Eximia Journal

(ISSN 2784-0735)

Vol. 9

2023

Eximia Journal
Vol. 9, 44-63, May, 2023
ISSN: 2784-0735
www.eximiajournal.com

Understanding the relationship between states' unemployment rates and gross domestic product

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Abstract. This research paper examines the factors that affect the unemployment rate in public sector states of America. The study is based on the relationship between states' unemployment rates and Gross Domestic Product (GDP). The research question is: What is the relationship between states' unemployment rates and GDP? The hypothesis is that states with high unemployment rates will have lower GDPs. The research design contains three studies and one theory for different authors in the literature review section relevant to this study. The unit of analysis is the states of America. The paper proposes a methodology that describes the measures of the study. The researcher used nominal-level data to measure states and scale to measure GDP, states' unemployment rate, and population. The study concludes that higher unemployment rates caused lower GDP in states of America. An interesting subject for future study is the effects of states' unemployment rates on the state's GDP.

Keywords. unemployment rate, public sector, states of America, GDP, nominal-level data, regression equation, correlation coefficient, cyclical unemployment, economic growth, computer technology, global trade

Introduction

Unemployment is the phenomenon of the unavailability of a job despite active searching. It usually gives an estimation of the economy of the country. The unemployment rate of any country is estimated by dividing the number of unemployed people by employed people. Economists divide unemployment into nine types: classical unemployment, seasonal unemployment, real unemployment, long-term unemployment, structural unemployment, frictional unemployment, natural unemployment, cyclical unemployment, and underemployment. Types of unemployment are based on the population's willingness (Amadeo, 2022).

The United States has three types of unemployment: cyclical unemployment, which means unemployment is due to the rise and fall in the business itself, structural unemployment, which means unemployment due to the replacement of labor with technology; and frictional unemployment, which means unemployment due to job searching or transition (Congressional Research Service, 2017).

Unemployment is a persistent issue that has a significant impact on individuals, families, and society as a whole. It is a complex problem with various causes and sources,

particularly in the public sector. In order to effectively address this issue, it is crucial to understand the underlying reasons behind it and to improve employment opportunities and policies. The unemployment rate in the U.S. is 4.1 percent, with 2.3 percent annual GDP growth in 2017 (Amadeo, 2022). This suggests that the government's economy must be strengthened to tackle this challenge. In this context, examining the causes and sources of unemployment is crucial to develop effective strategies for addressing it.

Literature review

Several studies are relevant to the research study. The research discusses the relationship between the unemployment rate and the GDP in the government sector and the impact on the economy, which is very important to writers and researchers. Many investigations have examined certain variables that could notably influence the unemployment rate. This research will be an extension of previous studies, which reached several conclusions about the factors that lead to the relationship between the GDP and the unemployment rate. As for the most critical studies, this study will explain some of them below:

Linda Levine's (2013) report analyzed the relationship between economic growth and the unemployment rate. The report revealed that despite the economy bouncing back in June 2009 from the 11th postwar recession, the unemployment rate remained historically high for over three years. This was concerning for Congress due to its adverse effects on individuals' economic well-being and its impact on the federal budget. The report also highlighted that economic growth is the primary driver of the unemployment rate from a public policy perspective. To examine this relationship further, the study focused on the recovery periods after postwar recessions.

A study by Marlen Jurisch, Christian Ilkas, Petra Wolf, and Helmut Krcmar (2013) about the critical differences between private and public sector business process change. The public sector worldwide needs to rethink, adapt, and change its underlying service process to address current financial and other challenges. For example, in Obama's administration in the U.S., public administration was forced to transform them into more efficient and effective ones. The resulting pressures to cut budgets and increase efficiency while maintaining performance prompted public managers to turn to the private sector for solutions. Cutting the budget and others affect the government employment rate, and cutting red tape can reduce the decline of the government employment rate and unemployment rate.

A study by Iulia Rosoiu and Andreea Rosoiu (2014) about the relationship between the unemployment rate and economic growth in the USA. This study analyzed the relationship between the unemployment rate and gross domestic product for the economy of the United States of America. During recession periods, the unemployment rate strongly reacts to a particular variation in gross domestic product evolution. On the other hand, the unemployment rate keeps its value around a natural level during economic upswing periods. Moreover, the evolution of the unemployment rate is also influenced by other factors which the writers do not include in the analysis.

This paper is based on the unemployment of states of America. It describes unemployment due to the lack of opportunities available for the people due to the poor economic condition and lack of business in some states of America (Figure I). Keeping in view all the conditions mentioned above, the theory which is most applicable in this situation is 'Computer technology and Global trade" considered as a cause of unemployment in the United States because the U.S. economy has been disrupted, for example, bedrock jobs and other job are gone, especially in manufacturing, and will not come back again. This theory better

Eximia Journal
Vol. 9, 44-63, May, 2023
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www.eximiajournal.com

describes the public sector condition of the United States as compared with the private sector (Rotemberg, 2008).

Figure I: U.S. Unemployment Rate 2016 & 2017

Research question

This study explores a research question: What is the relationship between states' unemployment rates and the Gross Domestic Product? In particular, this research paper proposes a study exploring the relationship between the states' unemployment and GDP. The dependent variable (Y) here is the GDP. The independent variable (X) is the state's unemployment rate and population.

Hypothesis

Based on the research question several hypotheses were found related to the research question, but this research paper will discuss the essential hypothesis, which is listed below:

H0: There is no relationship between states' unemployment rates and the GDP.

H1: States with high unemployment rates will have lower GDPs.

Considering the literature review described earlier, it proposes that GDP led to unemployment in the public sector. Therefore, the research hypothesis is that GDP is related to the unemployment rate. The null hypothesis is that the GDP is unrelated to states' unemployment rate. This paper proposes a study that explores the hypotheses above.

Methodology

This study used a quantitative research approach and utilized secondary data. The secondary data was collected from three different sources and, for unemployment rates, used 2017 data. For GDP, 2010 data was used. For population, 2016 data was used. For the analysis, the SPSS program and regression will be shown, which will be applied so that better results can be captured here. The alpha level for this research is set at 0.5 (α=0.5). It used nominal-level data to measure states and scale to measure GDP, states' unemployment rate, and population. It provides a list of states with their GDP, unemployment rate, and population measured as a

Eximia Journal
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www.eximiajournal.com

percentage of each state of America. Then, it used regression and correlational techniques to explore the relationship between GDP and the unemployment rate of states of America. A brief discussion follows of using regression to test relationships between variables in this study.

Data

Table I: List of states of America with their percentage of dependent and independent variables

State	2017 Unemployment Rate	2016 Population	2010 GDP
Alabama	5.8	1.51	1.2
Alaska	6.4	0.23	0.31
Arkansas	3.6	0.93	0.73
California	4.9	12.15	13.34
Colorado	2.6	1.72	1.79
District of Columbia	5.8	0.21	0.72
Georgia	5.1	3.19	2.79
Hawaii	2.7	0.44	0.47
Idaho	3.5	0.52	0.38
Iowa	3.1	0.97	1.01
Kansas	3.8	0.9	0.89
Louisiana	5.7	1.45	1.47
Maine	3	0.41	0.37
Massachusetts	3.6	2.11	2.6
Minnesota	3.8	1.71	1.84
Montana	3.8	0.32	0.26
Nebraska	3.1	0.59	0.62
New Hampshire	2.8	0.41	0.42
New Mexico	6.7	0.64	0.52
North Dakota	2.8	0.24	0.23
Oregon	3.8	1.27	1.16
South Dakota	2.8	0.27	0.27
Texas	5	8.62	7.95
Utah	3.1	0.94	0.81
Vermont	3	0.19	0.18
Virginia	3.8	2.6	2.95
Wisconsin	3.4	1.79	1.73
Hawaii	2.71	0.44	0.47
Nevada	3.1	0.41	0.88
Ohio	2.81	3.96	3.33

Eximia Journal
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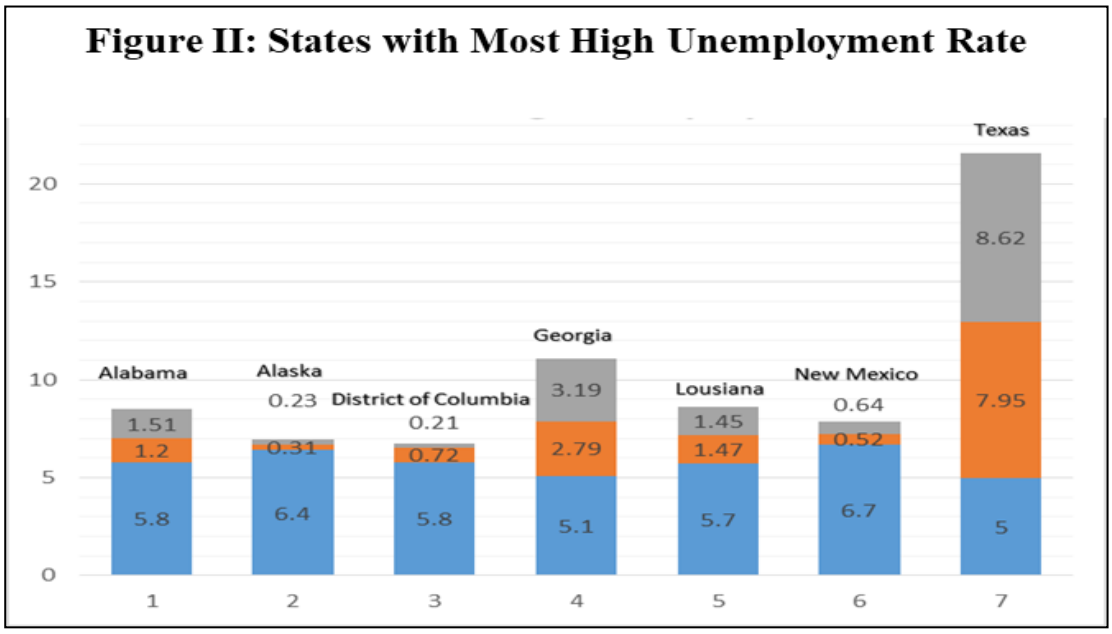
Unemployment Rate by States:

The seven states: Alabama, Alaska, the District of Columbia, Georgia, Louisiana, New Mexico, and Texas, are highlighted explicitly due to their high unemployment rates. Figure II likely displays information about the unemployment rates in these states, allowing for comparison and analysis of their respective situations. It shows three lines within the graph, indicating the relationship between the dependent and independent variables. It states that the relationship between these variables is a direct relationship. As the independent variable increases, the dependent variable also increases.

Figure II: States with Most High Unemployment Rate



DATA ANALYSIS

***Frequency:**

Statistics
2017 unemployment Rates

N	Valid	27
	Missing	0
Mean		3.9815
Median		3.6000
Mode		3.80
Std. Deviation		1.22413
Variance		1.498
Range		4.10
Minimum		2.60
Maximum		6.70

The frequency statistic table for the 2017 unemployment rate shows that the mean, median, and mode are close to "3.9815, 3.6000.and 3,80'. The standard deviation is 1.22, less than the variance of 1.498. However, the minimum is 2.60 while the maximum is 6.70, so the range is 4.10.

Eximia Journal
Vol. 9, 44-63, May, 2023
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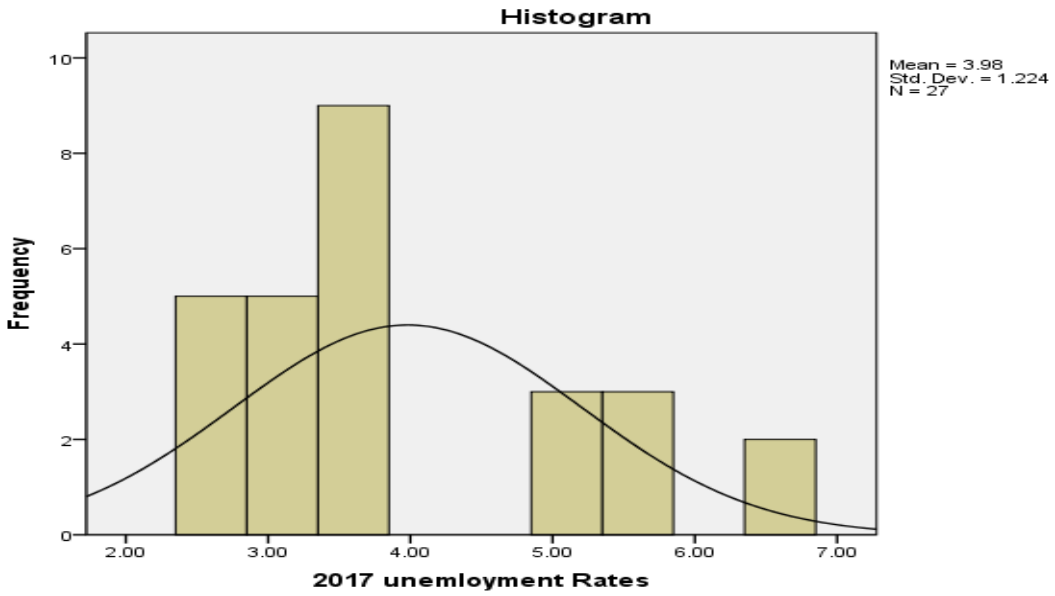
2017 unemployment Rates

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2.60	1	3.7	3.7	3.7
	2.70	1	3.7	3.7	7.4
	2.80	3	11.1	11.1	18.5
	3.00	2	7.4	7.4	25.9
	3.10	3	11.1	11.1	37.0
	3.40	1	3.7	3.7	40.7
	3.50	1	3.7	3.7	44.4
	3.60	2	7.4	7.4	51.9
	3.80	5	18.5	18.5	70.4
	4.90	1	3.7	3.7	74.1
	5.00	1	3.7	3.7	77.8
	5.10	1	3.7	3.7	81.5
	5.70	1	3.7	3.7	85.2
	5.80	2	7.4	7.4	92.6
	6.40	1	3.7	3.7	96.3
	6.70	1	3.7	3.7	100.0
	Total	27	100.0	100.0	



The histogram shows that the mean is 3.98, higher than the standard deviation 1.224. So, the distribution is a standard curve.

Eximia Journal
Vol. 9, 44-63, May, 2023
ISSN: 2784-0735
www.eximiajournal.com

Statistics
2010 GDP

N	Valid	27
	Missing	0
Mean		1.7411
Median		.8100
Mode		.18[a]
Std. Deviation		2.78912
Variance		7.779
Range		13.16
Minimum		.18
Maximum		13.34

The frequency statistic table for 2010 GDP shows that the mean, median, and mode are far from each other "1.74, .8100, and .18'. Also, many modes appear in this table. The standard deviation is 2.789, less than the variance of 7.779. However, the minimum is .18 while the maximum is 13.34, so the range is 13.16.

2010 GDP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.18	1	3.7	3.7	3.7
	.23	1	3.7	3.7	7.4
	.26	1	3.7	3.7	11.1
	.27	1	3.7	3.7	14.8
	.31	1	3.7	3.7	18.5
	.37	1	3.7	3.7	22.2
	.38	1	3.7	3.7	25.9
	.42	1	3.7	3.7	29.6
	.47	1	3.7	3.7	33.3
	.52	1	3.7	3.7	37.0
	.62	1	3.7	3.7	40.7
	.72	1	3.7	3.7	44.4
	.73	1	3.7	3.7	48.1
	.81	1	3.7	3.7	51.9
	.89	1	3.7	3.7	55.6
	1.01	1	3.7	3.7	59.3
	1.16	1	3.7	3.7	63.0
	1.20	1	3.7	3.7	66.7
	1.47	1	3.7	3.7	70.4
	1.73	1	3.7	3.7	74.1
	1.79	1	3.7	3.7	77.8
	1.84	1	3.7	3.7	81.5
	2.60	1	3.7	3.7	85.2
	2.79	1	3.7	3.7	88.9
	2.95	1	3.7	3.7	92.6
	7.95	1	3.7	3.7	96.3
	13.34	1	3.7	3.7	100.0
	Total	27	100.0	100.0	

Eximia Journal
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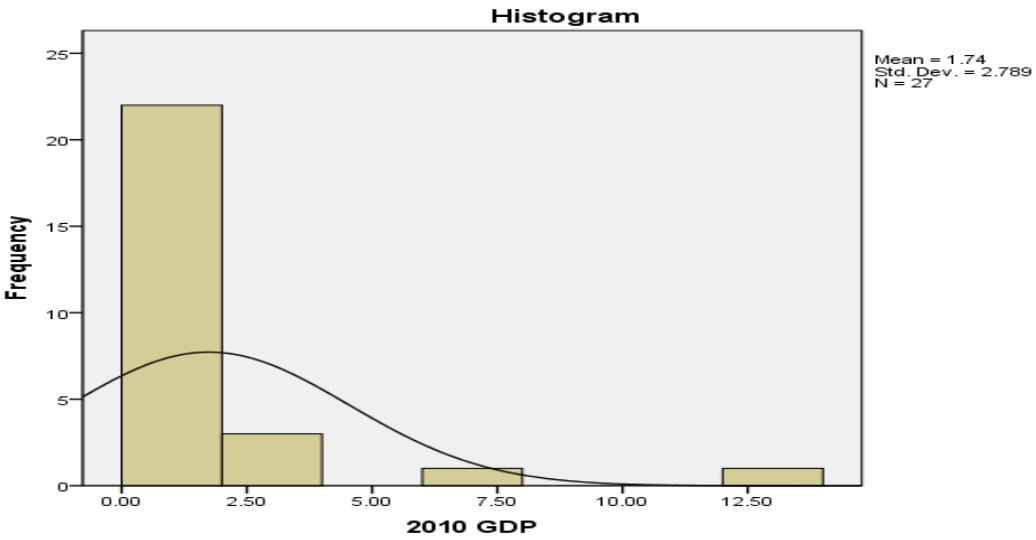
www.eximiajournal.com



The histogram shows a mean of 1.74, less than the standard deviation of 2.789. So, the distribution is positively skewed.

Statistics

2016 population

N	Valid	27
	Missing	0
Mean		1.7159
Median		.9300
Mode		.41
Std. Deviation		2.66257
Variance		7.089
Range		11.96
Minimum		.19
Maximum		12.15

The frequency statistic table for the 2016 population shows that the mean, median, and mode are far from each other " .1.7159,.9300, and .41". The standard deviation is 2.66, less than the variance of 7.089. However, the minimum is .19, while the maximum is 12.15, so the range is 11.96.

2016 population

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.19	1	3.7	3.7	3.7
	.21	1	3.7	3.7	7.4
	.23	1	3.7	3.7	11.1
	.24	1	3.7	3.7	14.8
	.27	1	3.7	3.7	18.5
	.32	1	3.7	3.7	22.2
	.41	2	7.4	7.4	29.6
	.44	1	3.7	3.7	33.3
	.52	1	3.7	3.7	37.0
	.59	1	3.7	3.7	40.7
	.64	1	3.7	3.7	44.4
	.90	1	3.7	3.7	48.1
	.93	1	3.7	3.7	51.9
	.94	1	3.7	3.7	55.6
	.97	1	3.7	3.7	59.3
	1.27	1	3.7	3.7	63.0
	1.45	1	3.7	3.7	66.7
	1.51	1	3.7	3.7	70.4
	1.71	1	3.7	3.7	74.1
	1.72	1	3.7	3.7	77.8
	1.79	1	3.7	3.7	81.5
	2.11	1	3.7	3.7	85.2
	2.60	1	3.7	3.7	88.9
	3.19	1	3.7	3.7	92.6
	8.62	1	3.7	3.7	96.3
	12.15	1	3.7	3.7	100.0
	Total	27	100.0	100.0	

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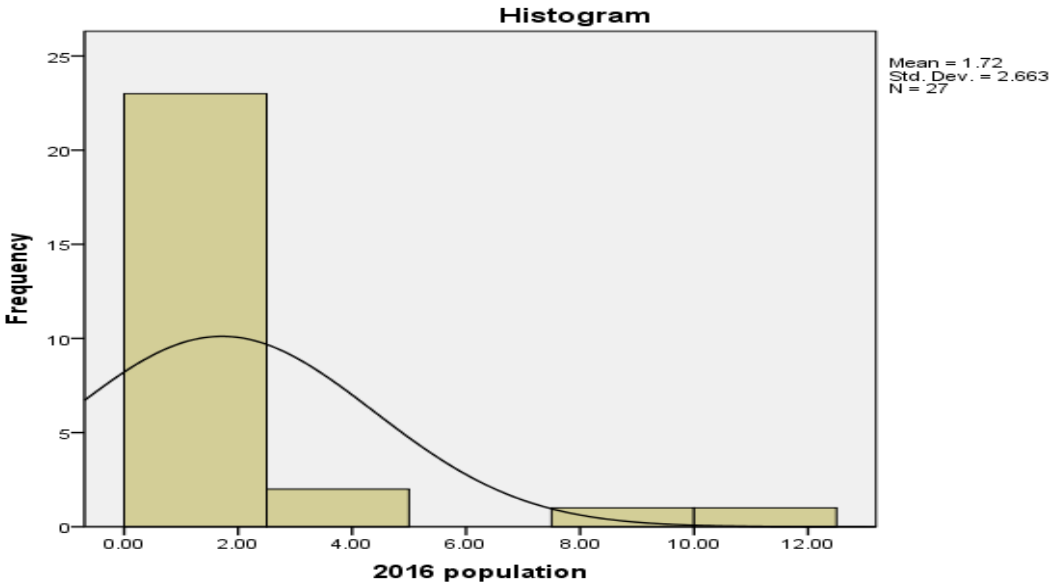

The histogram shows a mean of 1.72, less than the standard deviation of 2.663. So, the distribution is positively skewed.

***Oneway:**

Eximia Journal
Vol. 9, 44-63, May, 2023
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www.eximiajournal.com

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
2010 GDP	2.60	1	1.7900	.	.	.	.	1.79	1.79
	2.70	1	.4700	.	.	.	.	.47	.47
	2.80	3	.3067	.10017	.05783	.0578	.5555	.23	.42
	3.00	2	.2750	.13435	.09500	-.9321	1.4821	.18	.37
	3.10	3	.8133	.19502	.11260	.3289	1.2978	.62	1.01
	3.40	1	1.7300	.	.	.	.	1.73	1.73
	3.50	1	.3800	.	.	.	.	.38	.38
	3.60	2	1.6650	1.32229	.93500	-10.2153	13.5453	.73	2.60
	3.80	5	1.4200	1.02608	.45888	.1459	2.6941	.26	2.95
	4.90	1	13.3400	.	.	.	.	13.34	13.34
	5.00	1	7.9500	.	.	.	.	7.95	7.95
	5.10	1	2.7900	.	.	.	.	2.79	2.79
	5.70	1	1.4700	.	.	.	.	1.47	1.47
	5.80	2	.9600	.33941	.24000	-2.0895	4.0095	.72	1.20
	6.40	1	.3100	.	.	.	.	.31	.31
	6.70	1	.5200	.	.	.	.	.52	.52
	Total	27	1.7411	2.78912	.53677	.6378	2.8445	.18	13.34
2016 population	2.60	1	1.7200	.	.	.	.	1.72	1.72
	2.70	1	.4400	.	.	.	.	.44	.44
	2.80	3	.3067	.09074	.05239	.0813	.5321	.24	.41
	3.00	2	.3000	.15556	.11000	-1.0977	1.6977	.19	.41
	3.10	3	.8333	.21127	.12197	.3085	1.3581	.59	.97
	3.40	1	1.7900	.	.	.	.	1.79	1.79
	3.50	1	.5200	.	.	.	.	.52	.52
	3.60	2	1.5200	.83439	.59000	-5.9767	9.0167	.93	2.11
	3.80	5	1.3600	.86044	.38480	.2916	2.4284	.32	2.60
	4.90	1	12.1500	.	.	.	.	12.15	12.15
	5.00	1	8.6200	.	.	.	.	8.62	8.62
	5.10	1	3.1900	.	.	.	.	3.19	3.19
	5.70	1	1.4500	.	.	.	.	1.45	1.45

Eximia Journal
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www.eximiajournal.com

	5.80	2	.8600	.91924	.65000	-7.3990	9.1190	.21	1.51
	6.40	1	.2300	.	.	.	.	.23	.23
	6.70	1	.6400	.	.	.	.	.64	.64
	Total	27	1.7159	2.66257	.51241	.6626	2.7692	.19	12.15

As this table shows, n in each group is less than 30, so the pretest criteria are not satisfied.

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
2010 GDP	3.787[a]	5	11	.031
2016 population	2.634[b]	5	11	.084

This table shows that the HOMOGENEITY of VARIANCES for 2010 GDP is P = .031which, a mean less than .05. So, it suggests a statistically significant difference among variances. Hence this criterion is not satisfied, while the HOMOGENEITY of VARIANCES for the 2016 population is P = .084, which is a mean higher than .05. So, it suggests no statistically significant differences among the variances. Hence this criterion is satisfied.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
2010 GDP	Between Groups	196.070	15	13.071	23.231	.000
	Within Groups	6.189	11	.563		
	Total	202.259	26			
2016 population	Between Groups	179.689	15	11.979	28.445	.000
	Within Groups	4.633	11	.421		
	Total	184.322	26			

This table shows that the ANOVA is p = .000, less than .05. So, it suggests a statistically significant difference among the states of America.

***Regression:**

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
Dimension0 1	2016 population, 2017 unemployment rates	.	Enter

Eximia Journal
Vol. 9, 44-63, May, 2023
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www.eximiajournal.com

This table tells us what variables are used to predict one variable. So, population and unemployment rates predict the dependent variable GDP.

Model Summary

Model	R	R square	Adjust R Square	Std. Error of the Estimate
1	.994a	.987	.986	.32588

Adjust R square here is .986, which tells us how the dependent explains the independent variable.

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	199.710	2	99.855	940.284	.000[a]
	Residual	2.549	24	.106		
	Total	202.259	26			

a. Predictors: (Constant), 2016 population, 2017 unemployment Rates
b. Dependent Variable: 2010 GDP
"The ANOVA model tells us if the model sig model. F test here tells us about the null hypothesis: there is no relationship between the state's unemployment rate and GDP. So, " F (2, 24) = 940.284. P = .000," which is less than Alpha .05, the null hypothesis will be rejected". That means there is a relationship between the variables.

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	.030	.217		.137	.892
	2017 unemployment Rates	-.020	.054	-.009	-.366	.717
	2016 population	1.043	.025	.996	42.112	.000

a. Dependent Variable: 2010 GDP
This table shows us first the slope of the unemployment rate, which is close to zero by -.020 and t-test -.366 and .717 sig, meaning there is no sig. So, every time the unemployment rate increases by one percent, the GDP decrees by -.020. Second, the slope of the population is 1.043 with a t-test of 42.112 and sig .000, meaning there is sig. So, when the population increases by one percent, the GDP will increase by 1.043 percent.
After multiplying -.020*100, rerun the statistic for the unemployment rate because it was positively skewed.

***Frequency:**

Eximia Journal
Vol. 9, 44-63, May, 2023
ISSN: 2784-0735
www.eximiajournal.com

Statistics

Unemployment R

N	Valid	27
	Missing	0
Mean		.5820
Median		.5563
Mode		.58
Std. Deviation		.12468
Variance		.016
Range		.41
Minimum		.41
Maximum		.83

This table shows that the mean and mode are the same at .58, but the median is less than .55. The standard deviation is .12468, which is higher than the variance of .016. However, the minimum is .41 while the maximum is .83, so the range is 41.

Unemployment R

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.41	1	3.7	3.7	3.7
	.43	1	3.7	3.7	7.4
	.45	3	11.1	11.1	18.5
	.48	2	7.4	7.4	25.9
	.49	3	11.1	11.1	37.0
	.53	1	3.7	3.7	40.7
	.54	1	3.7	3.7	44.4
	.56	2	7.4	7.4	51.9
	.58	5	18.5	18.5	70.4
	.69	1	3.7	3.7	74.1
	.70	1	3.7	3.7	77.8
	.71	1	3.7	3.7	81.5
	.76	1	3.7	3.7	85.2
	.76	2	7.4	7.4	92.6
	.81	1	3.7	3.7	96.3
	.83	1	3.7	3.7	100.0
	Total	27	100.0	100.0	

Eximia Journal
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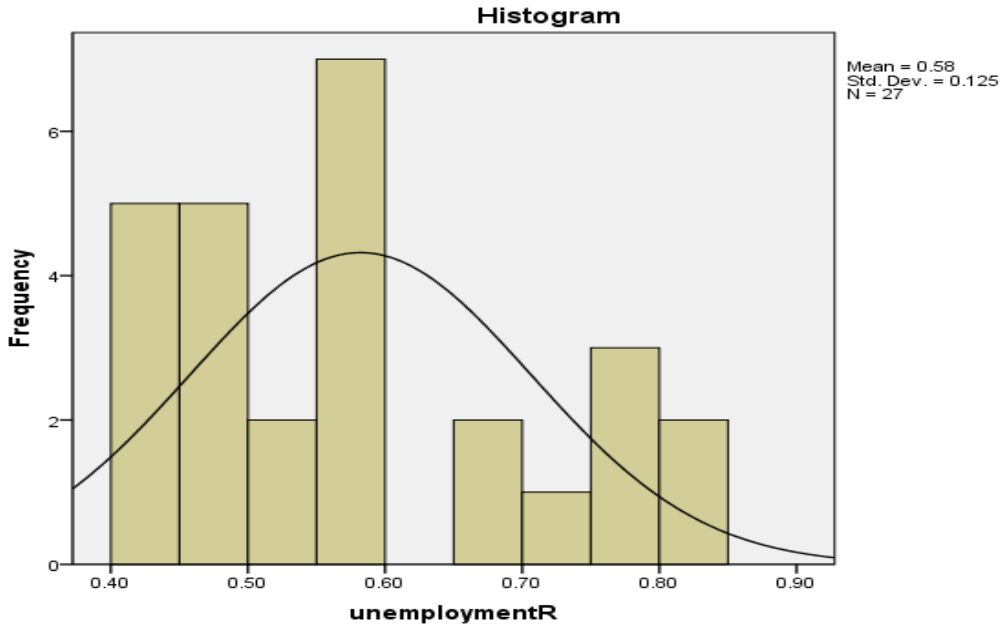
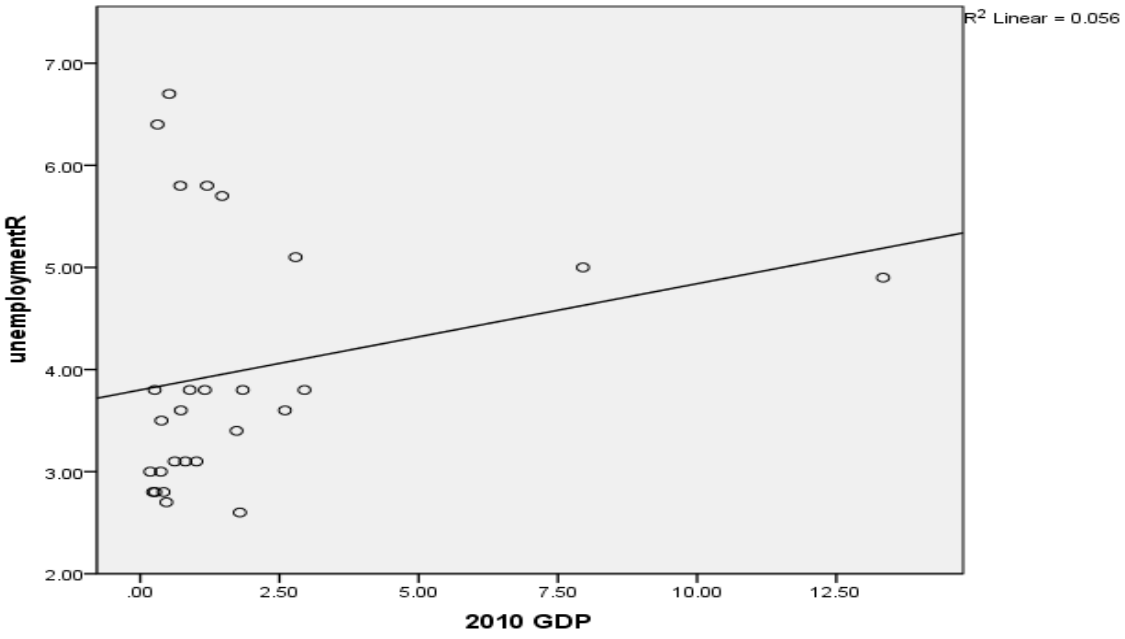
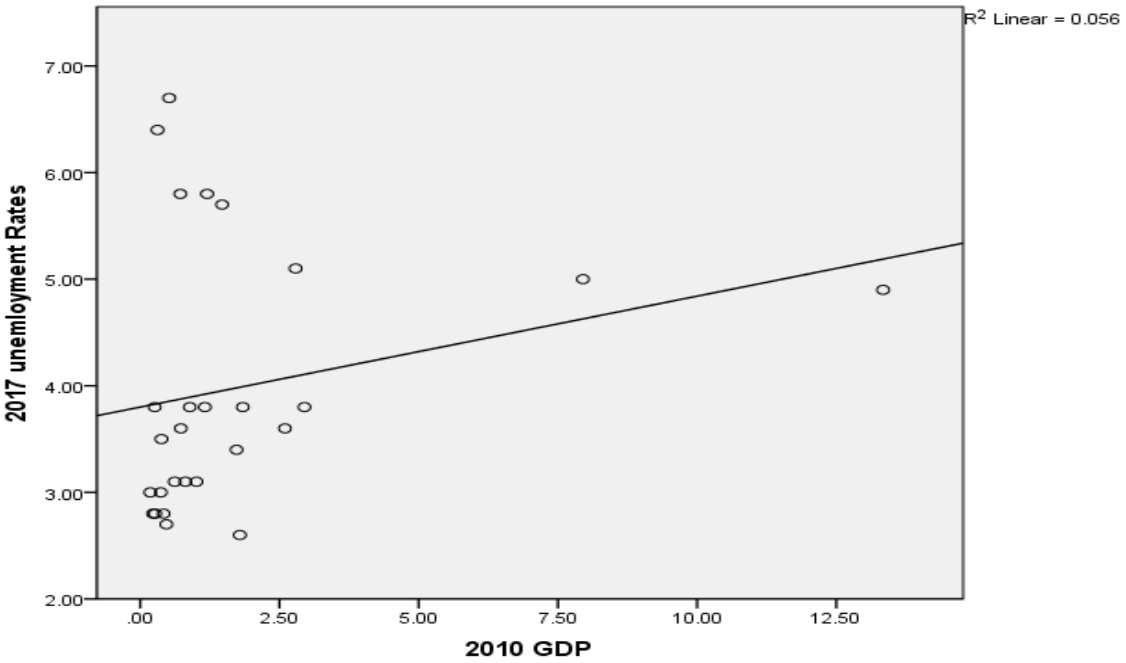


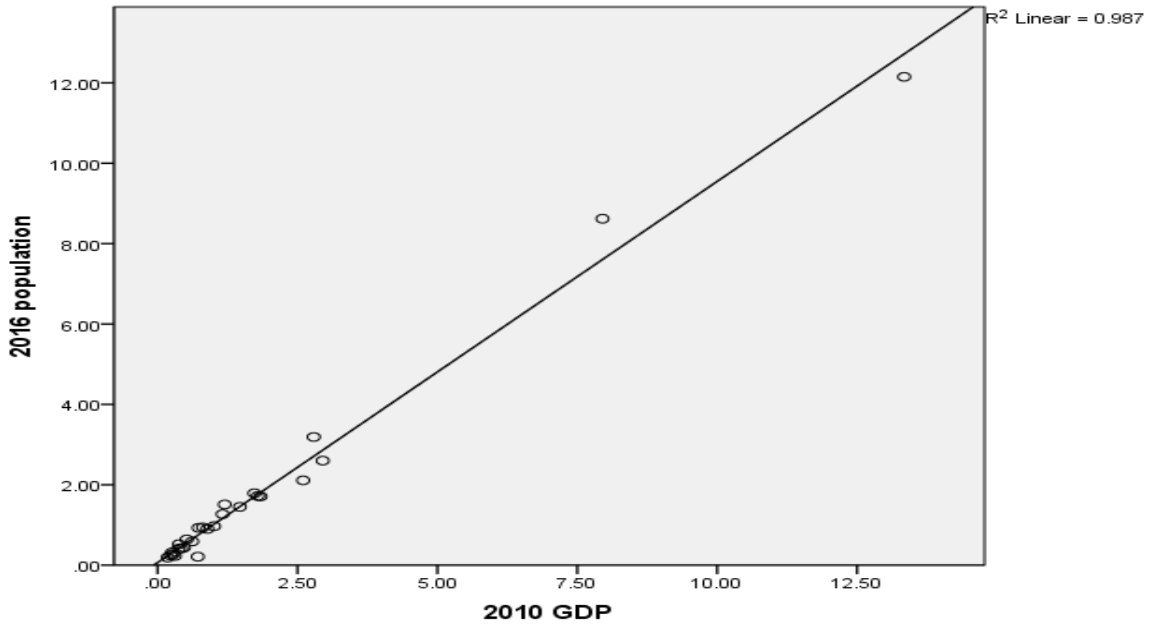
This histogram shows that the mean is 0.58 and the standard division = 0.125, so the distribution shows a normal curve.

***Liner Regression:**



Eximia Journal
Vol. 9, 44-63, May, 2023
ISSN: 2784-0735
www.eximiajournal.com





These lines show an inverse relationship between unemployment and GDP, meaning that when the unemployment rate increases, the GDP goes down. Back to Figure 1.
*Correlation:

Eximia Journal
Vol. 9, 44-63, May, 2023
ISSN: 2784-0735
www.eximiajournal.com

Correlations

			2017 unemployment Rates	2010 GDP	2016 population	unemployment
2017 Rates	unemployment	Pearson Correlation	1	.237	.247	.993**
		Sig. (2-tailed)		.234	.214	.000
		N	27	27	27	27
2010 GDP		Pearson Correlation	.237	1	.994**	.282
		Sig. (2-tailed)	.234		.000	.155
		N	27	27	27	27
2016 population		Pearson Correlation	.247	.994**	1	.292
		Sig. (2-tailed)	.214	.000		.139
		N	27	27	27	27
unemployment		Pearson Correlation	.993**	.282	.292	1
		Sig. (2-tailed)	.000	.155	.139	
		N	27	27	27	27

**. Correlation is significant at the 0.01 level (2-tailed).

The regression equation is:

$Y = Bo + B1\ X1 + B2\ X2 + \sum$

In order to examine the relationship between the independent and dependent variables, the research needs to produce a regression equation and a correlation coefficient. The regression equation involves four steps. First, data must be obtained on the independent and dependent variables. The second step involves plotting the data on a graph. The dependent variable, GDP, will be graphed on the vertical axis as Y—the independent variable, the population and unemployment rate, is graphed on the horizontal axis as X. In the third step, determine whether a straight line can accurately summarize the relationship between the independent and dependent variables represented by the plotted data. The final step involves the calculation of the regression equation.

The correlation coefficient will be identified using the "r." When the r is 1.00, the relationship between the variables is direct, and every point on the plotted point's scatterplot falls on the regression line. When the r equals -1.00, the relationship between the independent and dependent variables is inverse, and every point on the scatterplot falls on the regression line.

Findings

After examining the data, the results should vary from state to state according to the impact of the unemployment rate. The states with an effective unemployment rate should have a higher decline in the GDP. Therefore, the findings should prove an interval relationship between the independent and dependent variables. That means if the unemployment rate increases, the GDP decreases in the 30 states of America. According to the 'Cyclical unemployment' theory, cyclical unemployment will be low when business cycles peak. In other words, when the business or economy goes up, the unemployment rate will decrease because opportunities will be available for the people in some states in America. Finally, this research

design will show that the unemployment rate is related interval to the GDP in the 30 states of America.

Limitations

The study's limitations that the researcher faced will summarize in one point. The researcher discovered the main reasons for the unemployment rate and the relationship between it and the GDP because we are still at the beginning of 2017. Hence, the researcher found only 30 out of 50 states of America with an unemployment rate. The timing was inaccurate to collect the data for all states of America. It expects other researchers to collect the whole data and discover the main reasons that caused unemployment in states of America, propose some solutions to reduce the unemployment rate in most states with a high unemployment rate and deduce the correct correlation between the unemployment rate and GDP.

Conclusion

This research aims to develop a study that will examine the factors that affect the unemployment rate in public sector states of America. This research design contains three studies and one theory for different authors in the literature review section relevant to this study. It also provides a research question examining the relationship between states' unemployment rate and GDP, the research hypothesis that the states with high unemployment rates will have lower GDP, and the null hypothesis that there is no relationship between states' unemployment rates and GDP. Moreover, it proposes a methodology that describes the measures of the study. The researcher used nominal-level data to measure states and scale to measure GDP, states' unemployment rate, and population. Finally, it provides an analysis of the findings claiming a direct relationship between the independent and dependent variables of the study. An interesting subject for future study is the effects of states' unemployment rates on the state's GDP. Higher unemployment rates caused lower GDP in states of America. This research design is essential because it proposes a study examining the unemployment rate's effect on the GDP.

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