

# Analysis of the Effects of Economic Growth and Development on Inequality and the Environment

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**Abstract:** Economic growth is often only experienced by certain actors or households, causing income inequality. Economic growth is also synonymous with CO2 emissions. Economic growth will certainly increase CO2 emissions caused by increasing demand for energy consumption, which will cause environmental damage. The inverted Kuznets U curve is a theory that can be used to describe and explain economic development and growth. The research period is the last 12 years, namely 2010-2021. The research findings show that there is no inverted Kuznets U curve for the problem of inequality, which negates the effect of increasing per capita GRDP and economic growth on reducing inequality and poverty in Jambi Province. Second, the Mining and Quarrying Industry remains a sector that makes a dominant contribution to GRDP and is also the main driver of economic growth in Jambi Province, according to the results of Location Quotient and Shifts Share. Third, it is shown that environmental problems cause the Kuznets U curve to be inverted. According to data supporting the Environmental Kuznets Curve (EKC) hypothesis in Jambi Province, environmental pollution will eventually decrease due to economic expansion. The results of this study can be used as a basis for consideration in measuring the performance and quality of the economy of Jambi Province.

**Keywords:** Basic economy, inequality, environment, Kuznets.

**JEL Classification:** O13, O44, Q51, Q53, Q56.

## INTRODUCTION

Economic growth has a detailed measurable analysis in each sector to realize economic certainty. However, even though economic growth is a benchmark for a country or region in terms of economic conditions, there will be weaknesses on the side of change. It can be seen in economic growth, which does not necessarily reduce environmental pollution, reduce inequality and poverty, which is caused by the gross domestic product (GDP) that does not take into account welfare so that growth indicators do not represent good development (Tietenberg & Lewis, 2018). The concept of economic development should include aspects of change, as measured by the National Development Index, which measures aspects of the environment, education, health, and purchasing power.

Economic growth is the most objective main policy. This is because measures for environmental problems, handling inequality, poverty, and social problems are difficult to measure, so it is often represented by economic growth as a representation of welfare (Perman et al., 2003). Gross regional domestic product (GRDP), which spans a variety of industries, is used to gauge economic growth at the province

level. The province's economic growth rate in 2021 is 3.66%, whereas, in the previous year, Jambi Province's economic growth was in a minus position due to the COVID-19 pandemic, which was -0.44%.

The largest contributor to the Jambi Province's GRDP is the agriculture, forestry, and fishery sector, which amounted to 41,243.85 billion rupiahs. The second position was the mining and quarrying sector of 35,692.22 billion rupiahs. Therefore, it can be concluded that almost 50% of the contributors to the GRDP of Jambi Province are from these two sectors, where the total GRDP of Jambi Province is 153,881.69 billion rupiahs. Agricultural, forestry, mining, and quarrying activities are activities that have a great impact on environmental pollution because these activities are very closely related to finding natural resources that are in the earth, which will definitely change the shape of the earth's landscape. Furthermore, the Jambi Province poverty depth index for 2021 has increased by 0.19% to 1.29%. The highest poverty depth index is East Tanjung Jabung Regency at 2.07%, and the lowest is Sungai Penuh city at 0.43%.

Basic economic research is important because it refers to sectoral development planning that further optimizes overall economic growth and development. This can be seen through basic economic analysis using the Williamson Index, nonlinear regression quadratic model, Location Quotient, and Shift Share for analysis at the provincial level. And to analyze the district and city levels, Klassen Typology analysis was used.

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In addition to looking for strategic sectors to develop, it is also necessary to consider increasing the base sector and whether this sector can contribute to reducing inequality and improving the environment. For this reason, an inverted Kuznets U curve hypothesis analysis approach is used, which identifies whether the economic growth that Jambi Province has achieved can contribute to reducing inequality and environmental pollution.

Information and studies on basic economic analysis and economic growth concerning inequality and environmental pollution in Jambi Province have not been detected in national or international journal publications. The research that has been done is still very limited and not comprehensive. Research on identifying basic and non-base sectors (Emilia et al., 2014). Research on the effect of the growth of the basic economic sector on poverty (Imelia & Hardiani, 2014). And research on the factors that influence regional inequality (Mahakso, 2013; Putra, 2015).

This study aims to identify whether economic growth can participate in reducing inequality and environmental pollution so that it becomes the basis for consideration in measuring the performance and quality of the economy of Jambi Province. As a result, and in the future, local governments will carry out plans that encourage improvements in strategic development indicators, such as improving inequality and environmental pollution.

## LITERATURE REVIEW

### A. Economic Growth and Development

Economic growth is the growth and development of various economic activities in an area due to the interaction and overall activities of population growth, investment accumulation, technological development, and production results (Mankiw, 2010).

If considered a scientific field of study, economic development (development growth) encompasses a broad economic analysis of the effective distribution of limited productive resources, the pursuit of sustainable economic growth, and the consideration of social mechanisms operating in both the public and private spheres (Todaro & Smith, 2015).

Economic development is a combination of growth and changes in economic structure towards a better stage, which also looks at the socio-economic aspects that exist in society, such as poverty, unemployment, purchasing power, the environment, and so on. Meanwhile, economic growth emphasizes quantitative economic aspects, namely an increase in output analytically, and does not pay attention to social aspects.

### B. Regional Economy and Base Economy

Regional economics is about the spatial characteristics of the economic system used (Hoover & Giarratani, 2020). Regional economics can be an applicable study in assessing the process of sustainable use of natural resources that produce value outputs that can provide business benefits for the community and immigrants (Stimson et al., 2006).

The dominant sector is the basic sector that drives economic growth. That is, the regional economy has basic and non-basic sectors and the endogenous sector (which cannot grow freely) only depends on the influence of the economic situation (Tarigan, 2005). And to see the basic economy can be done through analysis of the Williamson Index and Location Quotient.

Datt et al., (2020) Their study suggests transformational structural growth, with the secondary and tertiary sectors contributing more to national output and employment in India. And strengthening non-agricultural and urban economic growth for poverty reduction does not mean that agricultural growth is no longer important for poverty reduction.

The five basic economic sectors of Jambi Province for the years 2005 to 2010 were identified by Emilia et al. (2014) using the Location Quotient approach and Klassen Typology. These sectors are: agriculture; mining and quarrying; electricity, gas, and clean water; trade; hotels and restaurants; and transportation and communication. Research by Imelia & Hardiani (2014) found that basic economic growth in Jambi Province from 2000-2010 did not affect poverty.

### C. Inequality and Kuznets Curves

Economic inequality is the result of income inequality. In almost all developing countries, economic growth has increased, but people's income growth has not increased significantly because only a few actors and households enjoy economic growth. This is what causes income disparities (Oyvat, 2015). The Kuznets hypothesis explains that economic growth will reduce inequality and poverty in a certain period of time, or the so-called turning point (Saputra, 2016; Younsi & Bechtini, 2020).

Kuznets curve analyzes endogenous economic variables, such as technology, population, demographics, and institutions (Syrquin, 2005). Therefore, high inequality will result in losses to long-term economic growth (Castells-Quintana, 2018; Younsi & Bechtini, 2020).

Topuz & Dağdemir (2020) carried out research to determine how trade liberalization affected inequality in Turkey (1987-2016). Inequality of income and trade liberalization are found to be related nonlinearly in this study. Early trade liberalization leads to a reduction in income disparity, but trade liberalization ultimately causes an increase in income inequality. Additionally, Topuz & Dademir claimed that as the income disparity between the agricultural and industrial sectors widened, so would overall income inequality. that the degree of poverty and inequality is influenced by training's impact on various levels of education and income inequality (Shahabadi et al., 2018).

Putra (2015) using the Klassen Typology found that factors such as capital costs/government spending, investment, and labor greatly affect the occurrence of regional development inequality in the districts/cities of Jambi Province. According to study by Mahakso (2013) utilizing the Williamson Index analysis tool, capital investment and school enrollment have a favorable impact on inequality. In contrast, neither poverty nor economic growth in Jambi Province have an impact on inequality that is either favorable or bad.

**D. Environment and Kuznets Curves**

The Kuznets curve demonstrates the causal connection between economic expansion and CO2 emissions, which results in the formation of an inverted U-curve (Aydin & Esen, 2017; Apergis et al., 2017). This is accomplished by examining the relationship between environmental deterioration and economic growth using a variety of empirical variable plots, particularly by examining the magnitude and evolution of CO2 emissions (Tietenberg & Lewis, 2018). Pérez-Suárez & López-Menéndez (2015), using a sample of 175 countries, that it was useful to understand CO2 emissions in different countries using the Environmental Kuznets Curve (EKC) and Environmental Logistics Curve (ELC).

The Environmental Kuznets Curve (EKC), which analyzes the phenomenon of the optimum point (turning point), predicts that when the phenomenon passes the optimum point, it will produce an inverse relationship between per capita income and income inequality. This relationship was first proposed by Simon Kuznets in 1955 (Apergis et al., 2017; Hussen, 2005).

CO2 carbon emissions have increased since 1990 by almost 50 percent, so special attention is needed to the evolution and projections of emissions in several countries (Pérez-Suárez & López-Menéndez, 2015). Research conducted by Koirala & Mysami (2015) discovered that the relationship between income and CO2 emissions is inversely U-shaped. That high-income inequality can damage the environment (Ridzuan, 2019).

Economic growth cannot solve environmental problems (Aydin & Esen, 2017). Fasikha & Yuliadi (2018) see a causal relationship between economic growth and CO2 emissions in ASEAN countries in the period 2000-2015, indicating the EKC hypothesis, in which the total CO2 emissions and GDP together have increased and have not yet reached a turning point.

There are indications that high-income countries will be able to reduce CO2 emissions after reaching the turning point, while lower-middle-income countries will still be unable to reduce CO2 emissions even though they have exceeded the turning point (Apergis et al., 2017; Nikensari et al., 2019). Middle development countries have an inverted U curve characteristic, while developed countries and low development countries are indicated to have no turning point, or CO2 emissions, and environmental damage will continue to increase (Yustisia & Sugiyanto, 2014).

The size of the ecological footprint will rise due to the growth in population, economic activity, and social activity, all of which involve consumption, production, and investment activities in general, notably in terms of rising CO2 emissions brought on by rising energy demand (Firdaus, 2017; Ullah & Awan, 2020; Ulucak & Bilgili, 2018).

The Kuznets curve has a pattern that "every continuous increase in certain economic variables will lead to a continuous decrease in other affected economic variables as well." The Kuznets curve for inequality and poverty suggests that a sustained increase in economic growth will reduce poverty and inequality. And the EKC stated that an increase in quality

sustainable economic growth would be able to reduce environmental pollution in greenhouse gas emissions.

**RESEARCH METHOD**

**1. The research Method Used**

Descriptive and quantitative statistical analysis is the analytical method used to answer the problems in this study. Descriptive statistical analysis is presented in the form of tables and graphs to identify, describe, and analyze: first, the economic growth conditions of districts, cities, and Jambi Province; second, inequality in Jambi Province is seen from the analysis of the Williamson Index; third, the economic base of Jambi Province using Location Quotient analysis and Shift Share analysis; and the four regencies and cities qualification quadrants in Jambi Province using Klassen Typology, during the period 2010-2021. Finally, quantitative analysis using a non-linear regression quadratic model was used to test and determine the inverse Kuznets U curve hypothesis for inequality and environmental issues.

**2. Types and Sources of Data**

This study uses secondary data with time series data for 2010-2021 sourced from the Central Statistics Agency and the Jambi Province Environmental Service. The data used in this study consisted of Jambi Province GRDP data in billions of rupiah; Jambi Province GDP per capita data in thousands of rupiah; Jambi Province economic growth data in percent; data on greenhouse gas emissions (Energy, IPPU, agriculture, forest fires, and waste) in Gg CO2 units; and population in soul units.

**3. Data Analysis Method**

**A. Looking for a sectoral basis of the economy in the issue of inequality**

The analysis used for the provincial level is the Williamson Index, non-linear regression analysis of the quadratic model, Location Quotient analysis, and Shift Share analysis. And to analyze the district and city levels, Klassen Typology analysis was used. The following is the equation to determine the Williamson Index (Khuluk et al., 2021; Waluyaningsih & Setiawan, 2020):

$$WI = \frac{\sqrt{\sum_{i=1}^n (y_i - \bar{y})^2 (f_i/n)}}{\bar{y}} \text{ (Equation 1)}$$

Inequality Criteria:

- WI > 1 = Very high inequality
- WI 0.7 – 1 = High inequality
- WI 0.4 – 0.69 = Medium Inequality
- WI < 0.39 = Low inequality

And to estimate the Kuznets curve hypothesis with a non-linear regression quadratic model (Cahyadin et al., 2021; Şentürk et al., 2020)

$$WI = \alpha + \beta_1 Y + \beta_2 Y^2 + + \epsilon \text{ (Equation 2)}$$

Information:

- WI = Williamson Index for the region i in year t
- Y = GRDP per capita for the region i in year t
- Y<sup>2</sup> = GRDP per capita squared region i in year t
- α = Constant
- β = Coefficient
- ε = error term

**B. Relative Comparison Between Sectors Through Certain Regions with Comparison Areas**

By making a relative comparison, a reliable base sector will be found in economic growth and optimizing the economic development of a region, and the analysis uses Location Quotient (Khuluk et al., 2021; Saputra, 2016):

$$LQ = \frac{S_i/s}{N_i/N} \text{ (Equation 3)}$$

Information:

- Si = Value added sector i
- S = Provincial GRDP
- Ni = Value added of national sector i
- N = National GDP

Based on the above equation, to find the Location Quotient, the conditions are as follows:

LQ > 1, the sector is a basic, the sector not only meets the needs of the region but also needs outside the region;

LQ = 1, the sector is only sufficient to meet the needs of the region;

LQ < 1, non-basic sector, less prospective sector, and need to be imported from outside the region.

**C. Determining the Performance or Productivity of the Regional Economy**

Determine the performance or productivity of the regional economy, and it is measured through Shift Share. This analysis provides an overview of the output size of the test sectors that are influenced by the industrial sector or the location sector (Saputra, 2016). Here are the calculations to determine the Shift Share Analysis:

- > Dij = Nij + Mij + Cij
- > Nij = Eij x Rn
- > Mij = Eij (Rin - Rn)
- > Cij = Eij (Rij - Rin) (Equation 4)

Information:

- Dij = The real impact of regional economic growth from the influence of national growth
- Nij = National share, the effect of national economic growth on the economy in a region.
- Mij = Proportional shift, or the influence of the industry mix

- Cij = Differential Shift, the effect of the competitive advantage of a particular sector compared to the national level
- Eij = GRDP (output) sector i
- Rij = Growth rate of sector i
- Rin = National sector i growth rate
- Rn = GDP growth rate

**D. Classification of districts and cities**

Klassen Typology is used as a measure to see the development of regional economic growth in the context of quadrants (Mukhlis et al., 2018; Saputra, 2016)

**Table 1. Classification of areas according to Klassen Typology**

GRDP per capita (y)	yi < y	yi > y
	Growth rate (r)	
ri > r	Quadrant II Retarded Region y1 < y ; r1 > r	Quadrant I Rapid Growth Region y1 > y ; r1 > r
ri < r	Quadrant III Underdeveloped Region y1 < y ; r1 < r	Quadrant IV Growing Region y1 > y ; r1 < r

Information:

- y1 = Regional income per capita i
- y = National per capita income
- r1 = Growth rate of regional GRDP to i
- r = GDP growth rate

**E. Determine the inverted U hypothesis on environmental issues**

A quadratic nonlinear regression model is used to determine the projected decline (Cahyadin et al., 2021; Nikensari et al., 2019):

$$CO2 = \alpha + \beta_1 PDRB + \beta_2 PDRB^2 + \epsilon \text{ (Equation 5)}$$

Information:

- CO2 = Emissions for region i in year t
- PDRB = GRDP per capita for region i in year t
- PDRB<sup>2</sup> = GRDP per capita squared for region i in year t
- α = Constant
- β = Coefficient
- ε = error term

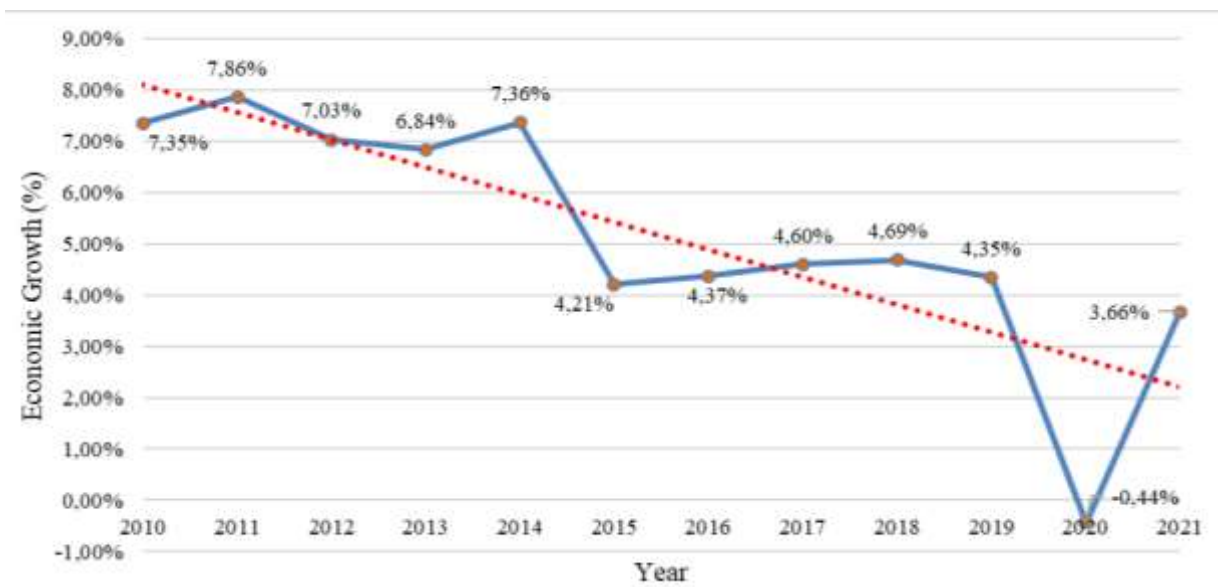


Fig. (1). Economic growth in the Province of Jambi, 2010-2021. Source: Author's preparation.

**f. Significant Test**

Based on equations 2 and 5, to estimate the validity of the inverted Kuznets U curve hypothesis, it is based on the following conditions:

If  $\beta_2 < 0$ , there is an inverted U-shaped relationship

If  $\beta_2 > 0$ , there is no inverse U-shaped relationship

This study uses a 95% Confident Interval or 0.05

**RESULT AND DISCUSSION**

**A. Economic Growth in Jambi Province**

Jambi province's economic growth during the 2010-2021 period had a positive trend, except in 2020, this year's economic growth contracted by -0.44% due to the COVID-19 pandemic. This year's economic contraction was much better than the national economic growth, where Indonesia's economic growth in 2020 contracted by -2.07%. Fig. (1). Jambi Province's economic growth tends to decline, which can be seen from the graph, which tends to move to the bottom right. The average economic growth of Jambi Province during the study period was 5.16%. For more than a decade, the mining and quarrying sector and the sectors of agriculture, forestry, and fisheries have been the ones that have made the biggest contributions to economic growth in Jambi Province. Together, these two sectors have consistently contributed 50% of Jambi Province's total GDP.

During the 2010-2021 period, the highest economic growth was obtained by Bungo Regency, with an average economic growth of 5.97%. Then followed by Kerinci Regency at 5.92% in the second position, Tebo Regency at 5.80% in the third position, Sungai Penuh City at 5.78% in the fourth position, Batanghari Regency at 5.67% in the fifth position, and

Merangin Regency at 5.60% in sixth place. Meanwhile, the 6 regencies/cities with the lowest average economic growth during the 2010-2021 period were East Tanjung Jabung Regency at 3.10%, West Tanjung Jabung Regency at 4.62%, Jambi City at 5.45%, Sarolangun Regency at 5.51%, and Muaro Jambi Regency by 5.57%.

**B. The Kuznets curve hypothesis and inequality in the Province of Jambi**

According to Table 2's Williamson Index analysis findings, Jambi Province continues to experience inequality.

According to data from the Williamson index from 2010 to 2019, the level of inequality in Jambi Province is moderate, ranging from 0.4 to 0.69. Additionally, the Williamson index value for 2020 and 2021 is close to 0.39, indicating that Jambi Province has modest inequality. The Williamson Index is declining, which indicates that inequality in the province of Jambi is on the decline. This suggests that the level of inequality in the province of Jambi has decreased.

Using the Williamson Index and GRDP per capita of Jambi Province, the inverse Kuznets U curve hypothesis test is carried out using a non-linear regression quadratic model: so that the results are obtained as in Table 3's.

The results of the hypothesis test show that in Jambi Province, there is no inverted "U"-shaped Kuznets curve on the issue of inequality. The relationship between inequality and income distribution can be seen in Fig. (2). The Kuznets curve hypothesis can be proven from the graph between GRDP per capita and the Williamson Index. From the graph, it can be seen that, during the period 2010-2021, it was not proven that the Kuznets inverted U-curve in Jambi Province did not occur.

**Table 2. The examination of the Williamson Index in the Province of Jambi, 2010-2021**

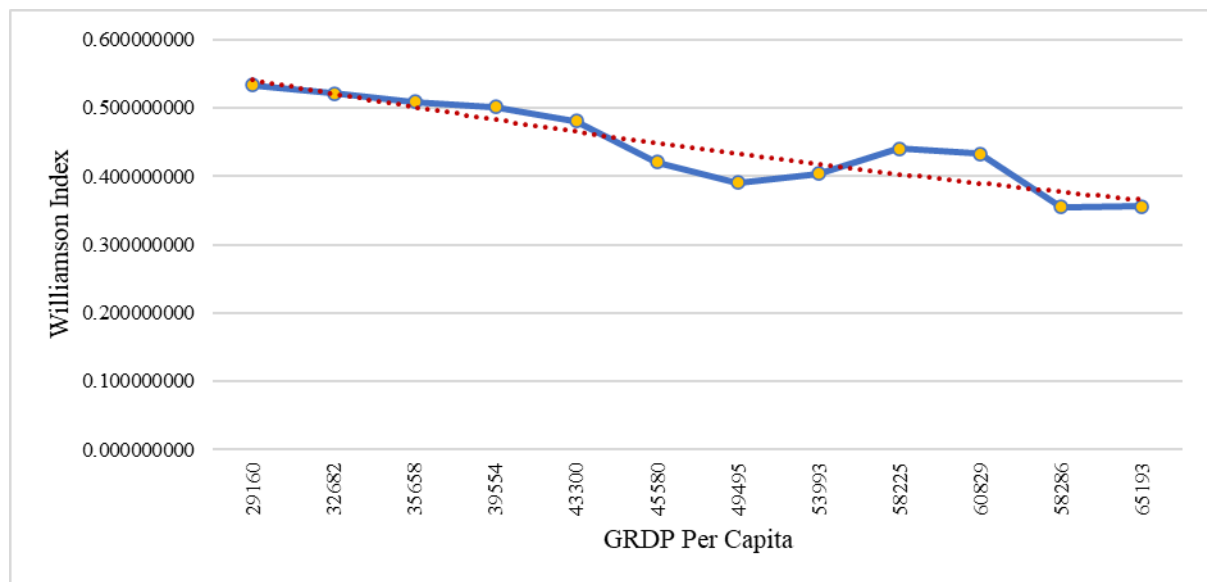
Year	Population (Soul)	GRDP per capita (Thousand Rupiah)	Williamson Index	Change
2010	3.092.265	29.160,16	0,533700268	-
2011	3.169.814	32.682,04	0,521731546	-0,02242593
2012	3.242.814	35.657,57	0,509281649	-0,02386265
2013	3.317.034	39.553,64	0,501957053	-0,01438221
2014	3.344.421	43.300,30	0,480988796	-0,04177301
2015	3.402.052	45.580,04	0,420482133	-0,12579641
2016	3.458.926	49.494,98	0,391085689	-0,06991128
2017	3.515.017	53.993,40	0,403709292	0,03227836
2018	3.570.272	58.224,89	0,441023133	0,09242750
2019	3.624.579	60.828,86	0,432927759	-0,01835589
2020	3.677.894	58.285,73	0,355078864	-0,17981960
2021	3.585.459	65.193,22	0,355586091	0,00142849

Source: Author's preparation.

**Table 3. Results of the Kuznets Curve Hypothesis Analysis of Inequality Issues.**

Variable	Coefficient	t-statistics	Probability	Adjusted R <sup>2</sup>	Position
C	0.815271	4.411111*	0.0017	0.733758	No Reverse "U" happens
y	-1.13E-05	-1.384357d	0.1996		
y <sup>2</sup>	7.07E-11	0.818562d	0.4342		

Source: OLS Estimation Results, Author's preparation.



**Fig. (2).** Kuznets curve Jambi Province inequality issues, 2010-2021.

Source: Author's preparation.

Previous research and finding the same thing, that there is no inverted U-shaped Kuznets curve on the issue of inequality, is a study conducted by: Agala & Eke (2019); Asogwa et al. (2021); Kanbur et al. (2021); Khuluk et al. (2021); Iek &

Blesia (2019); Onafowora & Owoye (2017); Oyvat (2015); Topuz & Dağdemir (2020); Waluyaningsih & Setiawan (2020). Mahakso (2013), who had previously carried out study in the province of Jambi similarly discovered that be-

**Table 4. The Average Result of Analysis Location Quotient in Jambi Province, 2010-2021.**

Base Sector			Non-base Sector			Base Potential		
A	Agriculture, Forestry, and Fisheries	1,9471	C	Processing industry	0,4974	O	Government Administration, Defense, and Mandatory Social Security	0,9546
B	Mining and excavation	2,8239	D	Electricity and Gas Supply	0,0459	Q	Health Services and Social Activities	0,9724
E	Water Supply, Waste Management, Waste, and Recycling	1,6438	F	Construction	0,6899			
P	Education Services	1,0468	G	Wholesale and Retail Trade; Car and Motorcycle Repair	0,6678			
			H	Transportation and Warehousing	0,7776			
			I	Provision of Accommodation and Food and Drink	0,3380			
			J	Information and Communication	0,7181			
			K	Financial Services and Insurance	0,5690			
			L	Real Estate	0,4895			
			MN	Company Services	0,6258			
			R S T U	Other services	0,6012			

Source: Author's preparation.

tween 2003 and 2010, there was no inverted Kuznets U-curve between inequality and economic growth. In similar research, Alin et al. (2019) also found that there was no inverted Kuznets U-curve between the Gini ratio and GRDP per capita in Jambi Province during the year 2001-2016.

The increase in GRDP per capita, which does not have an impact on inequality and poverty in Jambi Province, is most likely due to the sectors that form the economic basis of Jambi Province, which are still oriented to the agriculture, forestry, and fishery sectors, as well as the mining and quarrying sector. So, there has been no shift in the magnitude of the contribution of these two sectors to the industrial and service sectors to the GRDP of Jambi Province. Meanwhile, industry and service-oriented sectors are sectors that will create jobs and the distribution of income. The fact that the basic sector in Jambi Province has not yet shifted indicates that the economy in Jambi Province has not yet entered the industrialization and technology phase, or it can be interpreted as not yet developed and sustainable.

### C. The Economic Base and Klassen Typology in the Province of Jambi

From the Location Quotient analysis results, the base and non-base sectors in Jambi Province during the 2010-2021 period can be determined.

Table 4 shows that Jambi Province is divided into four basic economic sectors: A. Agriculture, Forestry, and Fisheries; B. Mining and Quarrying; E. Water Supply; W. Waste Management; W. Waste and Recycling; and P. Educational Services. In Jambi Province, these four industries are the ones that are propelling economic growth. Especially sector B. Mining and Quarrying, which has LQ = 2.8239. The Location Quotient result is in line with the previous Kuznets Curve hypothesis and inequality that the basic sector in Jambi Province is the sector that creates fewer jobs or absorbs less labor, which results in a lack of income distribution. The Jambi Province base sector has not yet shifted to the industrial and service sectors, indicating that the economy in Jambi Province is still far from the industrialization and technology phase, or it can be interpreted as not yet developed and sustainable.

Sectors O. Government Administration, Defense, and Mandatory Social Security with a LQ of 0.9546 and sector Q. Health Services and Social Activities with a LQ of 0.9724 both have a LQ close to 1 in the Location Quotient analysis used to identify the base sector and non-base sector in the Jambi Province. This demonstrates that these two sectors are new ones that are boosting the economy in the province of Jambi. And it is hoped that these two sectors would develop into fundamental ones during the next one to five years.

**Table 5. Shift Share Analysis Results in Jambi Province, 2010-2021.**

Sector	Component			
	Nij	Mij	Cij	Dij
A. Fisheries, Agriculture, and Forestry	14.089,61	6.595,80	6.546,94	27.232,35
B. Quarry and Mining	14.464,13	2.094,12	7.925,25	24.483,50
C. Manufacturing Sector	6.176,53	3.152,29	67,38	9.396,19
D. Gas and Electricity Purchasing	22,89	13,35	26,11	62,35
E. Waste and Recycling, Waste Management, and Water Supply	86,45	60,17	-32,79	113,83
F. Construction	3.175,73	2.409,32	2.667,38	8.252,44
G. Automotive and motorcycle repair; wholesale and retail trade	4.578,42	2.608,05	2.993,40	10.179,87
H. Warehousing and Transportation	1.634,48	1.071,20	-124,64	2.581,04
I. Providing lodging and refreshments	505,88	279,04	344,84	1.129,75
J. Communication and information	1.759,87	3.027,04	-1.692,29	3.094,62
K. Insurance and Financial Services	1.066,20	1.000,30	208,91	2.275,40
L. Real Estate	859,90	585,97	-142,69	1.303,18
M N. Company Services	647,45	640,49	-619,48	668,46
O. Mandatory Social Security, Defense, and Government Administration	1.923,88	774,95	568,02	3.266,85
P. Education Services	1.923,72	1.423,00	-428,67	2.918,05
Q. Social Activities and Health Services	539,03	735,47	42,83	1.317,33
R.S.T.U. Other services	584,22	576,42	-442,99	717,66
<b>Total</b>	<b>54.038,40</b>	<b>27.046,97</b>	<b>17.907,50</b>	<b>98.992,87</b>

Source: Author's preparation.

Previous research found something similar to the researcher that the basic sector of a region has not yet shifted to a sector that creates jobs, absorbs labor, and has an impact on income distribution, such as the industrial and service sectors. Or the still large dominance of the agricultural, forestry, mining, and mining sectors in the economic growth of a region, is research conducted by: Khuluk et al. (2021); Mukhlis et al. (2018). Previous research on the growth of the basic and non-basic economic sectors in Jambi Province also found almost the same results, namely the results of research by Emilia et al. (2014) from 2005-2010 and Imelia & Hardiani (2014) during the period 2000-2010, that in the Jambi Province economy there are 5 (five) basic economic sectors ( $LQ > 1$ ), namely the agricultural sector, mining and quarrying sector, electricity, gas and clean water sector, trade sector, hotels and restaurants and transportation, and communications sector.

Additionally, the Shift Share study was performed, and based on its findings, the value of **Dij** was determined to be positive with a total of 98,992.87 billion rupiahs. This indicates that Jambi Province's absolute value-added performance is productive across the board.

The level of a sector's competition is indicated by its **Cij** value. A high **Cij** value denotes a sector's competitive advantage, whereas a low **Cij** value denotes the opposite. If the

result is negative, the industry lacks a competitive advantage. It is clear from Table 5 that there are 10 sectors with competitive advantages, with sector B. Mining and Quarrying having the biggest or most significant advantage over the other sectors. Sector A, which includes agriculture, forestry, and fishing, is in second place, followed by sector G, which includes wholesale and retail trade as well as auto and motorcycle repair, as shown in Table 5. Seven industries, however, are not at a competitive advantage. Sector J. The sector with the least competitive advantage in comparison to other sectors is information and communication, as evidenced by the negative **Cij** value of -1,692.29 billion rupiahs.

Additionally, the **Mij** value is a value that depicts proportional growth; if it is positive, it indicates that the sector is growing relatively quickly, and if it is negative, it indicates that the sector is growing relatively slowly. Sector A includes forestry, fishing, and agriculture; Sector C includes processing; Sector J includes information and communication; Sector G includes wholesale and retail trade; Sector H includes automobile and motorcycle repair; and Sector B includes construction. Mining and Quarrying are the six sectors that Jambi Province specializes in its economic growth. Meanwhile, the positive **Nij** value with a total of 54,038.40 billion rupiahs, means that the economy of Jambi Province during the study period, namely 2010-2021, grew faster than the national economy of 54,038.40 billion rupiahs.



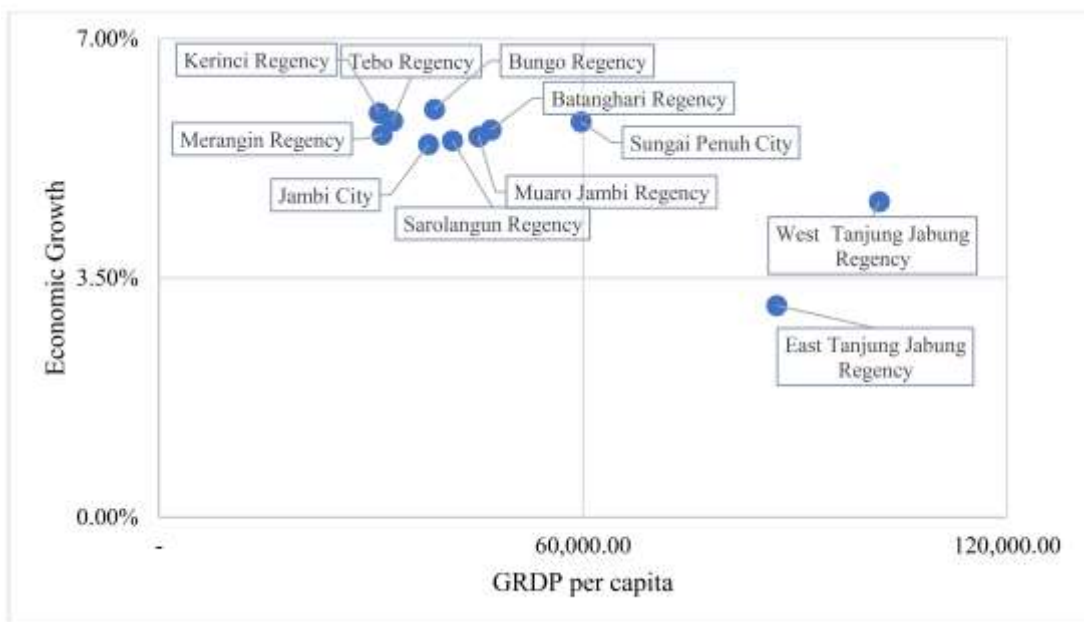


Fig. (3). Regency/City Typology Qualification Quadran In Jambi Province, 2010-2021.

Source: Author's preparation.

Jambi Province consists of 11 regencies and cities, which of course, have different economic bases and regional characteristics. The morphology of districts and cities is formed from the interactions and economic and social activities of their communities (Wijaya et al., 2020). Due to this difference, Klassen Typology analysis was carried out to see the trend of economic growth as well as an effective economic strategy for each of the qualified districts/cities. By looking at the rate of economic growth and GRDP per capita in each district/city in Jambi Province, the Klassen typology classification results are obtained in Fig. (3).

Districts and cities in quadrant I are developed and growing rapidly in Jambi Province during the research period, namely 2010-2021. The area is West Tanjung Jabung Regency. This illustrates that West Tanjung Jabung Regency is an area that has good economic independence and productivity so that it can be superior to 10 other regencies and cities in Jambi Province. However, if seen, West Tanjung Jabung Regency is in the second lowest position for average economic growth during 2010-2021, after East Tanjung Jabung Regency. Of course, this is a question mark, why based on Klassen's Typology analysis, it is included in quadrant I, namely developed and rapidly growing regions. This is most likely due to the highest or superior GRDP per capita of West Tanjung Jabung Regency compared to other Regencies and Cities in Jambi Province. Where the average GRDP per capita of West Tanjung Jabung Regency during the period 2010-2021 is 101,924.50 thousand rupiahs, more than double that of Jambi Province, whose average GRDP per capita is only 47,662.90 thousand rupiahs. The income per capita is income whose amount describes the average income of the population in a particular area. Per capita income is also often used as a measure of the prosperity level of development in a region. This means that economic development is not only assessed from the aspect of economic growth but also from equity (Soebagyo et al., 2019). Thus, the results of the Klas-

sen Typology analysis, which places West Tanjung Jabung Regency in quadrant I, of course, become reasonable.

Furthermore, there are 9 regencies/cities in quadrant II, namely Kerinci Regency, Tebo Regency, Bungo Regency, Batanghari Regency, Merangin Regency, Jambi City, Sarolangun Regency, Muaro Jambi Regency, and Sungai Penuh City. And if seen from Fig. (3)., Sungai Penuh City is almost heading to quadrant I. Regencies and cities located in quadrant II describe the area as being developed but depressed. There are no regencies and cities in quadrant III, or underdeveloped areas, while in quadrant IV, there is East Tanjung Jabung Regency. East Tanjung Jabung Regency, which is in quadrant IV, means that this area is a fast-growing area and has the potential to develop economic resources but has not been managed more effectively and efficiently. Therefore, it is hoped that the regional government of East Tanjung Jabung Regency can increase economic growth and development by encouraging potential regional sources in a sustainable manner.

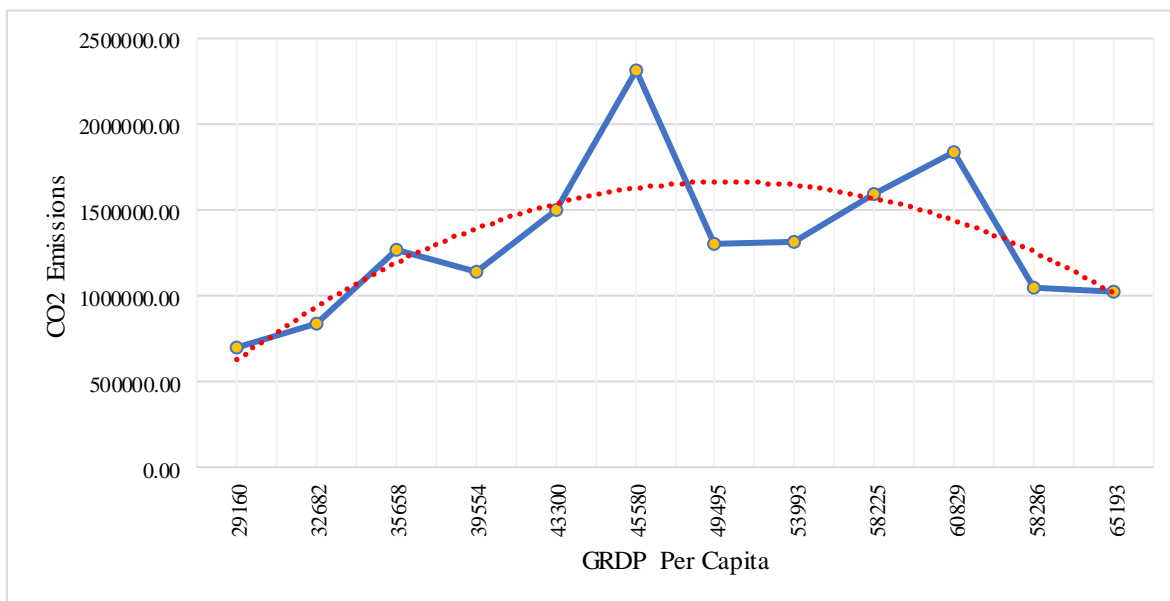
**D. Environment and hypothesis Environmental Kuznets Curve (EKC) in the Province of Jambi**

By using CO2 gas emission data and GRDP per capita in Jambi Province during the 2010-2021 period, the results of hypothesis testing for environmental issues are obtained. From the results of the Kuznets curve hypothesis analysis of environmental issues in Table 6, the coefficient  $\beta_2 < 0$  shows that in Jambi Province, there is an inverted Kuznets U curve on environmental issues. With the application of the inverted Kuznets U curve hypothesis, it means that in the long term, economic growth in Jambi Province will reduce environmental pollution. This means that an increase in economic growth can or is able to reduce environmental pollution.

**Table 6. The results of the Kuznets Curve Hypothesis Analysis on Environmental Issues.**

Variable	Coefficient	t-statistics	Probability	Adjusted R <sup>2</sup>	Position
CO2	-3937295.	-1.879470***	0.0929	0.312861	Reverse "U" happens
y	222.9480	2.406678**	0.0395		
y <sup>2</sup>	-0.002233	-2.282539**	0.0484		

Source: OLS Estimation Results, Author's preparation.



**Fig. (4).** Kuznets curve Jambi Province environmental issues, 2010-2021.

Source: Author's preparation.

Fig. (4) shows the association between CO2 gas emissions and income distribution in addition to the regression results, which demonstrate the occurrence of an inverted Kuznets U curve. The graph illustrating the correlation between GRDP per capita and CO2 gas emissions that researchers got from the office of the Environmental Service of Jambi Province provides proof that the notion of an inverted U-shaped Kuznets curve does in fact exist. The graph's trendline makes it clear that the Kuznets inverted U curve in Jambi Province took place between 2010 and 2021.

Previous research that proves that the inverted U-shaped Kuznets curve occurs for environmental issues is research conducted by: Adeel-Farooq et al. (2021), investigates the effects of GDP, namely the quadratic form of GDP, and two controlled variables, specifically energy consumption and trade openness to methane (CH4) emissions in six ASEAN nations. In these nations, the study's findings support the EKC hypothesis. That is, the EKC hypothesis' projected economic expansion eventually leads to a decrease in pollution (CH4 emissions) after reaching a particular higher level; Apergis et al. (2017), that the EKC hypothesis occurs in 10 US states; Cahyadin et al. (2021), revealed that traditional EKC occurred in 97 developing countries during the period 1991-2014; Chen & Taylor (2020), assessed environmental quality in Singapore from 1900 to 2017 in the context of economic development and related phenomena utilizing heavy metals (chromium, Cr). After conducting an econometric study, the National Emissions Inventory (NEI) as-

essment determined that Singapore's Cr emission history is consistent with the EKC; Davidson et al. (2021), based on dynamic data panel estimates with GMM and Russian regional data for 2004–2018, the EKC hypothesis was validated, implying an inverted U-shaped economic relationship between regional growth and CO2 emissions; Fasikha & Yuliadi (2018), that ASEAN country during the period 2005-2015 indicated the EKC hypothesis; Koirala & Mysami (2015), testing the inverted U-shaped EKC hypothesis was successful at the district level in the US using information on the net impact of forest resources on CO2 emissions and per capita income; Tiba & Frikha (2020), investigates a modified Kuznets curve for the environment that considers governance and human development factors affecting macroeconomic sustainability. That for the modified version of the EKC, the presumptive EKC hypothesis is confirmed. According to empirical data, sustainability factors significantly impact ecological challenges, which serve as the background for the Millennium Development Goals; Ullah & Awan (2020), EKC occurs in emerging Asian economies in the long run; Ulucak & Bilgili (2018), using the Ecological Footprint (EF) data reveals that the EKC hypothesis occurs in groups of low, middle and high-income countries. Meanwhile, previous studies that identified and analyzed the relationship between economics and environmental issues, particularly the Kuznets curve hypothesis on environmental issues in Jambi Province, have not been detected in national or international journal publications.

## CONCLUSION

The concept of economic growth encouraging economic development will have an impact on quality economic growth planning. Economic growth planning includes sectoral planning and economic indicators. Sectoral planning is planning in the form of encouraging the growth of regional strategic sectors and also improving these strategic sectors, for example, the GDP and GRDP sectors. Meanwhile, planning for economic indicators can be interpreted as planning that encourages improvements in strategic indicators of economic development, such as improving inequality and environmental pollution.

From the study's findings, it is possible to draw numerous significant conclusions that serve as a basis for gauging the effectiveness and standard of the Jambi Province economy. First, there is no inverted "U" Kuznets curve on the topic of inequality, which means that Jambi Province's economic growth and rising GRDP per capita have no bearing on lowering poverty and inequality. Second, the Mining and Quarrying industry continues to be a sector that makes a dominant contribution to GRDP and is also the key driver of economic growth in Jambi Province, according to the results of Location Quotient and Shift Share. When it comes to the issue of inequality, the Location Quotient and Shift Share results are unquestionably consistent with the Kuznets curve hypothesis. The basic economy in Jambi Province has not yet shifted to the industrial and service sectors, which are sectors that can generate employment or absorb labor and have an effect on an equitable distribution of income. The fact that the base sector in Jambi Province has not changed indicates that the region's economy is still in the early stages of development and is not yet industrialized or technologically advanced.

However, economic expansion is the same as environmental pollution. There is an inverted "U"-shaped Kuznets curve for environmental issues using information on CO<sub>2</sub> gas emissions from the Jambi Province Environmental Service and GRDP per capita in Jambi Province throughout the 2010–2021 timeframe. In Jambi Province, environmental pollution will decline over time as a result of economic expansion, according to evidence supporting the Environmental Kuznets Curve (EKC) theory. In other words, more economic expansion has the potential to lessen environmental damage.

From the results of this study, the researcher recommends several things. First, the regional government of Jambi Province should try to expand the entrepreneurial, industrial, and service climate to optimize economic growth so that it can encourage job creation or employment and also have an impact on poverty reduction and equity income distribution. Second, although the results of the study show that the Kuznets U curve is inverted in Jambi Province, local governments must continue to realize environmentally friendly economic growth and have a sustainable perspective by applying permits for activities in the agricultural, forestry, and mining sectors which have more or less no impact good for the environment. Third, in order to foster quality economic growth that will ultimately benefit all parties, local governments, the business sector, and the community must be committed to working together. Fourth, the researcher hopes that the results of this study can be a starting point for further research, such as research on factors that influence and en-

courage the economy of Jambi Province to be able to enter the industrialization and technology phase, as well as research on regional development planning that encourages income distribution or regional equity and quality environment in Jambi Province.

## APPENDIX

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## REFERENCES

- Adeel-Farooq, R. M., Raji, J. O., & Adeleye, B. N. (2021). Economic growth and methane emission: testing the EKC hypothesis in ASEAN economies. *Management of Environmental Quality: An International Journal*, 32(2), 277–289. <https://doi.org/10.1108/MEQ-07-2020-0149>
- Agala, F. B., & Eke, F. A. (2019). Income Inequality, Environmental Degradation and Economic Development Nexus in Nigeria: Reassessing the Kuznets Hypothesis. *International Journal of Innovation and Applied Studies*, 27(4), 1014–.
- Alin, N. F., Heriberta, H., & Umiyati, E. (2019). Fakta empiris kurva U-terbalik Kuznets mengenai pertumbuhan ekonomi di Provinsi Jambi. *Jurnal Paradigma Ekonomika*, 14(1), 9–16. <https://doi.org/10.22437/paradigma.v14i1.6788>
- Apergis, N., Christou, C., & Gupta, R. (2017). Are there Environmental Kuznets Curves for US state-level CO<sub>2</sub> emissions? *Renewable and Sustainable Energy Reviews*, 69(November 2016), 551–558. <https://doi.org/10.1016/j.rser.2016.11.219>
- Asogwa, F. O., Onyeko, Q. O., Kuma, P. M., Arazue, W. O., & Nkulu, C. N. (2021). Do macroeconomic indicators determine income inequality in selected African countries? *Journal of Public Affairs*, September 2020, 1–7. <https://doi.org/10.1002/pa.2560>
- Aydin, C., & Esen, Ö. (2017). The Validity of the Environmental Kuznets Curve Hypothesis for CO<sub>2</sub> Emissions in Turkey: New Evidence From Smooth Transition Regression Approach. *Mustafa Kemal University Journal of Social Sciences Institute*, 14(39), 101–116.
- Cahyadin, M., Sari, V. K., & Juwita, A. H. (2021). New Evidence of Environmental Kuznets Curve Hypothesis in Developing Countries. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, 22(2), 251–262. <https://doi.org/10.23917/jep.v22i2.15794>
- Castells-Quintana, D. (2018). Beyond Kuznets: Inequality and the size and distribution of cities. *Journal of Regional Science*, 58(3), 564–580. <https://doi.org/10.1111/jors.12368>
- Chen, Q., & Taylor, D. (2020). Economic development and pollution emissions in Singapore: Evidence in support of the Environmental Kuznets Curve hypothesis and its implications for regional sustainability. *Journal of Cleaner Production*, 243(118637), 1–11. <https://doi.org/10.1016/j.jclepro.2019.118637>
- Datt, G., Ravallion, M., & Murgai, R. (2020). Poverty and Growth in India over Six Decades. *American Journal of Agricultural Economics*, 102(1), 4–27. <https://doi.org/10.1093/ajae/aaz043>
- Davidson, N., Mariev, O., & Turkanova, S. (2021). Does income inequality matter for CO<sub>2</sub> emissions in Russian regions? *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 16(3), 533–551. <https://doi.org/10.24136/eq.2021.019>
- Emilia, Syaifuddin, & Nurjanah, R. (2014). Analisis Tipologi Pertumbuhan Sektor Ekonomi Basis dan Non Basis dalam Perekonomian Provinsi Jambi. *Jurnal Paradigma Ekonomika*, 9(2), 1–8. <https://doi.org/https://doi.org/10.22437/paradigma.v9i2.2202>
- Fasikha, Y., & Yuliadi, I. (2018). Analisis Pengaruh Perubahan Lingkungan Terhadap Pendapatan Per Kapita di Negara-Negara Asean Periode

- 2005–2015. *Journal of Economics Research and Social Sciences*, 2(1), 34–43.
- Firdaus, I. A. (2017). Pengaruh Pertumbuhan dan Keterbukaan Ekonomi Terhadap Perubahan Kualitas Lingkungan: Analisis Environmental Kuznet Curve (Studi Kasus Negara-Negara Anggota Regional Comprehensive Economic Partnership Tahun 1999–2014). *Jurnal Ilmiah Fakultas Ekonomi Dan Bisnis Universitas Brawijaya*, 4.
- Hoover, E. M., & Giarratani, F. (2020). *An Introduction to Regional Economics*. Regional Research Institute, West Virginia University.
- Hussen, A. M. (2005). *Principles of Environmental Economics: Economics, Ecology and Public Policy*. Routledge.  
<http://books.google.com/books?id=fgYgfaTh6KMC&pgis=1>
- Iek, M., & Blesia, J. U. (2019). Development inequalities in autonomous regions: A study pre-and post- special autonomy in Indonesia's most eastern provinces. *Journal of Asian Finance, Economics and Business*, 6(1), 303–314.  
<https://doi.org/10.13106/jafeb.2019.vol6.no1.303>
- Imelia, & Hardiani. (2014). Dampak Pertumbuhan Sektor Ekonomi Basis Terhadap Kemiskinan Di Provinsi Jambi. *Jurnal Paradigma Ekonomika*, 9(2), 51–59.  
<https://doi.org/https://doi.org/10.22437/paradigma.v9i2.2208>
- Kanbur, R., Wang, Y., & Zhang, X. (2021). The great Chinese inequality turnaround. *Journal of Comparative Economics*, 49(2), 467–482.  
<https://doi.org/10.1016/j.jce.2020.10.001>
- Khuluk, D. R. K., Muljaningsih, S., & Asmara, K. (2021). Analisis Disparitas Pendapatan Antar Wilayah Di Daerah Penyangga Surabaya. *Jurnal Ekonomi Pembangunan STIE Muhammadiyah Palopo*, 7(1), 9. <https://doi.org/10.35906/jep01.v7i1.762>
- Koirala, B. S., & Mysami, R. C. (2015). Investigating the effect of forest per capita on explaining the EKC hypothesis for CO<sub>2</sub> in the US. *Journal of Environmental Economics and Policy*, 4(3), 304–314.  
<https://doi.org/10.1080/21606544.2015.1010456>
- Mahakso, W. (2013). *Analisis Faktor-faktor yang Mempengaruhi Ketimpangan Wilayah Di Provinsi Jambi, 2003-2010* [Universitas Gadjah Mada].  
<http://etd.repository.ugm.ac.id/penelitian/detail/59669>
- Mankiw, N. G. (2010). *Macroeconomics* (7th Ed.). Worth Publishers.
- Mukhlis, I., Utomo, S. H., Rahmani, L., & Fernanda, Y. M. (2018). A Competitiveness Analysis of Economic Sector in Tuban Regency, East Java. 57(Piceeba), 443–452. <https://doi.org/10.2991/piceeba-18.2018.27>
- Nikensari, S. I., Destilawati, S., & Nurjanah, S. (2019). Studi Environmental Kuznets Curve Di Asia: Sebelum Dan Setelah Millennium Development Goals. *Jurnal Ekonomi Pembangunan*, 27(2), 11–25.  
<https://doi.org/10.14203/jep.27.2.2019.11-25>
- Onafowora, O., & Owoye, O. (2017). A panel vector AutoRegression analysis of income inequality dynamics in each of the 50 states of USA. *International Journal of Social Economics*, 44(6), 797–815.  
<https://doi.org/10.1108/IJSE-06-2015-0154>
- Oyvatt, C. (2015). Structural Change and the Kuznets Hypothesis Acknowledgments. In *Greenwich Political Economy Research Centre* (Vol. 23). [http://gala.gre.ac.uk/14074/1/GPERC23\\_-\\_Oyvatt.pdf](http://gala.gre.ac.uk/14074/1/GPERC23_-_Oyvatt.pdf)
- Pérez-Suárez, R., & López-Menéndez, A. J. (2015). Growing green? Forecasting CO<sub>2</sub> emissions with Environmental Kuznets Curves and Logistic Growth Models. *Environmental Science and Policy*, 54, 428–437. <https://doi.org/10.1016/j.envsci.2015.07.015>
- Perman, R., Ma, Y., McGilvray, J., & Common, M. (2003). *Natural Resource and Environmental Economics* (3rd Eds). Pearson Education Limited.
- Putra, A. (2015). Analisis Diterminan Ketimpangan Wilayah di Provinsi Jambi Pada Periode Tahun 2008–2013. *Jurnal Development*, 3(2), 1–17. <https://doi.org/https://doi.org/10.53978/jd.v3i2.59>
- Ridzuan, S. (2019). Inequality and the environmental Kuznets curve. *Journal of Cleaner Production*, 228, 1472–1481.  
<https://doi.org/10.1016/j.jclepro.2019.04.284>
- Saputra, D. (2016). Analisis Pertumbuhan Ekonomi dan Tingkat Ketimpangan Antar Kabupaten/Kota di Provinsi Jawa Barat. *CR Journal, Creative Research for West Java Development*, 2(1), 1–16.
- Şentürk, H., Omay, T., Yildirim, J., & Köse, N. (2020). Environmental Kuznets Curve: Non-Linear Panel Regression Analysis. *Environmental Modeling and Assessment*, 25(5), 633–651.  
<https://doi.org/10.1007/s10666-020-09702-0>
- Shahabadi, A., Nemati, M., & Hosseinioust, S. E. (2018). The effect of education on income inequality in selected Islamic countries. *International Journal of Asia-Pacific Studies*, 14(2), 61–78.  
<https://doi.org/10.21315/ijaps2018.14.2.3>
- Soebagyo, D., Fahmy-Abdullah, M., Sieng, L. W., & Panjawa, J. L. (2019). Income inequality and convergence in Central Java under regional autonomy. *International Journal of Economics and Management*, 13(1), 203–215.
- Stimson, R. J., Stough, R. R., & Roberts, B. H. (2006). *Regional Economic Development: Analysis and Planning Strategy*. Springer Berlin Heidelberg.
- Syrquin, M. (2005). Kuznets and Modern Economic Growth Fifty Years Later. *Thinking Ahead: The Future of Development Economics, Helsinki: WIDER Conference., June*, 1–15.
- Tarigan, R. (2005). *Ekonomi Regional: Teori dan Aplikasi*. Bumi Aksara.
- Tiba, S., & Frikha, M. (2020). EKC and Macroeconomics Aspects of Well-being: A Critical Vision for a Sustainable Future. *Journal of the Knowledge Economy*, 11(3), 1171–1197.  
<https://doi.org/10.1007/s13132-019-00600-9>
- Tietenberg, T. H., & Lewis, L. (2018). *Environmental and Natural Resource Economics* (11th Ed.). Routledge.
- Todaro, M. P., & Smith, S. C. (2015). *Economic Development* (12th Ed.). Pearson.
- Topuz, S. G., & Dağdemir, Ö. (2020). Analysis of the relationship between trade openness, structural change, and income inequality under Kuznets curve hypothesis: The case of Turkey. *Journal of International Trade and Economic Development*, 29(6), 647–664.  
<https://doi.org/10.1080/09638199.2019.1711146>
- Ullah, S., & Awan, M. S. (2020). Environmental Kuznets Curve and Income Inequality: Pooled Mean Group Estimation for Asian Developing Countries. *Forman Journal of Economic Studies*, 15, 157–179.  
<https://doi.org/10.32368/fjes.20191507>
- Ulucak, R., & Bilgili, F. (2018). A reinvestigation of EKC model by ecological footprint measurement for high, middle and low income countries. *Journal of Cleaner Production*, 188, 144–157.  
<https://doi.org/10.1016/j.jclepro.2018.03.191>
- Waluyaningsih, V. D., & Setiawan, A. H. (2020). Analisis Ketimpangan Pendapatan Antarwilayah Subosukawonosraten Periode 2008–2017. *Diponegoro Journal Of Economic*, 9(2), 123–134.  
<https://ejournal2.undip.ac.id/index.php/dje>
- Wijaya, A., Darma, S., & Darma, D. C. (2020). Spatial interaction between regions: Study of the East Kalimantan Province, Indonesia. *International Journal of Sustainable Development and Planning*, 15(6), 937–950. <https://doi.org/10.18280/ijstdp.150618>
- Younsi, M., & Bechtini, M. (2020). Economic Growth, Financial Development, and Income Inequality in BRICS Countries: Does Kuznets' Inverted U-Shaped Curve Exist? *Journal of the Knowledge Economy*, 11(2), 721–742.  
<https://doi.org/10.1007/s13132-018-0569-2>
- Yustisia, D., & Sugiyanto, C. (2014). Analisis Empiris Environmental Kuznets Curve (EKC) Terkait Orientasi Energi. *Jurnal Ekonomi Dan Studi Pembangunan*, 161–170.