Indonesia has become a reality. In this case, economic convergence between the five major islands in Indonesia have been occurred, with condition that the acceleration of convergence must keep being pushed.

The acceleration of the convergence of Regional GDP per capita is determined by several factors that are closely related to the economy. Harrod-Domar in his theory emphasizes the important role of investment as key to economic growth, where investment has double role in creating income and increasing the production

capacity of the economy (Sulistiawati, 2012). Investment is a source of capital that drives economic activity, and a good investment climate will empower the economy, due to the increase of production activity. This condition will absolutely bring positive impact on the increase of people's incomes and creation of new jobs. (Masniadi, 2012) along with (Sabilla & Sumarsono, 2022) found a positive relationship between investment and income per capita. Increasing the investment, both domestic and foreign will bring significant impact to the increase of Regional GDP (Aswanto, 2021); (Susetyo et al., 2019). Along with investment, capital expenditure also brings positive and significant influence on per capita GRDP (Cahyono & Kumalasari, 2021). Capital expenditure is one of the main sources of fixed asset financing that supports the achievement of economic development. Therefore, any allocation of capital expenditure should bring positive impact to the economic growth. The finding of (Prajanto et al., 2019) in his study confirms that the increase of capital expenditures allocation for land, equipment and machinery, as well as roads, irrigation and networks, have bring significant impact on the Regional GDP.

Besides the propelling factors, there are also inhibiting factors to the acceleration Regional GDP per Capita convergence. Massive population growth is a factor that can potentially hinders the achievement of convergence. Solow's theory of economic growth states that large population growth rate will cause the level of capital per worker to be lessened, causing low population income and economic growth (E. Kurniawati & Sugiyanto, 2021). These conditions indicates that there is a negative relationship between population growth and Regional GDP per Capita. This is in line with (Masniadi, 2012) which states that population growth has negative correlation with income per capita of the people of Indonesia. Variables of population growth, domestic investment, and capital expenditure in this study will be observed as control variables, so it can be discovered how the role of each variable in the convergence of Regional GDP per capita of the five big islands in Indonesia.

Based on the explanation, this study aims to analyze the convergence of regional GDR per capita on the five big islands in Indonesia for the period 2012-2021. Analyzed convergence includes sigma convergence, absolute beta convergence, and conditional beta convergence. Review of previous literature shows that research on the convergence of income per capita in the five big islands in Indonesia had never been done before.

Method

This research is quantitative research that aims to analyze income per capita convergence on the Big Five Islands in Indonesia, which is Sumatera, Java, Borneo, Celebes, and Papua during 2012-2021 period. Data type that will be used is panel data. Data can be accessed online through Central Statistical Agency (BPS) website. Convergence that is analyzed in this research include Sigma Convergence, Absolute Beta Convergence, and Conditional Beta Convergence. Sigma Convergence is analyzed by measuring the Five Big Islands' regional GDP per Capita variation coefficient. Sigma Convergence occurred if the coefficient value is decreasing annually. The formula for Sigma Convergence is as follows:

$$CV = \frac{\sqrt{\frac{\Sigma(Y_i - \bar{Y})^2}{n}}}{\bar{Y}} \quad \text{..... (1)}$$

Where:
CV = Coefficient Variant
Yi = Regional GDP per Capita island i
$\bar{Y}$ = Average value of the Five Big Islands Regional GPD per Capita

Beta Convergence, whether it is absolute or conditional can be deemed to occur if Regional GDP per Capita coefficient value on the previous period (β_1) is less than 1, and significantly affect the t year of Regional GDP per Capita. Absolute Beta Convergence is analyzed using Regional GDP per Capita on the previous year as a sole independent variable. Equation model that is used to analyzed Absolute Beta Convergence is as follows:

$$LnYi_t = \alpha + \beta_1 LnY\_1_{i,(t-1)} + e_{it} \quad \text{..... (2)}$$

Where:
LnY_{it} = Natural logarithm of Regional GDP per Capita island i on year t
$LnY\_1_{i,(t-1)}$ = Natural logarithm of Regional GDP per Capita island i on year t-1
α = Constant
β_1 = Regression Coefficient or Convergence Coefficient
e_{it} = Error Standard

Conditional Beta Convergence is analyzed by adding several control variables, which is population growth, domestic investment, and capital expenditure. Equation model that is used to analyze Beta Convergence is:

$LnYi_t = \alpha + \beta_1 LnY\_1_{i,(t-1)} + \beta_2 LnPG_{it} + \beta_3 LnINV_{it} + \beta_4 LnCE_{it} + e_{it}$ .....(3)

Where:

LnY_{it} = Natural logarithm of Regional GDP per Capita island i on year t
$LnY\_1_{i,t-1}$ = Natural logarithm of Regional GDP per Capita island i on year t-1
$LnPG_{it}$ = Natural logarithm of Population Growth of island i on year t
$LnINV_{it}$ = Natural logarithm of Sum of domestic investment realization of island i on year t
$LnCE_{it}$ = Natural logarithm of Sum of Capital Expenditure of island i on year t
α = Constant
$\beta_1 - \beta_4$ = Regression Coefficient
e_{it} = Error Standard

If Absolute or Conditional Beta Convergence occurred, then convergence rate and time that is needed to reach half of the convergent condition (Half-time Convergence) can be measured. Convergence rate can be measured by using this equation:

$$\lambda = \frac{\ln(1+\beta_1)}{\tau} \quad \text{..... (4)}$$

Where:

λ = Convergence Rate
ln = Natural Logarithm
τ = Number of Observation Years

And time that is needed to reach Half-time Convergence can be measured by using this equation:

$$T = \frac{\ln(2)}{\lambda} \quad \text{..... (5)}$$

Where:

T = *Half-time Convergence*
ln = Natural Logarithm
λ = Convergence Rate

The measurement of research variables is presented in Table 1.

Table 1. Variables Measurement

Variable	Measurement
Dependent Variable	
Regional GDP per Capita (Y)	Sum of regional GDP per Capita of the Big Five Islands in Indonesia released by Central Statistical Agency (BPS)
Independent Variable	
Regional GDP per Capita t-1 (Y_1)	Sum of regional GDP per capita on the year before (t-1) of the Big Five Islands in Indonesia score released by Central Statistical Agency (BPS)
Control Variables	
Population growth (PG)	Population growth of Big Five Islands in Indonesia released
Domestic investment (INV)	Sum of domestic investment realization of Big Five Islands in Indonesia released by Central Statistical Agency (BPS)
Capital expenditure (CE)	Capital expenditure of Big Five Islands in Indonesia released by Central Statistical Agency (BPS)

Results and Discussions

Sigma Convergence Analysis

Sigma Convergence indicates the decrease of development gap between five big islands in Indonesia that is reflected by the decrease of income per capita disparity. The tendency of Sigma Convergence occurrence is showed by Regional GDP per Capita variation coefficient value that is declining.

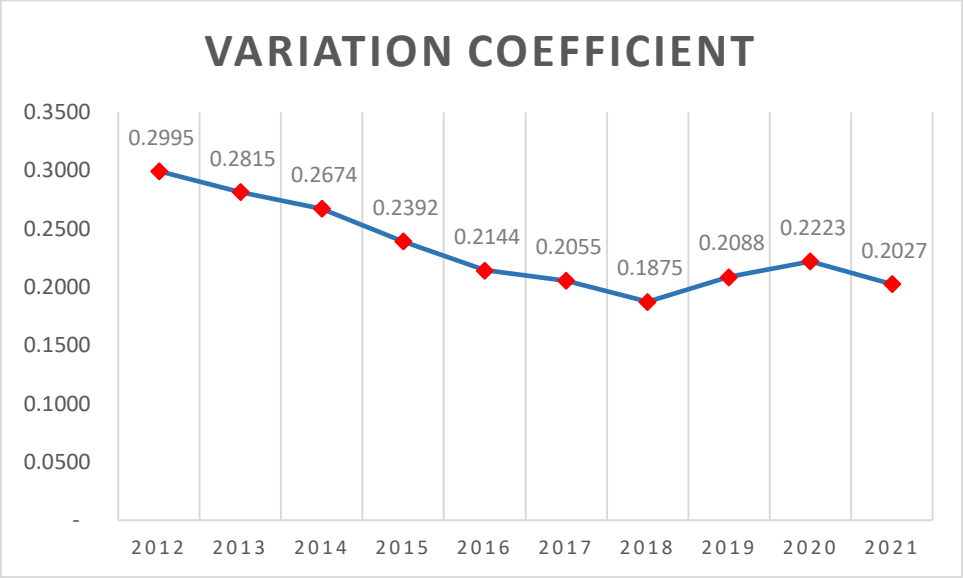


Figure 2. Income per Capita Variation Coefficient of Five Big Islands in Indonesia
Source: BPS (2022), Processed Data

Results of variation coefficient equation shows the tendency of Sigma Convergence occurrence. This is reflected from the downward trend of Regional GDP per Capita variation coefficient value of the Big Five Islands in Indonesia during period 2012 to 2021. In the year 2012, Regional GDP per Capita value is 0,2995. And then, it was decreasing until the lowest point in year 2018, which is 0,1875. In the year 2019 and 2020, coefficient variation value is increasing consecutively to 0,2088 and 0,2223. In the year 2021, it is decreasing again to 0,2027. Although there are increasing occurred, variation coefficient on the year 2021 is much lower than 2012. It means, during period 2012-2021 income per capita sigma convergence on the big give islands in Indonesia is happened. This shows that income dispersion between Java, Sumatera, Borneo, Celebes, and Papua tends to decrease. Lowest dispersion occurred in the year 2018.

Beta convergence analysis

Model selection

Beta Convergence Analysis, either Absolute Beta Convergence or Conditional Beta Convergence is conducted by using Fixed Effect Model (FEM) approach. Model selection is based on Chow Test and Hausman Test that have been conducted earlier. Chow Test and Hausman Test are presented on Table 2 below:

Table 2. Chow Test and Hausman Test

	Prob.	
	Chow Test	**Hausman Test**
Cross-section F	0,0014	-
Cross-section random	-	0,0002

Source: Processed Data (2022)

Table 2 shows cross-section F probability value on Chow Test that is 0,0014 which is smaller than 0,05. This indicates that Fixed Effect Model is more suitable to use than Common Effect Model (CEM). Hausman Test also shows that Fixed Effect Model is more suitable to analyze Beta Convergence than Random Effect Model (REM). This is based on the random cross-section probability value which is smaller than alpha value (0,0002 < 0,05).

Absolute Beta Convergence Analysis

Absolute Beta Convergence analysis aims to observe the tendency of Income per Capita Convergence occurrence on the big five islands in Indonesia. Independent Variable that tested is Regional GDP per Capita year t-1. Absolute Beta Convergence is occurred if regional GPD per Capita regression coefficient value (β_1) year t-1 is lower than 1. The analysis result is presented on Table 3 below:

Table 3. Absolute Beta Convergence Analysis Result

Variable	Coefficient	Prob.
C	2.413106	0.0038
LOG(Y_1)	0.862995	0.0000

Sources: Processed Data (2022)

From Table 3, it is discovered that Absolute Beta Convergence on the big five islands in Indonesia occurred during period 2012 until 2021. It is reflected from the Regional GDP per Capita regression coefficient value on the year before (t-1), which is less than 1. Furthermore, regional GDP per capita on the year before (t-1) is found out to significantly affect the current regional GDP per Capita. It means that income per capita growth for underdeveloped island is faster than the developed. The convergence rate is 6,2 percent per year and needs 11,1 years to reach half of the convergence condition.

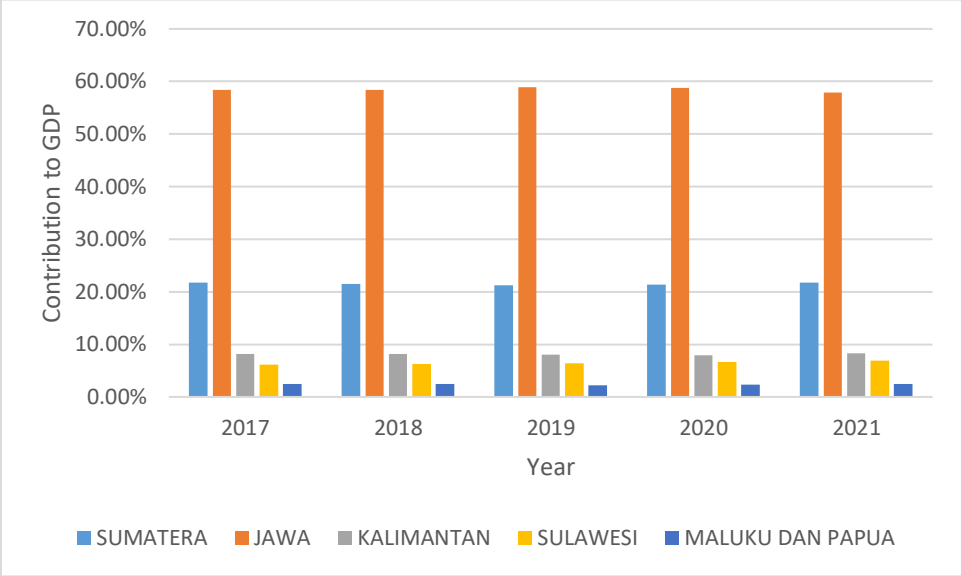


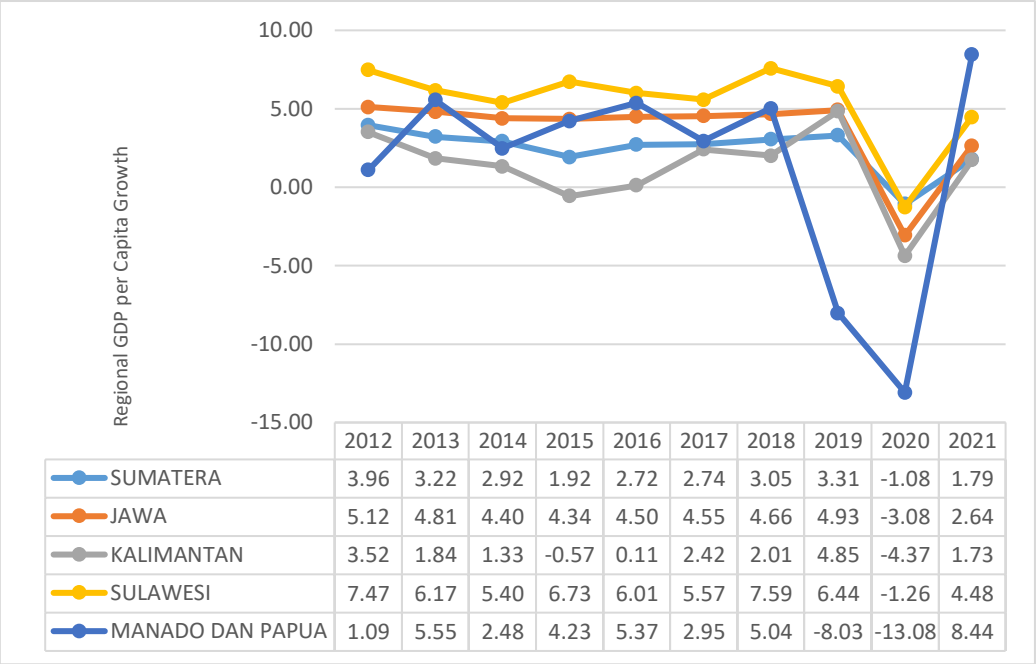
Figure 3. Regional GDP Contribution of Sumatera, Java, Borneo, Celebes, and Moluccas and Papua Islands to GDP (2017-2021)
Source: BPS (2022), Processed Data

Island of Moluccas and Papua is one of the big five islands in Indonesia with economic development that is fall behind. This is showed from Figure 3 where the contribution of that island to national income always placed on the lowest position during the last five year. Developing Village Index (IDM) that is published by the Minister of Village, Underdeveloped Regions, and Transmigration (Mendes PDTT) year 2022 emphasizes the lag of Moluccas and Papua Island to others. IDM is a composite index that is formed by Social Security Index, Economic Resilience Index, and Village Ecology Resilience Index. Based on this index, development and autonomy status of a village can be determined. Also, this index can determine the development and autonomy status of a regency or province by measuring the IDM average value on that region.

Reviewed from IDM value of year 2022, Moluccas and Papua Island can be categorized as underdeveloped island. Two of the four provinces in Moluccas and Papua Island acquired IDM status "underdeveloped" and one of them acquired "heavily underdeveloped". Provinces with the status "underdeveloped" is Moluccas and West Papua Provinces, while provinces with "Heavily Underdeveloped" status is acquired by Papua Provinces. Only Moluccas Province gained "Developing" IDM status. Papua Province is a province with the greatest number of "Heavily Underdeveloped" subregions, which is 15 regencies. West Papua follows with two regencies and North Sumatera with one regent. This condition is contradicted with Java and Borneo Islands. All the provinces in Java Island except Banten, gained "Developed" IDM status. Similar condition is also found out in Borneo Island, where three of five provinces in Borneo Island gained "Developed" IDM status, and the rest is "Developing". This indicates that economic development in Java and Borneo Islands is more advanced than others. Sumatera and Celebes Islands achieved quite better status than Moluccas and Papua Island. Three from then provinces in Sumatera Island gained "Developed" IDM status, meanwhile

seven others are "Developing". In Celebes Island, only North Celebes Province has gained "Developed" IDM status, while five other provinces are "Developing".

This finding indicates that there is a tendency of Absolute Beta Convergence occurrence, showing that Celebes and Moluccas and Papua Islands could catch up with Java, Borneo, and Sumatera islands in terms of income per capita. The reason is the income per capita growth of underdeveloped islands is faster than the developed. Looking at Figure 3 below, it can be figured out that during period 2012-2021 Celebes has the highest income per capita growth than other islands. Also, during that period income per capita growth in Celebes Island is consistently above 5 percent. In the year 2020 it was negatively corrected by 1,26 percent because of the Covid-19 pandemic, meanwhile in 2021 it was growing back again by 4,48 percent. During 2020 pandemic, Celebes is not the only island that experience negative growth, but other islands also experience similar thing.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
SUMATERA	3.96	3.22	2.92	1.92	2.72	2.74	3.05	3.31	-1.08	1.79
JAWA	5.12	4.81	4.40	4.34	4.50	4.55	4.66	4.93	-3.08	2.64
KALIMANTAN	3.52	1.84	1.33	-0.57	0.11	2.42	2.01	4.85	-4.37	1.73
SULAWESI	7.47	6.17	5.40	6.73	6.01	5.57	7.59	6.44	-1.26	4.48
MANADO DAN PAPUA	1.09	5.55	2.48	4.23	5.37	2.95	5.04	-8.03	-13.08	8.44

Figure 4. Income per Capita Growth of Five Big Islands in Indonesia (2012-2021)
Source: BPS (2022), Processed Data

Income per Capita growth in Moluccas and Papua Island is known to be volatile. Even so, the growth rate is generally higher than Borneo and Sumatera Islands. In the year 2013, 2016, 2018, and 2021, income per capita growth rate of Moluccas and Papua Island are above 5 percent. Sumatera and Borneo Islands never achieved this above 5 percent growth during the last ten year, even Java Island successfully write above 5 percent growth only in year 2012. Nevertheless, the economic fragility of Moluccas and Papua Island is still can be seen. This is proven from the instable growth and susceptibility during economic turbulence. In the year 2019, Moluccas and Papua Regional GPD per Capita growth is negatively corrected by 8,03 percent. In the year 2020 at the peak of Covid-19 pandemic, Moluccas and Papua Island income per capita growth is negatively corrected by 13,08 percent, the most severe among other big islands. In the year 2021, Moluccas and Papua Island achieved the highest growth than others with the rate of 8,44 percent.

Sumatera Island experiences a volatile income per capita growth and tends to be slow. Growth achievement of Sumatera Island is consistently below 4 percent, lower than Java, Celebes, and Moluccas and Papua Islands. Likewise, the income per capita growth rate of Borneo Island is generally lowest among the big five islands. This probably happened because Borneo Island income per capita has reached maximum level and already achieved steady state condition. As previously known, Borneo Islands has the biggest Regional GDP per Capita among big five islands. Contrary with Java, the island income per capita growth rate is quite stable and relatively high. Java Island growth is consistently above Borneo and Sumatera Islands with growth rate above 4 percent, except in year 2020 and 2021. This indicates that Java Islands has achieved steady state economic condition.

Conditional Beta Convergence Analysis

Conditional Beta Convergence shows the tendency of underdeveloped regions' income per capita growth is faster than developed regions, by controlling various dimensions and specific characteristics that can influence the success of a regions' economic development. Some of the control variables in this research are population growth, investment, and capital expenditure. Conditional Beta Convergence is analyzed by using fixed effect model. Conditional Beta Convergence occurred if regional GDP per Capita regression coefficient value (β_1) year t-1 is less than 1. Analysis result is presented on the Table 3 below:

Table 4. Conditional Absolute Beta Analysis Result

Variable	Coefficient	Prob.
C	3.299605	0.0001
LnY_1	0.793246	0.0000
LnPG	-0.041827	0.0000
LnINV	0.004580	0.5560
LnCE	0.024350	0.0374
R-squared		0.985667
Adjusted R-squared		0.982871
F-statistic		352.4469
Prob(F-statistic)		0.000000

Source: Processed Data (2022)

Where:

$LnY\_1_{i,\,t-1}$ = Natural logarithm of Regional GDP per Capita island i on year t-1
$LnPG_{it}$ = Natural logarithm of Population Growth of island i on year t
$LnINV_{it}$ = Natural logarithm of Sum of domestic investment realization of island i on year t
$LnCE_{it}$ = Natural logarithm of Sum of Capital Expenditure of island i on year t

According to Table 4, it is discovered that Regional GDP per Capita regression coefficient value on the previous year (t-1) is 0,793246 or less than 1. Regional GDP per Capita on the previous year (t-1) also significantly affect current Regional GDP per Capita. This condition shows that the Conditional Beta Convergence on the big five islands during 2012-2021 is occurred. It means that the underdeveloped island can still catch up with the developed, until convergence come to pass. Annual convergence rate is 5,8 percent and needs about 11,8 years to reach half of the convergence condition. Several factors that are discovered to be able to determine the convergence acceleration of Java, Sumatera, Borneo, Celebes, and Moluccas and Papua is population growth and capital expenditure.

Based on this analysis result, population growth variable has regression coefficient value -0.041827 with significance probability value smaller than alpha value (0,0000 < 0,05). This shows that population growth negative significantly affect regional GDP per Capita. It Means that the rise of population growth gives negative impact on income per capita, that it can potentially hinder the convergence acceleration. This research is in line with Solow's growth economy theory which states that higher population growth caused lower capital per labor and lower income, and results in lower economic growth (E. Kurniawati & Sugiyanto, 2021). To make convergence acceleration occurred, population growth must be controlled.

The control of population growth is essential to suppress population density. Efforts that the government has done on population growth control over various policies such as enhancement of Keluarga Berencana (Family Planning) program, enhancement of regular and real transmigration program, urbanization arrangement and even distribution of work field (Harjanto, 2021). These various policies are expected to surpress population density in one area, because it could detain economic development. Yunianto (2021) research result found that there are negative and significant population density impacts on economic development.

Domestic investment regression coefficient value is 0,00458, with significance probability value bigger than alpha value (0,5560 > 0,05). This condition shows that domestic investment doesn't significantly affect income per capita growth, so it cannot be made as one of the convergence acceleration variables. This research is supported by Triarsa & Purbadharmaja (2021) who discovered that domestic investment does not significantly affect regional GDP per Capita. Similar condition is also discovered by Martikasari (2016) who found out that domestic investment (PMDN) does not significantly affect regional GDP per capita in Java Island.

On recent years, especially between Joko Widodo's presidency era, infrastructure development is intensely done to support economic development and increase public welfare (Bimananda et al., 2019; Maramis, 2018).

Infrastructure development is not centralized in Java anymore, but in every area in Indonesia, particularly remote areas around East Indonesia. Various infrastructure that were built such as marine infrastructure to support sea highway, that cover port development, ship building, modes of transportation such as new railway and new airports (Sinaga & Mamahit, 2020). Furthermore, highway development, Jakarta-Bandung high speed train and bridge building are included in important infrastructure projects that were held by the government (Zakiyya & Purnama, 2022). A great budget is needed to accomplished these developments. One of government budget source is domestic investment. Domestic investment is directed to finance those planned infrastructures (Hasna et al., 2019; Saputro & Taufiequrrohman, 2021). Today, several infrastructure projects are done, and not many of them are still on work in progress. Because of that, it is logically accepted if domestic investment has not give significant effect on GDP just like this research proved. The benefit of domestic investment will be felt fully when every infrastructure projects are completely done and utilized for public to support economic activities.

Capital expenditure regression coefficient value is 0,024350 with significance probability value smaller than alpha value (0,0347 < 0,05). This condition shows that capital expenditure positive significantly affect regional GDP per Capita. Capital expenditure holds an important role on income per capita convergence achievement in Sumatera, Java, Borneo, Celebes, and Moluccas and Papua. Capital expenditure is used to finance fixed assets and other assets procurement, that can give long lasting impact especially in empowering the economic and enhancing health and education service quality. Capital expenditure is one of the government instruments to accelerate economic development, and because of that capital expenditure fund must be allocated on the right target so it can give optimal benefit in empowering the economic and finally impacts on the enhancement of people's income. This research shows that capital expenditure is one of the main factors that can determine convergence achievement between five big islands in Indonesia. Capital expenditure significantly affect people's income per capita, and in line with research from (Purba & Silalahi, 2019) and (Cahyono & Kumalasari, 2021).

Conclusions

This research finds evidence that Regional GDP per Capita Sigma Convergence is occurred on the big five islands in Indonesia (Sumatera, Java, Borneo, Celebes, and Moluccas and Papua) during period 2012-2021. It means that there is an indication that income per capita dispersion between Java, Sumatera, Borneo, Celebes, and Moluccas and Papua are decreasing. Besides, Absolute Beta Convergence and Conditional Beta Convergence are found to occur. These findings show that income per capita growth of underdeveloped islands is higher than the developed. Absolute Beta Convergence rate is 6,2 percent annually and needs 11,1 years to reach half of the convergence condition. Meanwhile, Conditional Beta Convergence rate is 5,8 percent annually and needs 11,8 years to reach half of the convergence condition.This research findings confirm that too high population growth gives negative effect on income per capita and potentially hinder convergence acceleration. On the other hand, capital expenditure gives positive effect on the increase of income per capita and become one of determining factors in convergence achievement beside population growth. Because of that, for the government this research reminds of the importance of population growth control, human capital quality enhancement, and exact capital expenditure allocation. This research contributes on finding evidences of sigma convergence and beta convergence from the GDP per capita of five big islands in Indonesia over the year 2012-2021 dan implicates on policy making to accelerate income per capita convergence in Indonesia. Nevertheless, this research has some limitations, such as it does not include Bali and Nusa Tenggara Island in the analysis because they still categorized as small islands. Abd also, control variable that is used in this research is limited. Because of that, this research suggests for the further research to analyze income per capita convergence between islands in Indonesia by including Bali and Nusa Tenggara Islands in the research and adding other control variables to the model like average of school duration and length of road in good condition.

References

Ahmad, I. (2011). Disparitas Hasil Pembangunan Kabupaten / Kota Sebelum dan Sesudah Otonomi Daerah. Jurnal Ilmu Administrasi Negara, 11(2), 156–166.

Arsyanti, R. A., & Nugrahadi, T. (2021). Analisis Konvergensi Ekonomi Pada Level Kawasan Dan Nasional Serta Faktor-Faktor Yang Memengaruhinya. Seminar Nasional Official Statistics, 2020(1), 717–727. https://doi.org/10.34123/semnasoffstat.v2020i1.481

Aswanto. (2021). Pengaruh Investasi dalam Negeri , Investasi Luar Negeri terhadap Produk Domestik Regional bruto (PDRB) Provinsi Riau 2010-2020. 1"st Seminar Nasional Teknologi Dan Multidisiplin Ilmu, 413–422.

Barro, R. J., & Sala-I-Martin, X. X. (1992). 1992 Barro and Martin _Convergence. Journal of Political Economy, 100(2), 223–251.

Barro, R. J., & Sala-I-Martin, X. X. (2004). Economic growth. In The MIT Press (Second Edi). The MIT Press. https://doi.org/10.4324/9781351242936-16

Bimananda, W., Riski, I., Dwi, K., Nooraeni, R., Siahaan, T., & Dhea, Y. (2019). Analisis Text Mining dari Cuitan Twitter Mengenai Infrastruktur di Indonesia dengan Metode Klasifikasi Naïve Bayes. EIGEN MATHEMATICS JOURNAL, 2(2), 92–101. https://doi.org/10.29303/emj.v1i2.36

Cahyono, Y. T., & Kumalasari, A. (2021). Pengaruh belanja modal, pendapatan asli daerah, dan jumlah penduduk terhadap pendapatan per kapita (studi empiris pada pemerintah daerah kabupaten/kota eks karesidenan surakarta tahun 2013-2019). Prosiding seminar nasional ekonomi dan bisnis 2021 universitas muhammadiyah jember, 712–724. https://doi.org/10.32528/psneb.v0i0.5225

Emalia, Z. (2012). Analisis Konvergensi Produk Domestik Regional Bruto (PDRB) Per Kapita Antar Kabupaten/Kota di Provinsi Lampung. Jurnal Ekonomi Pembangunan (JEP), 1(1), 1–20.

Gupta, S., Davoodi, H., & Alonso-Terme, R. (1998). Does Corruption Affect Income Inequality and Poverty? IMF Monetary Fund, 1–41.

Harjanto, T. (2021). Kebijakan Kependudukan dan Pertumbuhan Ekonomi. Cendekia Jaya, 3(2), 39–59.

Harmadi, S. H. B., & Adji, A. (2020). Regional inequality in Indonesia : Pre and post regional autonomy analysis. TNP2K, 1–35.

Hasna, S., Gazali, & Novitasari, D. (2019). Analisis Optimalisasi PMA dan PMDN Terhadap Kinerja Ekonomi Jangka Pendek di Indonesia. JUBISMA, 1(1), 109–115.

Ismail, A. (2020). Pertumbuhan dan Ketimpangan Pembangunan Ekonomi Antar Daerah Di Provinsi Kalimantan Barat. Prosiding Seminar Akademik Tahunan Ilmu Ekonomi Dan Studi Pembangunan 2020, 143–159.

Kumara, B. P., Gunarto, T., & Ratih, A. (2021). Disparitas dan Konvergensi Pendapatan Perkapita Propinsi di Kawasan Timur Indonesia. Ekonomikawan: Jurnal Ekonomi Dan Studi Pembangunan, 21(1), 46–56.

Kuncoro, M. (2015). Mudah memahami dan menganalisis indikator ekonomi. UPP STIM YKPN.

Kurniawati, E., & Sugiyanto, C. (2021). Pengaruh Struktur Umur Penduduk terhadap Pertumbuhan Ekonomi di Indonesia. Jurnal Ekonomi Dan Pembangunan Indonesia, 21(1), 41–58.

Kurniawati, S., & Suratman, E. (2009). Konvergensi Pendapatan Per kapitq di Provinsi Kalimantan Barat dan Kalimantan Timur Tahun 2001-2007 serta Faktor - Faktor yang Mempengaruhi. In Jurnal Ekonomi dan Pembangunan Indonesia (Vol. 10, Issue 1, pp. 53–67). https://doi.org/10.21002/jepi.v10i1.108

Kusumawati, N. T. I., & Purmiyati, A. (2020). The Influences Of Economic And Social Infrastructure On The Economic Growth In Eastern Indonesia. International Journal of Management (IJM), 11(6), 1957–1962.

Mahrizal, Hamzah, A., & Sofyan, S. (2014). Analisis Kesenjangan Pendapatan Antar Kabupaten/Kota Dalam Provinsi Aceh. Jurnal Magister Ilmu Ekonomi, 2(2), 91–100.

Maramis, J. B. (2018). Faktor-Faktor Sukses Penerapan KPBU Sebagai Sumber Pembiayaan Infrastruktur: Suatu Kajian. JURNAL MANAJEMEN BISNIS DAN INOVASI, 5(1), 49–63.

Martikasari, K. (2016). Pengaruh PMA, PMDN, Angkatan Kerja, Inflasi Dan Ekspor Neto Terhadap Pdrb Provinsi Provinsi Di Pulau Jawa. Jurnal Bisnis Dan Ekonomi, 2(2).

Masniadi, R. (2012). Analisis Pengaruh Jumlah Penduduk, Tabungan, Dan Investasi Terhadap Tingkat Pendapatan Per Kapita Indonesia. Jurnal Ekonomi Pembangunan, 10(1), 68–80.

Narayan, L., & Sharmila. (2019). Corruption and inequality : A survey of the literature. International Journal of Commerce and Management Research, 5(2), 65–70.

Nurhamidah, R., & Suhartini, A. M. (2014). Konvergensi Pendapatan di Provinsi Sumatera Selatan. Jurnal Ekonomi Dan Pembangunan Indonesia, 15(1), 71. https://doi.org/10.21002/jepi.v15i1.554

Prajanto, A., Susanto, W., Paradisi, F., & Pakpahan, B. S. P. (2019). Direktori Mini Tesis-Disertasi Ekonomi Pembangunan. In Badan Perencanaan Pembangunan Nasional (Bappenas) Republik Indonesia.

Purba, S., & Silalahi, M. (2019). Pengaruh Belanja Modal Pendapatan Asli Daerah Dan Dana Perimbangan Terhadap Pendapatan Perkapita Pada Pemerintah Kabupaten/Kota Provinsi Riau. Jurnal Ilmiah Semantik, 3(2).

Purwandari, A., & Wahyuni, K. (2016). Pendekatan Model Panel Dinamis dalam Kajian Konvergensi Pendapatan Daerah Istimewa Yogyakarta Tahun 2003-2014. Seminar Nasional Matematika Dan Pendidikan Matematika UNY, 45–52.

Sabilla, T. M., & Sumarsono, H. (2022). Pengaruh Belanja Pemerintah, Pendapatan Asli Daerah, Penanaman Modal Dalam Negeri, Indeks Pembangunan Manusia Terhadap PDRB. Forum Ekonomi, 24(1), 54–64.

Saputro, A., & Taufiequrrohman, T. (2021). Investasi dalam Bingkai Politik Luar Negeri Pemerintahan Jokowi Jilid Satu dan Dampaknya bagi Masyarakat Indonesia. PERSPEKTIF, 10(2), 450–466. https://doi.org/10.31289/perspektif.v10i2.4612

Septian, M. R. (2018). Kecenderungan Konvergensi Ekonomi Antardaerah di Provinsi Sumatera Utara. Journal of Regional and Rural Development Planning, 2(1), 90–103. https://doi.org/10.29244/jp2wd.2018.2.1.90-103

Sinaga, M., & Mamahit, D. A. (2020). Pembangunan Infrastruktur Maritim Untuk Mendukung Program Tol Laut Dalam Mewujudkan Poros Maritim Dunia (PMD). Jurnal Keamanan Maritim, 6(1), 1–15.

Sulistiawati, R. (2012). Pengaruh Investasi terhadap Pertumbuhan Ekonomi dan Penyerapan Tenaga Kerja Serta Kesejahteraan Masyarakat di Provinsi di Indonesia. Jurnal Ekonomi Bisnis Dan Kewirausahaan, 3(1), 29–50.

Susetyo, D., Zunaidah, ., Yulianita, A., & Lestari, W. (2019). Effect of Capital Expenditure, Investments and Human Development Index to Gross Regional Domestic Product Provinces in Sumatra-Indonesia. SEABC 2018 - 4th Sriwijaya Economics, Accounting, and Business Conference, 402–412.

Triarsa, I. G. N. B., & Purbadharmaja, I. B. P. (2021). Analisis Ketimpangan Distribusi Pendapatan Di Provinsi Bali Dan Faktor Yang Mempengaruhi. E-JURNAL EKONOMI PEMBANGUNAN UNIVERSITAS UDAYANA, 5(6), 2632–2660.

Wulandari, H., & Istiqomah, N. (2021). Konvergensi Ekonomi Provinsi Kalimantan Timur Pendekatan Data Panel Dinamis. BESTARI: Buletin Statistikan Dan Aplikasi Terkini, 1, 1–7.

Yanuar. (2017). Disparitas Antar Wilayah Dan Provinsi Di Indonesia Sebelum dan Sesudah Otonomi Daerah. Jurnal Ekonomi, 18(1), 97–108. https://doi.org/10.24912/je.v18i1.411

Yeniwati. (2021). Determinan Yang Mempengaruhi Perekonomian Dan Analisis Konvergensi Antar Provinsi Di Sumatera. Menara Ilmu, XV(01), 122–132.

Yudistira, M. R., & Sohibien, G. P. D. (2020). Analisis Konvergensi Ekonomi Di Pulau Jawa Menggunakan Data Panel Dinamis Spasial Tahun 2013-2017. Seminar Nasional Official Statistics, 2019(1), 438–448. https://doi.org/10.34123/semnasoffstat.v2019i1.66

Yunianto, D. (2021). Analisis pertumbuhan dan kepadatan penduduk terhadap pertumbuhan ekonomi. FORUM EKONOMI, 23(4), 687–698. http://journal.feb.unmul.ac.id/index.php/FORUMEKONOMI

Yuniasih, A. F., Firdaus, M., & Fahmi, I. (2013). Disparitas, Konvergensi, dan Determinan Produktivitas Tenaga Kerja Regional di Indonesia. Jurnal Ekonomi Dan Pembangunan Indonesia, 14(1), 63–81. https://doi.org/10.21002/jepi.v14i1.447

Zakiyya, A., & Purnama, C. (2022). Pembangunan Infrastruktur di Indonesia dalam Kerja Sama Indonesia-Tiongkok tahun 2010-2018. Padjadjaran Journal of International Relations, 4(2), 92–108. https://doi.org/10.24198/padjir.v4i2.39364

Zalukhu, R. S., & Collyn, D. (2021). Determinant Analysis of Gender Inequality in Human Development in Indonesia. Budapest International Research and Critics Institute-Journal (BIRCI-Journal), 4(4), 7895–7908. https://doi.org/10.33258/birci.v4i4.2708