EFFECT OF DISTRICT GDP AND POPULATION ON UNEMPLOYMENT AND WORK PARTICIPATION RATE IN WEST BENGAL

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CONTENTS

1. INTRODUCTION

> "We are unnecessary wasting our precious resources in wars… If we must wage war, we have to do it on unemployment, Diseases, Poverty and Backwardness."
>
> —— Atal Bihari Vajpayee.

"Unemployment' may be defined as a situation in which the person is capable of working both physically and mentally at the existing wage rate, but does not get a job to work. Unemployment is one of the major problems faced by the economy of different countries. As India is a developing country, the people who lived in different states and districts of India also affected by the unemployment problem.

During the worst economic crises since the Great Depression the global economy experienced the most severe case of unemployment. Unemployment is highly dependent on economic activity, in fact, it is said that growth and employment are the two sides of the same coin. Economists distinguished between various overlapping types of and theories of unemployment, including Cyclical Unemployment, Frictional Unemployment, Structural Unemployment, Technological Unemployment and Vulnerable Unemployment. But unemployment can broadly be divided in two types: Rural Unemployment and Urban Unemployment. Rural Unemployment can be of two types: Seasonal Unemployment and Disguised Unemployment. On the other hand, Urban Unemployment can again be subdivided into two streams: Industrial Unemployment and Educated Unemployment. All these types of unemployment cause jobless growth in the economy. Increasing unemployment has negative impact on the economy.

In the developing country India, West Bengal is an eastern state, between the Himalayas and the Bay of Bengal, where unemployment is a burning issue. People of West Bengal, mainly the age group of 20 to 29, have been facing a greater unemployment situation from a long time (Periodic Labour Force Surer for 2017-2018).As West Bengal is a populated state the growth of population every year gives rise to a numberof problems and becomes a big hindrance in the success of economic planning and development. Large size of population results in large army of labour force. But due to shortage of capital resources (article share by Pooja Mehta) it becomes difficult to provide gainful employment to the entire working population. Thus, so many people are unable to earn money for meeting their basic needs. Unemployed people cannot provide proper housing, clothes, clean water, healthy food and medical attention for their families too.Hence, as a result of income loss poverty take place in West Bengal. According to Planning Commission data using Tendulkar committee's estimates, about 20% of the population lives below the poverty line. The urban poverty rate in the state at 15% is higher than the national average by a percentage point. The rural poverty rate is higher than the urban poverty rate by 8 percentage points, though it is lower than the national average. Unemployment and poverty leads to

frustration and anger among the people. This leads to robbery, beggary, prostitution and murderetc. In India crime per lakh population is 383.5 while the crime in West Bengal is 163.3 in 2018.The terrorist activities that we find today in various parts of the state are the reflection of frustration among unemployed people.

In West Bengal increase in population is one of the main reasons which causes unemployment. The cast system, slow economic growth, fall of cottage and small-scale industries slow industrialization and immobility of labour also causes unemployment in West Bengal. Majority of the state population are cultivators and agricultural labours. Agriculture is the chief occupation of the people of West Bengal. According to the West Bengal state development report there are 71.23 lakh farm families of whom 96% are small and marginal farmers. As agriculture is a seasonal occupation, many natural calamities like drought, flood etc also creates a large problem for the people involving in agricultural work. They have to face the unemployment problem for some periods of time. Beside this there is an absolute decline in employment opportunities in West Bengal. It creates a problem for the working age people they cannot get any jobs. This jobless situation decreases the work participation rate of West Bengal and simultaneously increases the unemployment. GDP is also related to both unemployment and work participation rate. The general understanding is that work participation rate should be proportion to growth in GDP. Economic growth should ideally emerge from a suitable combination of productivity growth and employment growth. Creating more job opportunities increases work participation rate and decreases the unemployment. More employment and incomes are crucial for development and there by the GDP.

In West Bengal as a result of unemployment and underemployment West Bengal Government suffers extra borrowing burden because it causes a decrease in production and a less consumption of goods and services y the people. As a result, low economic growth and a low standard of living take place. This produces high fertility rate and population growth. In West Bengal the population is more than 9 crores according to the latest census figures (2011 Census). It leads to migration of people from rural areas to urban areas in search of jobs, causing the growth of slum areas. People live in most unhygienic and insanitary conditions.

In West Bengal we can see two faces in employment situation. In one hand some workers are doing well, as they have the skills and training that a growing industry require. On the other hand some people are unable to find work until they obtain new skills. Majority of the population in the state were facing unemployment and underemployment issue. Many people can barely live from what they earn. The less job opportunities create a sharp fall in the labour force participation ratio. As a result, in West Bengal, even more employment growth fall to increase the unemployment rate. The truth is that almost

half of the working age population is not even looking for jobs because generous unemployment benefits, which make accepting a job less attractive. However, it often seen that unemployed people end up getting addicted to drugs and alcohol or attempts suicide. This causes loss of the human resources.

2. MOTIVATION

Unemployment is a common economic malady faced byeachcountry in the world. Unemployment is a kind of situation where the unemployed persons do not find any meaningful or gainful job in spite of having willingness and capacity to work. In rural areas of West Bengal agriculture sector is a prime sector of the economy where expansion of industrial sector is limited due to its topographical constraints. West Bengal comprises of 8% of India's population and most of them engaged in farming and other agricultural activities, which is a seasonal occupation. It cannot provide work to the rural population of the country throughout the year. As a result, the huge labour force, which should be invested in West Bengal to derive its economic engine faster, across the state to join works of comparatively high wages. Instead of making West Bengal economically developed, it makes the other states economically rich.

According to the census 2011, West Bengal ranks fourth among states from where people migrate for work and employment. Uttar Pradesh, Assam, Bihar were the major states of origin of migrant workers. Hence to improve the economic development of West Bengal job creation is highly required. Enough job creation balances the labour supply and labour demand in West Bengal, which decreases the unemployment and migration. Similarly increase the work participation rate.

Though West Bengal is a populated state, the GDP of West Bengal is not growing well. In West Bengal the growth rate of GDP is 7.06%, which is lower than the population growth rate. The Okun's law (1962) suggests an inverse relationship the growth rate and the unemployment rate. Hence, lower GDP rate situation in West Bengal causes higher unemployment. The inverse relationship between GDP and Unemployment holds true for states that have high GDP.

The present situation of West Bengal requires more job opportunities and high work participation rate of labour force. For improving the present unemployment situation, it is important to investigate the factors more deeply, responsible for the situation. The present endeavor tries to remove those limitations which enhance the unemployment rate in West Bengal. Under this background, it is necessary to look into the factors that affect unemployment in West Bengal, so that steps can be taken in the appropriate direction to reduce unemployment. The present study will look into the effect of GDP and Population and assess if these variables meaningfully affect unemployment in West Bengal.

3. LITERATURE REVIEW

Petavel (1934) points out the importance of the formation of co-operative colonies as a solution of unemployment and poverty. According to him people could always get work in the colony, because they would get a ticket to take away what they had produced. According to Parthsarathy (1955) the absence of productive employment for a large number of farmers who while participating in farm income, do not contribute effectively to form output, disguised unemployment. P.Visaria (1981) examines the association between poverty and unemployment as measured by the per capita expenditure of households. The study says that the poor are too poor to remain unemployed. Islam (1987) and Papola (1984) in their research argued that though productivity enhancing technology in agriculture may induce agricultural output growth, such single - pronged strategy is not viewed by several scholars, as capable of solving the problems of rural unemployment. Bhaumik (2002) focused his study on the massive increase in number of unemployed that is experienced by West Bengal in recent time. He says that the increase in unemployment rate in West Bengal has its origin in the high growth of unemployed among rural males, rural females and urban males.A study report (Macroscan,2003) finds that the absence of gainful employment opportunities was primarily responsible for the rise in unemployment for the young male group in West Bengal.Jha (2006) in his study focused on the rural unemployment in West Bengal. The study shows that the poor are likely to be found in agricultural labourer households. Thus, it is important to examine the trends in rural unemployment during liberalization since 1991 and to monitor recent development. Kundu and Sarangi (2007), in their research argues that the increase in the rates of unemployment can at least partially be attributed to the process of formal informalisaton. They found that many of the rural migrants like dispossessed farmers; rural artisans etc, not having the minimum level of conversation skills or market smartness, are not able to foothold in the urban job market. Williams (2009) points out that in West Bengal, one of the major reasons for the lack of employment days generated is the lack of demand for jobs. Dey and Bedi (2010) in their study identifies the time lagebetween commencement of work and payment of wages and pinpoints the source of delay in the wage payment chain. Hirway and Shah (2011) found that the rural - urban migration is a factor that often enhances urban unemployment problems. They observe that people in rural areas were able to take up some work or the other involving land, animals or forests (residual sectors)while those in urban areas did not have many residual sectors, they could be employed in. Kumar, Mitra and Murayama (2012) conducted a study which shows that the mismatches between skills demand and supply causes high unemployment. According to the study, the skills levels of those who join the labour market early are low as they are often school drop-outs and haven't had the opportunity to undergo vocational training. Baumann et al (2012) found the expectations regarding unemployment rate do have effect on migration decision. In fact

information regarding unemployed prevailing in the destination areas helps the family to decide about further migration. Mitra and Verick (2013) in their research have studied correlation between participation in education and work participation rate. The study shows that there is an inverse relationship between participation in education and work participation rate. The increased participation in education could be a major reason of decline in the worker population ratio in the age groups of 15-19 and 19-24 for both males and females. The decline in the worker population ration causes unemployment. Dutta (2013) found the fact that rural West Bengal has been experiencing growth of distress - driven non - farm activities further indicates that a section of the rural labour force is simply not finding agricultural employment. Bairagya (2015) points out his study on the factors responsible for educated unemployment. In his study he says that high-industrialized states account for low educated unemployment rates unable to engage all educated people in the production process. Basole (2019) found that education plays a big role in the declining size of the labour force. But case studies and field reports also suggest that lack of suitable work, especially for women, is not readily available.

There are a number of literatures and studies, which can be a guide and reference to design our own programmes and activities to curb down the issues of unemployment through education reforms, social reforms, policy recommendation and many other practical activities that they have imprinted in their studies and research documents.

4. OBJECTIVE

The study is based on the secondary data from Census. The main purpose of this study is to analyze the present situation of unemployment in West Bengal. This paper focuses on the discussion about the factors which causes a massive increase in the amount of unemployment. We will also discuss about the fact that how GDP related to unemployment and work participation rate in West Bengal. The effect of unemployment and work participation rate on population will also be discussed here.

By analyzing the data, collected in unemployment rate, work participation rate, district GDP and population we will show the changes in unemployment situation of West Bengal. In this paper we will show the interrelation between unemployment rate, work participation rate and district GDP of West Bengal by using Multiple Linear Regression Model.

5. METHODOLOGY

This study is based exclusively on data available from secondary sources. Due to the pandemic situation, it is not possible to do proper field survey. Hence, we are not able to use any primary data in our research.

To continue the research, we have used different secondary data collected from official website of Census of India. In this paper we have used the district wise data on unemployment rate, work participation rate and GDP collected from Statistical Handbook West Bengal, Bureau of Applied Economics and Statistics. We also collect the data on population of West Bengal from census 2011.

By using the collected data, the research study examines the issue in depth. This study is thoroughly analyzed with the help of descriptive statistics, bar diagram and pie chart. We will use the multiple linear regression models in this study.

6. RESULTS AND DISCUSSION

The study has considered the district wise unemployment rate in West Bengal during the year 2009-10. These are again segregated into rural unemployment, urban unemployment and combined unemployment. The study of the following table shows different rate of unemployment for rural and urban areas in 19 districts of West Bengal.

Table-1 District-wise Unemployment Rate in West Bengal under usual activity status by residence during -2009-10

(Per 1000 persons)

Sl. No.	District	Rural	Urban	Combined
1	Darjeeling	63	112	77
2	Jalpaiguri	25	93	37
3	Coachbehar	16	0	12
4	Uttar Dinajpur	25	6	21
5	Dakshin Dinajpur	2	9	3
6	Malda	11	8	11
7	Murshidabad	20	6	17
8	Birbhum	43	8	39

9	Barddhaman	28	25	28
10	Nadia	14	22	16
11	North 24 Parganas	33	36	34
12	Hooghly	33	51	37
13	Bankura	5	0	5
14	Purulia	10	3	9
15	Paschim Medinipore	13	5	12
16	Howrah	26	26	26
17	Kolkata	27	74	34
18	South 24 Parganas	12	10	11
19	PurbaMedinipore	10	90	24
20	**West Bengal**	**21**	**24**	**23**

Source: District level pooled estimates of Key employment and Unemployment Indicators of West Bengal in 2009-10

Figure – (a)

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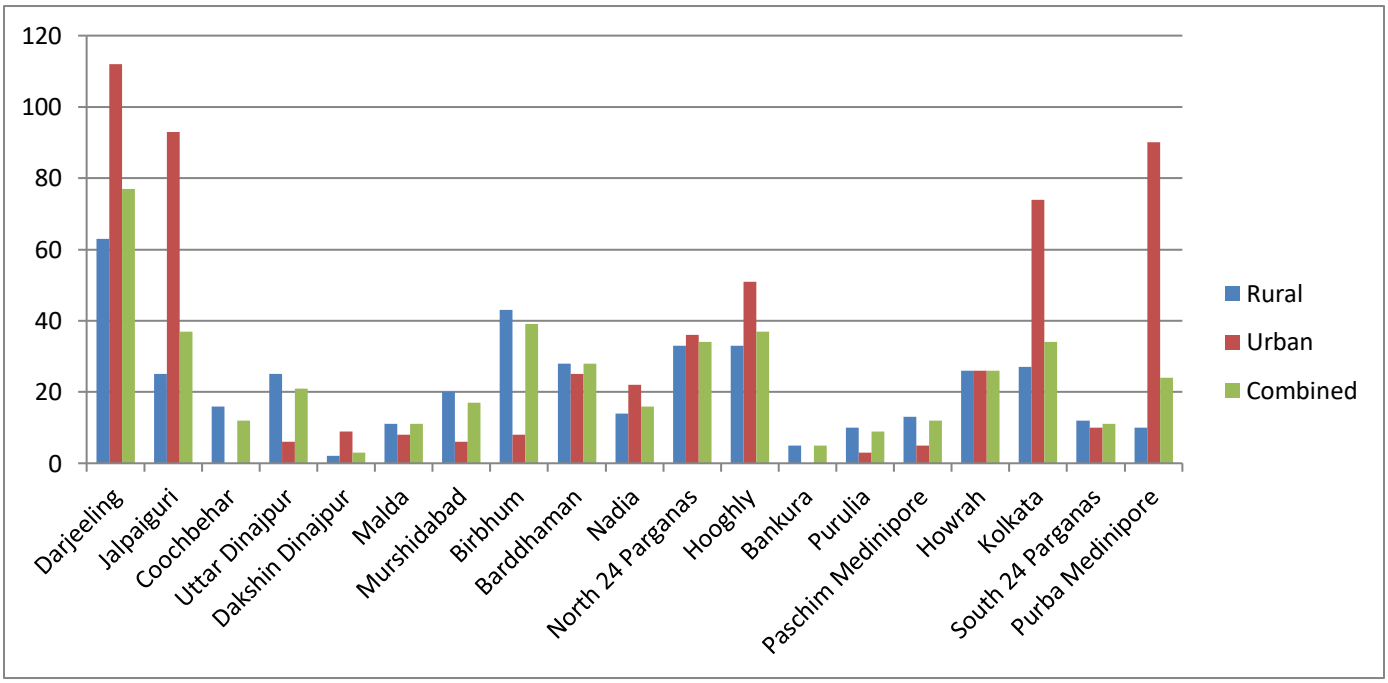


The above table-1 and the respective bar diagram [Figure-(a)] showing the district wise unemployment rates in West Bengal in Rural and Urban areas. The table suggests that in 19 districts of West Bengal, there is a difference between rural and urban unemployment rate (per 1000 persons). In case of Darjeeling, we can see that the rural unemployment rate is 63 while the urban unemployment rate is 112 during 2009-10. Hence the rural unemployment rate is lower than the urban unemployment rate in Darjeeling. Similarly, for Jalpaiguri, Nadia, Dakshin Dinajpur, North 24 Parganas, Hoogly, Kolkata, PurbaMedinipore districts, the rural unemployment is lower than urban unemployment rate. Whereas for Coachbehar, Uttar Dinajpur, Malda, Murshidabad, Birbhum, Barddhaman, Bankura, Purulia, Paschim Medinipore, South 24 Parganas districts rural unemployment rate is higher than urban unemployment rate.

Darjeeling has the highest rate of rural – urban unemployment rate during 2009-10. We can see the lowest rural-urban unemployment rate in Bankura during 2009-10.

Now, we will discuss about the district GDP in West Bengal. The table (Table-2) given below, showing the percentage of GDP of various districts in West Bengal.

Table-2: District wise Percentage Distribution of Gross District Domestic Product in West Bengal at Current Prices

(Per Cent)

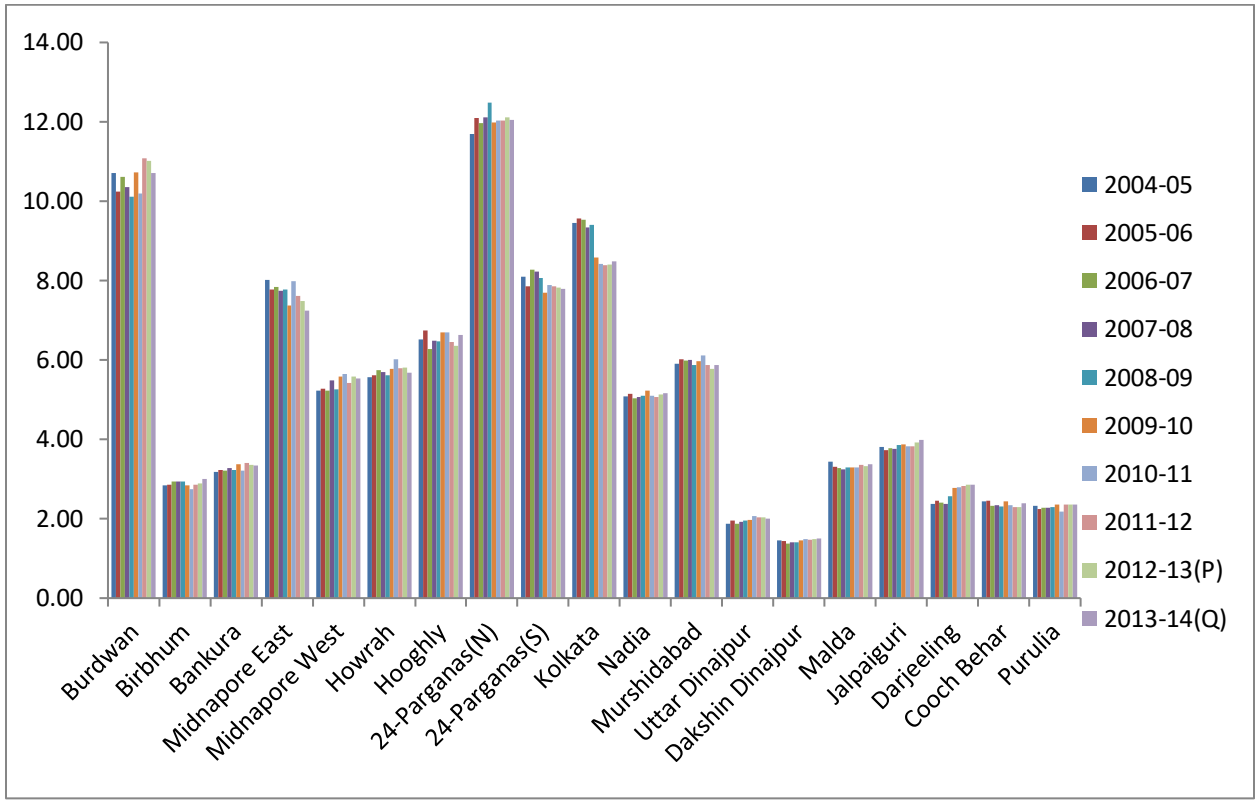
District	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13(P)	2013-14(Q)
Burdwan	10.71	10.25	10.61	10.35	10.12	10.73	10.20	11.08	11.01	10.71
Birbhum	2.84	2.86	2.94	2.93	2.93	2.84	2.75	2.86	2.89	3.01
Bankura	3.18	3.23	3.21	3.27	3.22	3.37	3.21	3.40	3.36	3.34
Midnapore East	8.02	7.77	7.84	7.74	7.77	7.37	7.98	7.61	7.49	7.25
Midnapore West	5.22	5.27	5.23	5.48	5.26	5.59	5.64	5.42	5.58	5.54
Howrah	5.57	5.61	5.75	5.69	5.61	5.78	6.01	5.79	5.80	5.68
Hooghly	6.52	6.74	6.28	6.49	6.47	6.69	6.69	6.45	6.36	6.63

24-Parganas(N)	11.70	12.09	11.97	12.11	12.48	11.99	12.03	12.04	12.11	12.05
24-Parganas(S)	8.09	7.86	8.28	8.22	8.07	7.70	7.89	7.86	7.82	7.79
Kolkata	9.45	9.57	9.54	9.34	9.41	8.58	8.42	8.38	8.40	8.48
Nadia	5.09	5.15	5.04	5.06	5.10	5.22	5.10	5.07	5.13	5.17
Murshidabad	5.91	6.02	5.98	6.00	5.88	5.97	6.11	5.87	5.78	5.88
Uttar Dinajpur	1.87	1.96	1.88	1.92	1.96	1.97	2.06	2.03	2.03	2.01
Dakshin Dinajpur	1.46	1.44	1.38	1.40	1.40	1.46	1.48	1.47	1.49	1.50
Malda	3.43	3.31	3.28	3.25	3.29	3.30	3.30	3.36	3.33	3.37
Jalpaiguri	3.81	3.73	3.78	3.76	3.86	3.87	3.82	3.83	3.92	3.99
Darjeeling	2.38	2.45	2.41	2.38	2.57	2.78	2.79	2.82	2.85	2.86
Cooch Behar	2.43	2.45	2.32	2.34	2.31	2.44	2.34	2.30	2.30	2.39
Purulia	2.32	2.24	2.28	2.27	2.29	2.35	2.18	2.36	2.35	2.35
West Bengal	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Bureau of Applied Economics and Statistics

Above table reveals that most of the districts have growth in GDP during the year gaps. If we keep an eye on the district Burdwan (now Bardhaman), we can see that Burdwan has 10.71% GDP during the year 2004-05, while the GDP is 10.25% during the year 2005-06. Here we noticed a decrease in the GDP. Again if we focus on the year 2006-07, there is an increase in the GDP relatively from the previous year 2005-06. We can see a alternative decrease and increase in the GDP during the year gaps.It can also be noticed for other districts of West Bengal. Among all the districts of West Bengal, North 24 Parganas has the highest growth in GDP during the year 2004-2011. On the other side Dakshin Dinajpur has the lowest growth in GDP during the same time period.

Figure - (b)



The given bar diagram (Figure –b) showing the difference in GDP among the various districts of West Bengal, according to the estimated GDP table (Table-2) for different year gaps.

As per the Census 2011, the total population of West Bengal was 9.13 Crore. Thus the population of West Bengal forms 7.54% of the total population of India in 2011. The table given below (Table-3), shows the total population of 19 districts of West Bengal according to the Census, 2011. It also reveals the difference between rural and urban population in all the districts of West Bengal.

Table-3: District wise population of West Bengal by Rural and Urban areas, 2011

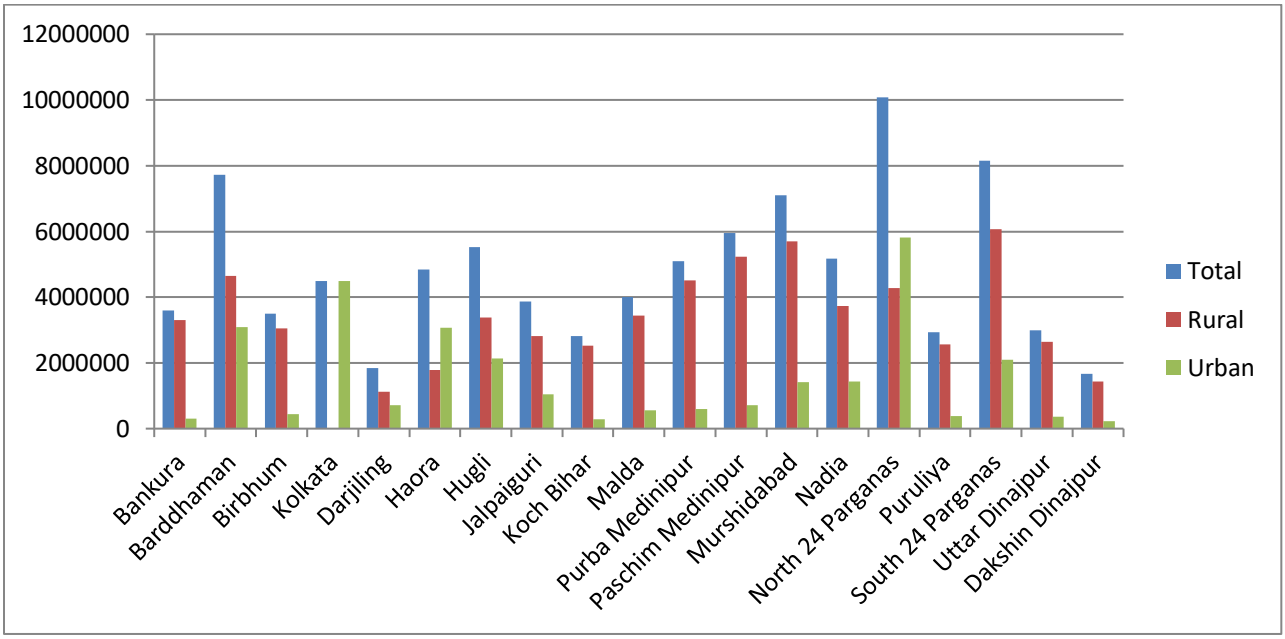
District	Population 2011 (P)			Percentage of urban population
	Total	Rural	Urban	
Bankura	3596292	3295613	300679	8.36
Barddhaman	7723663	4644079	3079584	39.87

Birbhum	3502387	3054019	448368	12.80
Kolkata	4486679	0	4486679	100.00
Darjiling	1842034	1123859	718175	38.99
Haora	4841638	1776970	3064668	63.30
Hugli	5520389	3388395	2131994	38.62
Jalpaiguri	3869675	2825001	1044674	27.00
Koch Bihar	2822780	2533480	289300	10.25
Malda	3997970	3446056	551914	13.80
Purba Medinipur	5094238	4500770	593468	11.65
Paschim Medinipur	5943300	5228308	714992	12.03
Murshidabad	7102430	5697224	1405206	19.78
Nadia	5168488	3730897	1437591	27.81
North 24 Parganas	10082852	4275724	5807128	57.59
Puruliya	2927965	2554584	373381	12.75
South 24 Parganas	8153176	6065179	2087997	25.61
Uttar Dinajpur	3000849	2638662	362187	12.07
Dakshin Dinajpur	1670931	1434856	236075	14.13
West Bengal	**91347736**	**62213676**	**29134060**	**31.89**

P: Provisional

Source: www.wbhealth.gov.in

Figure-(c)



By seeing the above table-3 and the bar diagram (Figure-c) we find that North 24 Parganas has the highest population among all the districts of West Bengal. We can also find that Dakshin Dinajpur has the lowest population in the year 2011.W also come to know that South 24 Parganas has the highest rural population (6065179) while Kolkata has the lowest rural population in 2011. According to the Census 2011, North 24 Parganas has the highest urban population (5807128) and Bankura has the lowest urban population (300676).

Now, we will focus on the ranking of districts population size in 2001 and 2011. Table-(4) depicts population size of 19 districts of West Bengal in2001 and 2011.

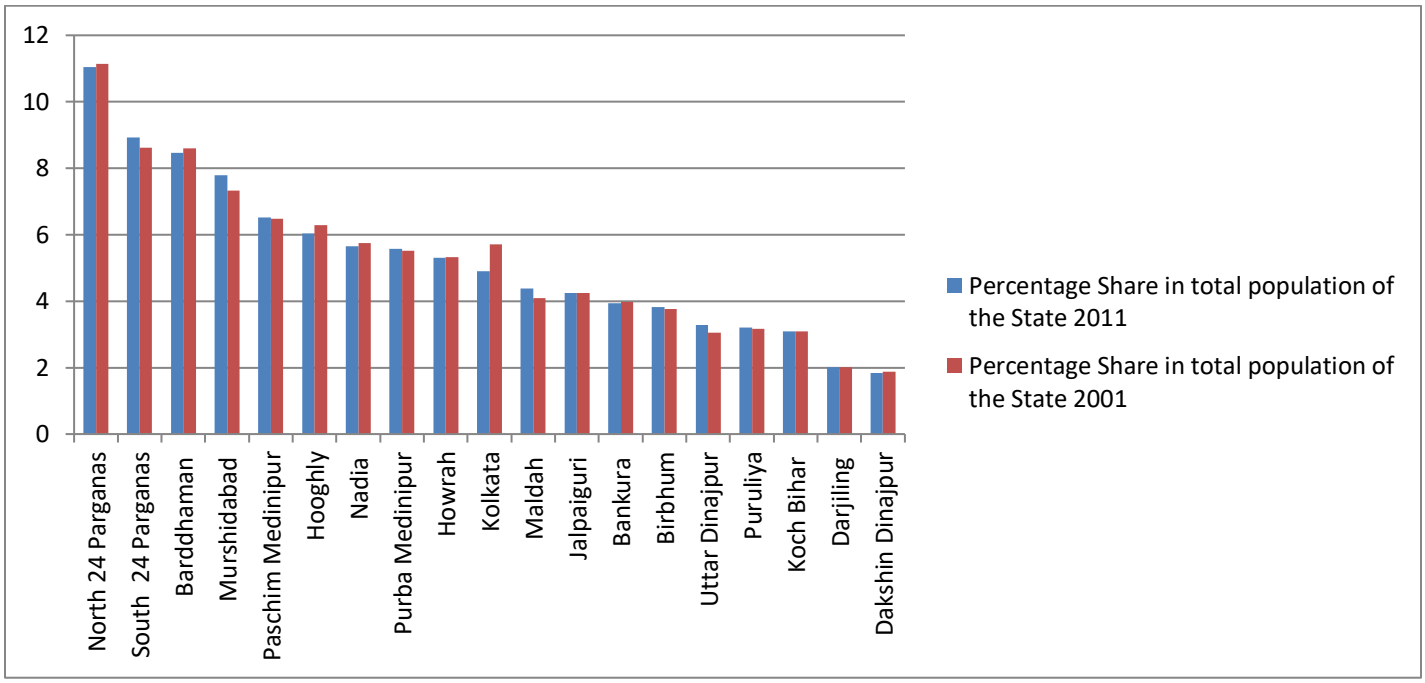
Table -4: Ranking of Districts by Population size in 2001 and 2011

Rank in 2011	District	Population 2011	Percentage Share in total population of the State 2011	Population 2001	Percentage Share in total population of the State 2001	Rank in 2001
1	2	3	4	5	6	7
	West Bengal	**91,347,736**	**100.00**	**80,176,197**	**100.00**	
1	North Twenty Four Parganas	10,082,852	11.04	8,934,286	11.14	**1**
2	South Twenty Four Parganas	8,153,176	8.93	6,906,689	8.61	**2**
3	Barddhaman	7,723,663	8.46	6,895,514	8.60	**3**
4	Murshidabad	7,102,430	7.78	5,866,569	7.32	**4**
5	Paschim Medinipur*	5,943,300	6.51	5,193,411	6.48	**5**
6	Hooghly	5,520,389	6.04	5,041,976	6.29	**6**
7	Nadia	5,168,488	5.66	4,604,827	5.74	**7**
8	Purba Medinipur*	5,094,238	5.58	4,417,377	5.51	**9**
9	Howrah	4,841,638	5.30	4,273,099	5.33	**10**
10	Kolkata	4,486,679	4.91	4,572,876	5.70	**8**
11	Maldah	3,997,970	4.38	3,290,468	4.10	**12**
12	Jalpaiguri	3,869,675	4.24	3,401,173	4.24	**11**
13	Bankura	3,596,292	3.94	3,192,695	3.98	**13**
14	Birbhum	3,502,387	3.83	3,015,422	3.76	**14**
15	Uttar Dinajpur	3,000,849	3.29	2,441,794	3.05	**17**
16	Puruliya	2,927,965	3.21	2,536,516	3.16	**15**
17	Koch Bihar	2,822,780	3.09	2,479,155	3.09	**16**
18	Darjiling	1,842,034	2.02	1,609,172	2.01	**18**
19	Dakshin Dinajpur	1,670,931	1.83	1,503,178	1.87	**19**

* Figures of Paschim Medinipur &Purba Medinipur for 2001 have been recast as erstwhile Medinipur divided into two districts after 2001 Census. Ranking of Districts for 2001 marginally changed accordingly.

From the above table we can see that the population in 2011 has increased to a great extended. The population of West Bengal in 2001 was 80,176,197; while it becomes 91,347,736 in 2011.

Figure-(d)



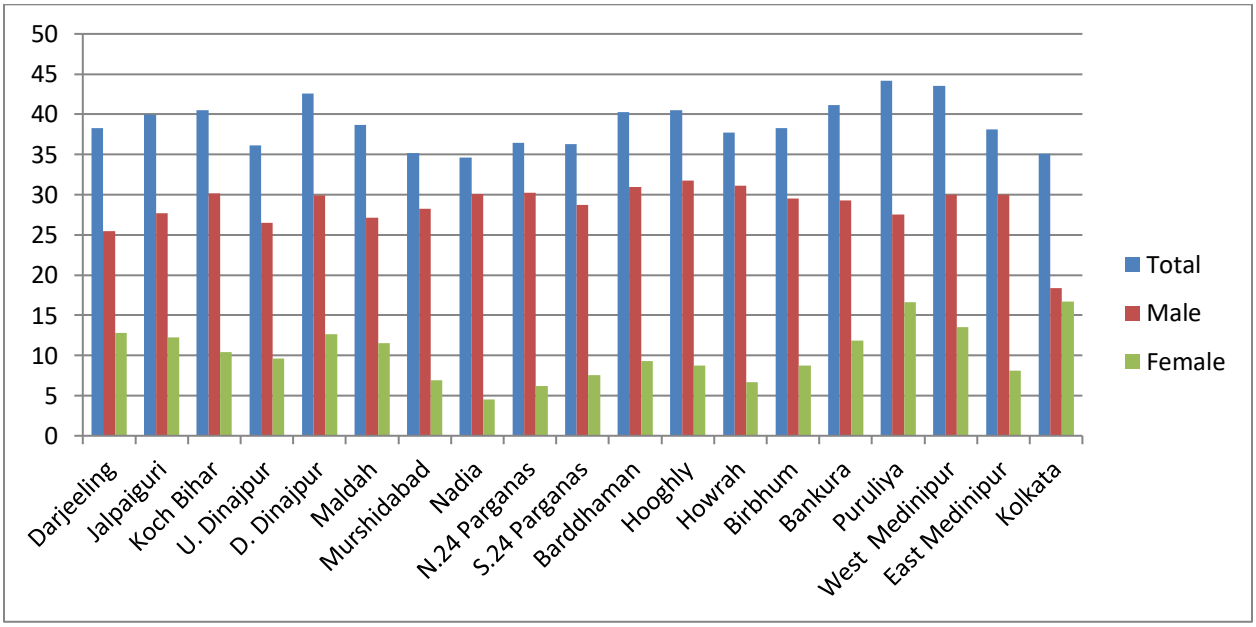
By seeing the above figure we find that among all the districts of West Bengal, North 24 Parganas ranked 1st in both the years 2001 and 2011, while Dakshin Dinajpur ranked last.

Table-5: Male and Female Work Participation rate in West Bengal (2011)

Districts	Total	Male	Female
Darjeeling	38.30	25.47	12.83
Jalpaiguri	39.92	27.67	12.25
Koch Bihar	40.51	30.13	10.37
U. Dinajpur	36.14	26.52	9.62
D. Dinajpur	42.61	29.95	12.66

Maldah	38.69	27.16	11.53
Murshidabad	35.21	28.27	6.93
Nadia	34.61	30.07	4.54
N.24 Parganas	36.43	30.22	6.20
S.24 Parganas	36.29	28.71	7.58
Barddhaman	40.29	30.99	9.30
Hooghly	40.49	31.75	8.74
Howrah	37.76	31.10	6.66
Birbhum	38.27	29.52	8.76
Bankura	41.16	29.29	11.87
Puruliya	44.21	27.56	16.65
West Medinipur	43.50	30.01	13.49
East Medinipur	38.10	29.99	8.11
Kolkata	35.10	18.40	16.70
west Bengal	38.73	29.29	9.44

Figure-(e)



Above table (5) and figure -(e) represents the work participation in different districts of West Bengal in the year 2011. This table reveals that Purulia has the highest work participation rate, which was about 44.21% and Nadia has the lowest work participation rate, which was about 34.61% .

Now, we have shown the interrelation between unemployment, district GDP and population of West Bengal. Data related to this discussion is collected from census 2011.

District	Unemployment (Y)	GDP (X1)	Population (X2)
Burdwan	28	11.08	8.46
Birbhum	39	2.86	3.83
Bankura	5	3.40	3.94
Midnapore East	24	7.61	5.58
Midnapore West	12	5.42	6.51
Howrah	26	5.79	5.30
Hooghly	37	6.45	6.04
24-Parganas(N)	34	12.04	11.04
24-Parganas(S)	11	7.86	8.93
Kolkata	34	8.38	4.91
Nadia	16	5.07	5.66
Murshidabad	17	5.87	7.78
Uttar Dinajpur	21	2.03	3.29
Dakshin Dinajpur	3	1.47	1.83
Malda	11	3.36	4.38
Jalpaiguri	37	3.83	4.24
Darjeeling	77	2.82	2.20
Cooch Behar	12	2.30	3.09
Purulia	9	2.36	3.21

In determining the interrelation, the study fits a multiple linear regression model where the unemployment is dependent variable and regressed upon percentage of district GDP and percentage of population, which are the explanatory variables. The model specification is as follows:

$Y_i = \alpha+\beta_1 X_{1i}+ \beta_2 X_{2i} +\varepsilon_i$---------- (1)

Where, Y_i = Unemployment; X_{1i} = Percentage of district GDP ; X_{2i} = Percentage of population;α, $\beta_1$and β_2 are unknown parameters; and $\varepsilon_i$is the disturbance term. i = 1,2, 3,…….,19.

Estimating the equation (1) by OLS method, we get

$\hat{Y}_i = \hat{\alpha}+\hat{\beta}_1X_{1i}+\hat{\beta}_2X_{2i} + e_i$---------- (2)

$\hat{\alpha}$, $\hat{\beta}_1$ and $\hat{\beta}_2$ are the numerical estimates of α, β_1 and $\beta_2$respectively.

$\hat{Y}_i$, gives the estimated values of Y_i for different values of X_1 and X_2 and obtained the estimated residual $e_i = \varepsilon_i$.

$e_i = \hat{Y}_i - \hat{\alpha}- \hat{\beta}_1X_{1i} - \hat{\beta}_2X_{2i}$ ---------- (3)

Estimated values are:

$\bar{Y} = 23.84210526\bar{X}_1 = 5.263157895\bar{X}_2 = 5.274736842$

Regression Statistics								
Multiple R	0.416911673							
R Square	0.173815343							
Adjusted R Square	0.070542261							
Standard Error	16.64658693							
Observations	19							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	2	932.7846121	466.3923061	1.683065319	0.217078596			
Residual	16	4433.741704	277.1088565					
Total	18	5366.526316						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	28.63805758	9.524628483	3.006737495	0.008361139	8.446747322	48.82936784	8.446747322	48.82936784
X1	5.119922853	2.805069224	1.825239395	0.086690011	-0.82655822	11.06640393	-0.82655822	11.06640393
X2	-6.017914382	3.526188923	-1.706634135	0.107220222	-13.49310092	1.457272152	-13.49310092	1.457272152

The above table gives the overall goodness of fit measure:

$R^2 = 0.1738$; Correlation between Y_i and $\hat{Y}_i$ is 0.4169 (when squared gives 0.1738)

The standard error here refers to the estimated standard deviation of the error term ε.

$R^2 = 0.1738$ means that 17.38% of the variation of Y_i around $\hat{Y}_i$ is explained by the regressors X_{1i} and X_{2i}.

Foe examining the overall significance of the estimated multiple regression model, we may apply the analysis of variance (ANOVA) technique. The column labeled F gives the overall F test of

$H_N : \beta_1 = \beta_2 = 0$

H_A : At least one of β_1 and β_2 does not equal zero.

In the ANOVA table we get $F^* = 1.683065319$; The table value of F associated with 16 degrees of freedom and 3 degrees of freedom and 3 degrees of freedom numerator is $F_{(3,16)} = 3.24$

Now, we see that $F^* < F_{(3,16)}$

The column labeled significance F has associated P value. Since 0.217078596 > 0.05; hence we accepted the null hypothesis and conclude that there is no overall significance of the estimated regression model.

Now, for testing the significance of $\hat{\beta}_1$ and $\hat{\beta}_2$ we have to test the validity of null hypothesis (H_N) that the value of true population parameter β_i is zero against the alternative hypothesis (H_A) is not equals to zero. We set our hypothesis as

$H_N: \beta_i = 0$

$H_A: \beta_i \neq 0$

In case of X_1 the coefficient ($\hat{\beta}_1$) = 5.119922853 and the standard error (SE) = 2.805069224.

Now, $|t^*| = \hat{\beta}_1 / SE(\hat{\beta}_1) = 5.119922853 / 2.805069224 = 1.825239395$

For a two-sided test, we compute level of significance as, $\lambda/2$ or 0.05/2 = 0.025 when $\lambda = 0.05$. The table value of t associated with a probability of 0.025 and 16 degrees of freedom is $t_{0.025, 16} = 2.120$.

Now, we see that $|t^*| < t_{0.025, 16;}$ it indicates that the null hypothesis is accepted and concluded that $\hat{\beta}_1$is statistically insignificant.

In case of X_2 the coefficient($\hat{\beta}_2$) = - 6.017914382 and the standard error (SE) = 3.526188923.

Now, $t^* = \hat{\beta}_2 / SE(\hat{\beta}_2) = -6.017914382 / 3.526188923 = -1.706634135$ or $|t^*| = 1.706634135$.

The table value t associated with a probability of 0.025 and 16 degrees of freedom is $t_{0.025, 16} = 2.120$.

Now, we see that $|t^*| < t_{0.025, 16;}$ it indicates that the null hypothesis is accepted and concluded that $\hat{\beta}_2$is statistically insignificant.

From this analysis we conclude that though unemployment and GDP have an inverse relationship, such a relation does not appear to be statistically significant. Similarly, though increasing population is one of the main reasons to increase unemployment, such a relation does not appear to be statistically significant.

Now, we will perform the descriptive statistics to analyze the data.

The mean of the data represents an average of the given collection of the data. In the above table we can see the mean of Unemployment (Y) in the year 2011 was 23.84210526. We can also see that in the year 2011, the mean of district GDP (X_1) was 5.26315789 and the mean of population (X_2) was 5.274736842.

Median is the middle value of the given list of data. From the above table we can see that the median of Unemployment

Y		*X1*		*X2*	
Mean	23.84210526	Mean	5.263157895	Mean	5.274736842
Standard Error	3.961262099	Standard Error	0.698337647	Standard Error	0.555524813
Median	21	Median	5.07	Median	4.91
Mode	12	Mode	#N/A	Mode	#N/A
Standard Deviation	17.26674118	Standard Deviation	3.043983232	Standard Deviation	2.42147652
Sample Variance	298.1403509	Sample Variance	9.265833918	Sample Variance	5.863548538
Kurtosis	3.920324638	Kurtosis	0.032731756	Kurtosis	0.319074937
Skewness	1.60457785	Skewness	0.852342157	Skewness	0.816312617
Range	74	Range	10.57	Range	9.21
Minimum	3	Minimum	1.47	Minimum	1.83
Maximum	77	Maximum	12.04	Maximum	11.04
Sum	453	Sum	100	Sum	100.22
Count	19	Count	19	Count	19

(Y) in the year 2011 was 21 while the median of district GDP (X_1) and population (X_2) were 5.07 and 4.91 respectively. The mode is the value which is repeatedly occurring in a given set. From the above table we can see that the mode of Unemployment (Y) in the year 20011 was 11, 12, 34 and 37. Here the given data set of Unemployment (Y) is multimodal.

We can also see that in case of the data set for district GDP (X_1) and population (X_2) we can't get any value which has a high frequency or appears more frequently. Hence, we can't get any mode of X_1 and X_2.

From the above table we can also get the standard deviation of the data set. A standard deviation is a statistic that measure the dispersion of a data set relative to its means. From the given data set we can see that the standard deviation of

Unemployment (Y) in the year 2011 was 17.26674118. Similarly, we can also get the standard deviation of district GDP (X_1) and population (X_2) which were 3.043983232 and 2.42147652 respectively. In the above table we find the sample variance which tells us about the degree of spread of the data in a sample. Two samples can have the same mean but be distributed very differently. Sample variance is one way to qualify this difference. In our data the sample variance of Unemployment (Y) in the year 2011 was 298.1403509. In the year 2011 the sample variance of district GDP (X_1) and population (X_2) were 9.265833918 and 5.863548538 respectively.

We also get the kurtosis of the data from the above table. Kurtosis refers to the degree of "peakedness" of the frequency curve. Two distributions may have the same average, dispersion and skewness, yet, in one there may be high concentration of values near the mode, showing a sharper peak in the frequency curve than in the others. Here we see that the kurtosis of Unemployment (Y) in the year 2011 was 3.920324638 i.e., the frequency curve has a relatively high peak. On the other hand, the kurtosis of district GDP (X_1) and population (X_2) were 0.032731756 and 0.319074937 respectively. It implies that the frequency curves have moderate peak. Skewness measures the lack of symmetry in data distribution. In the above table we can see that in the year 2011 the skewness of Unemployment (Y), district GDP (X_1) and population (X_2) were 1.60457785, 0.852342157 and 0.816312617 respectively. Here we get the positive skewness which means that the right-side tail of the frequency curve is longer. We can also see that there is a very smaller amount of asymmetry in the above data. The above table also shows the range of Unemployment (Y), district GDP(X_1) and population (X_2). Range is the difference between the two extremes, viz. the largest and the smallest values, and as such represents the maximum possible difference between any two observations. From the above table we can see that the range of Unemployment (Y), district GDP (X_1) and population (X_2) in the year 2011 were 74, 10.57 and 9.21 respectively. Now, we have shown the interrelation between Work participation rate, district GDP and population of West Bengal. Data related to this discussion is collected from census 2011.

In determining the interrelation, the study fits a multiple linear regression model where the work participation rate is dependent variable and regressed upon percentage of district GDP and percentage of population, which are the explanatory variables. The model specification is as follows:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \varepsilon_i \text{---------- (1)}$$

Where, Y_i =Work participation rate; X_{1i} = Percentage of district GDP; X_{2i} = Percentage of population. α, β_1 and β_2 are unknown parameters; and ε_i is the disturbance term. i = 1,2, 3,……,19.

Estimating the equation (1) by OLS method, we get -

$$\hat{Y}_i = \hat{\alpha} + \hat{\beta}_1 X_{1i} + \hat{\beta}_2 X_{2i} + e_i \text{---------- (2)}$$

$\hat{\alpha}$, $\hat{\beta}_1$ and $\hat{\beta}_2$ are the numerical estimates of α, β_1 and β_2 respectively.

$\hat{Y}_i$, gives the estimated values of Y_i for different values of X_1 and X_2 and obtained the estimated residual $e_i = \varepsilon_i$.

$$e_i = \hat{Y}_i - \hat{\alpha} - \hat{\beta}_1 X_{1i} - \hat{\beta}_2 X_{2i} \text{ ---------- (3)}$$

District	Work Participation Rate (Y)	GDP (X1)	Population (X2)
Burdwan	40.29	11.08	8.46
Birbhum	38.27	2.86	3.83
Bankura	41.16	3.40	3.94
Midnapore East	38.10	7.61	5.58
Midnapore West	43.50	5.42	6.51
Howrah	37.79	5.79	5.30
Hooghly	40.29	6.45	6.04
24-Parganas(N)	36.43	12.04	11.04
24-Parganas(S)	36.29	7.86	8.93
Kolkata	39.90	8.38	4.91
Nadia	34.61	5.07	5.66
Murshidabad	35.21	5.87	7.78
Uttar Dinajpur	36.14	2.03	3.29
Dakshin Dinajpur	42.61	1.47	1.83
Malda	38.69	3.36	4.38
Jalpaiguri	39.92	3.83	4.24
Darjeeling	38.30	2.82	2.20
Cooch Behar	40.51	2.30	3.09
Purulia	44.21	2.36	3.21

Estimated values are:

$\bar{Y}$ =39.06421053$\bar{X}_1$ = 5.263157895$\bar{X}_2$ = 5.274736842

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.431477668							
R Square	0.186172978							
Adjusted R Square	0.084444601							
Standard Error	2.585611869							
Observations	19							
ANOVA								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	2	24.46984333	12.23492166	1.830098763	0.19242294			
Residual	16	106.9662198	6.685388739					
Total	18	131.4360632						
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	41.61294336	1.479401907	28.1282207	4.72154E-15	38.47675144	44.74913528	38.47675144	44.749135
X1	0.314910181	0.435694134	0.722778106	0.480248933	-0.608720117	1.238540479	-0.608720117	1.2385405
X2	-0.797415106	0.547701218	-1.455930862	0.164753533	-1.958489812	0.3636596	-1.958489812	0.3636596

The above table gives the overall goodness of fit measure:

$R^2 = 0.1861$; Correlation between Y_i and $\hat{Y}_i$ is 0.4314 (when squared gives 0.1861)

The standard error here refers to the estimated standard deviation of the error term ε.

$R^2 = 0.1861$ means that 18.61% of the variation of Y_i around $\hat{Y}_i$ is explained by the regressors X_{1i} and X_{2i}.

Foe examining the overall significance of the estimated multiple regression model, we may apply the analysis of variance (ANOVA) technique. The column labeled F gives the overall F test of

$H_N: \beta_1 = \beta_2 = 0$

H_A: At least one of β_1 and β_2 does not equal zero.

In the ANOVA table we get $F^* = 1.830098763$; The table value of F associated with 16 degrees of freedom and 3 degrees of freedom and 3 degrees of freedom numerator is $F_{(3,16)} = 3.24$

Now, we see that $F^* < F_{(3,16)}$

The column labeled significance F has associated P value. Since 0.19242294 > 0.05; hence we accepted the null hypothesis and conclude that there is no overall significance of the estimated regression model.

Now, for testing the significance of $\hat{\beta}_1$ and $\hat{\beta}_2$ we have to test the validity of null hypothesis (H_N) that the value of true population parameter β_i is zero against the alternative hypothesis (H_A) is not equals to zero. We set our hypothesis as

$H_N: \beta_i = 0$

$H_A: \beta_i \neq 0$

In case of X_1 the coefficient ($\hat{\beta}_1$) = 0.314910181 and the standard error (SE) = 0.435694134.

Now, $|t^*| = \hat{\beta}_1 / SE(\hat{\beta}_1)$ = 0.314910181 /0.435694134 = 0.722778106.

For a two-sided test, we compute level of significance as, $\lambda/2$ or 0.05/2 = 0.025 when λ = 0.05. The table value of t associated with a probability of 0.025 and 16 degrees of freedom is $t_{0.025, 16}$ = 2.120.

Now, we see that $|t^*| < t_{0.025, 16}$; it indicates that the null hypothesis is accepted and concluded that $\hat{\beta}_1$ is statistically insignificant.

In case of X_2 the coefficient($\hat{\beta}_2$) = -0.797415106 and the standard error (SE) =0.547701218.

Now, $t^* = \hat{\beta}_2 / SE(\hat{\beta}_2)$ = - 0.797415106 / 0.547701218 = - 1.455930862 or $|t^*|$ = 1.455930862.

The table value t associated with a probability of 0.025 and 16 degrees of freedom is $t_{0.025, 16}$ = 2.120.

Now, we see that $|t^*| < t_{0.025, 16;}$ it indicates that the null hypothesis is accepted and concluded that $\hat{\beta}_2$ is statistically insignificant.

From this analysis we conclude that though Work Participation rate and GDP have a proportional relationship, such a relation does not appear to be statistically significant. Similarly, though increasing population also affects the work participation rate but such a relation does not appear to be statistically significant.

From the preceding regression analysis, we can see that unemployment and work participation rate does not affected by the districts GDP and population. Maybe it is the of the low power of test as we have come across only 19 observations for our regression analysis. If we got more observations for the analysis, the result may have changed.

Now, we will perform the descriptive statistics to analyze the data.

Y		*X1*		*X2*	
Mean	39.06421053	Mean	5.263157895	Mean	5.274736842
Standard Error	0.619932234	Standard Error	0.698337647	Standard Error	0.555524813
Median	38.69	Median	5.07	Median	4.91
Mode	40.29	Mode	#N/A	Mode	#N/A
Standard Deviation	2.702221958	Standard Deviation	3.043983232	Standard Deviation	2.42147652
Sample Variance	7.302003509	Sample Variance	9.265833918	Sample Variance	5.863548538
Kurtosis	-0.553589398	Kurtosis	0.032731756	Kurtosis	0.319074937
Skewness	0.223460555	Skewness	0.852342157	Skewness	0.816312617
Range	9.6	Range	10.57	Range	9.21
Minimum	34.61	Minimum	1.47	Minimum	1.83
Maximum	44.21	Maximum	12.04	Maximum	11.04
Sum	742.22	Sum	100	Sum	100.22
Count	19	Count	19	Count	19

The mean of the data represents an average of the given collection of the data. In the above table we can see the mean of Work participation rate (Y) in the year 2011 was 39.06421053. We can also see that in the year 2011, the mean of district GDP (X_1) was 5.26315789 and the mean of population (X_2) was 5.274736842.

Median is the middle value of the given list of data. From the above table we can see that the median of Work participation rate (Y) in the year 2011 was 38.69 while the median of district GDP (X_1) and population (X_2) were 5.07 and 4.91 respectively. The mode is the value which is repeatedly occurring in a given set. From the above table we can see that the mode of Work participation rate (Y) in the year 2011was 40.29. We can also see that in case of the data set for district GDP (X_1) and population (X_2) we can't get any value which has a high frequency or appears more frequently. Hence, we can't get any mode of X_1 and X_2.

From the above table we can also get the standard deviation of the data set. A standard deviation is a statistic that measure the dispersion of a data set relative to its means. From the given data set we can see that the standard deviation of Work participation rate (Y) in the year 2011 was 2.702221958. Similarly, we can also get the standard deviation of district GDP (X_1) and population (X_2) which were 3.043983232 and 2.42147652 respectively. In the above table we find the sample

variance which tells us about the degree of spread of the data in a sample. Two samples can have the same mean but be distributed very differently. Sample variance is one way to qualify this difference. In our data the sample variance of Work participation rate (Y) in the year 2011 was 7.302003509. In the year 2011 the sample variance of district GDP (X_1) and population (X_2) were 9.265833918 and 5.863548538 respectively.

We also get the kurtosis of the data from the above table. Kurtosis refers to the degree of "peakedness" of the frequency curve. Two distributions may have the same average, dispersion and skewness, yet, in one there may be high concentration of values near the mode, showing a sharper peak in the frequency curve than in the others. Here we see that the kurtosis of Work participation rate (Y) in the year 2011 was 0.553589398 i.e., the frequency curve has a moderate peak. Similarly, the kurtosis of district GDP (X_1) and population (X_2) were 0.032731756 and 0.319074937 respectively. It implies that the frequency curves have moderate peak. Skewness measures the lack of symmetry in data distribution. In the above table we can see that in the year 2011 the skewness of Work participation rate (Y), district GDP (X_1) and population (X_2) were 0.223460555, 0.852342157 and 0.816312617 respectively. Here we get the positive skewness which means that the right-side tail of the frequency curve is longer. We can also see that there is a very smaller amount of asymmetry in the above data. The above table also shows the range of Work participation rate (Y), district GDP (X_1) and population (X_2). Range is the difference between the two extremes, viz. the largest and the smallest values, and as such represents the maximum possible difference between any two observations. From the above table we can see that the range of Work participation rate (Y), district GDP (X_1) and population (X_2) in the year 2011 were 9.6, 10.57 and 9.21 respectively.

POLICY SUGGESTION:

In the present section we will discuss about some of the policies that can be implemented as a tool of employment and economic development in the districts of West Bengal.

- Policies must be formed to create employment opportunities for the young group in West Bengal.
- Productivity enhancing technology in agriculture should be implemented in the first row.
- Policies must be taken to remove the seasonal unemployment which is found in agriculture sector and agro based industries. Agriculture should have multiple cropping; plantations, horticulture, dairying and animal husbandry should be encouraged and cottage industries should be encouraged.
- Labour intensive technology should be encouraged in place of capital-intensive technology.
- Government might take policies to help the self-employed people financially, providing raw materials and technical training.
- Steps must be taken to accelerated the rate of capital formation. Capital formation should be particularly encouraged in such activities which generate greater employment opportunities.
- Government should take necessary steps to encourage the industries in co-operative sector.

- Family planning programme should be implemented widely and effectively. It will minimize the growth of population.

We have not taken all the factors into account. We have only taken two factors i.e., district GDP and population which are the two stepping stone variables. Both of the two variables return insignificant results. In our future researches we will work with the factors which we have not taken into account in this research.

CONCLUSION:

Now a days obviously the rate of unemployment in West Bengal is very high. The main reason of this situation is the less job vacancies and less work participation rate. As West Bengal is a highly populated state, the increase in population results in more supply of labour force. But the demand for labour is lower than that of the supply of labour. Increasing employment opportunities, growth in the district GDP and controlled population growth decreases the unemployment and increases the work participation rate. Unless until, the number of job opportunities are improved, economic development cannot be achieved in West Bengal. This is only possible through the enhancement of new job creation and more work participation.

From the preceding regression analysis, we can see that district GDP and population does not affect unemployment and work participation rate. This is so because the power of test is very low for the regression analysis as we have come across only 19 observations for our model. May have we got more observations for our model; the result may have changed.

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