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RESEARCH ARTICLE

MEASURING GENDER INEQUALITY IN INDIA USING DIFFERENT INDICES.

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Manuscript Info	Abstract

India has shown eminence in various domains and also experienced sturdy economic growth in the last decades. Despite this development, India's poor performance in many international gender gap measures indicates the prevalence of severe gender discriminatory practices. This paper tries to estimate the extent and intensity of gender disparity still prevailing across states in India using the Gender Inequality Index. Also, the study focuses on the usefulness and appropriateness of the index. Attempts are made to construct indices like Women's Disadvantage Index, Gender Relative Status Index to readdress the problem under concern. Inferences are drawn based on these new indices which are identified to overcome some of the limitations of Gender Inequality Index. This is high time to take necessary actions to create a more gender equal society so that India can reap the benefits of demographic dividend.

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Introduction:-

Women are regarded as the engine of sustainable human development. Their growing integration with the labor market enhances potential for economic growth. Many researches reveal the fact that in developing countries, women's labor force participation has helped to fight with the evils of poverty. Women's contribution in household as well as in the labor market, thus, framed as a major force in shaping country's growth and human development. Therefore, over the few decades, women's empowerment has gathered momentum. Even Gender Equality has given priority in the sustainable development goals by the United Nations Development Program.

India has shown excellence in various fields and also experienced steady economic growth in the last decades. But gender based discriminatory practices are rampant in India and also crime against women is very high. Indian women's contributions to the aggregate economic activities are conspicuously poor. Actually, their contributions to the labour market are usually undervalued. Most of the time, their activities are underreported or unreported. Women are seen involved in family owned business or farm, majority of whom still work as unpaid (almost 65.6 percent). They are barred from making any decision. Their right over property and other legal rights are also restricted. There has been still discriminatory hiring and pay practices. Women are perceived as having lesser ability or commitment; or most commonly seen as supplementary earners. Gender discrimination in India also stems from social norms and perceptions.

As per World Economic Forum's Global Gender Gap Report 2017 India ranks 108 out of 144 countries. India slipped by 21 places compared to 87th rank last year. As per the report, labor force participation of Indian women

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currently stood at 28.5 percent as compared to 82 percent of males. Also most of Indian girls start families early. The report pointed out that about 73.9 percent girls get married by age 25 whereas it is only 34.7 percent for boys. Disproportionate household work burden is a great hindrance to enter or continue to be in the workforce after marriage. Workforce participation of married women is still necessity driven. Significant gender bias exists when it comes to educating the girl child. Strong preference for boys among Indian parents has led to this. Even, Sri Lanka, Thailand, Singapore, Indonesia, Philippines and Maldives are ahead of India in the world ranking representing lower level of gender inequality. This is extremely necessary right now to delve deep into the matter and figure out the factors that are causing huge gender gap in states of India using a proper inequality index. So that appropriate steps can be taken to bridge the gender gap as early as possible.

As countries all over the world are trying hard to shrink gender gap there has been growing need of having an appropriate measure of inequality. The latest index introduced by the United Nations Development Program (UNDP) is the Gender Inequality Index (GII, 2010). GII is considered to be free from the flaws detected earlier with indices like, Gender-related Development Index (GDI) and Gender Empowerment Measure (GEM). These were also launched by the United Nations Development Program's Human Development Report in 1995. There is a large pool of literature discussing the relevance of these indices and at the same time acknowledging the defects (Bardhan and Klasen 1999, 2000; Dijkstra and Hanmer 2000; Schüler 2006, Permanyar, 2013). Hence we find it worthwhile to estimate the gender inequality index of the major Indian states to make an in depth assessment of the extent of gender bias persistent in India.

Methodology and Data Sources:-
The Framework of GII
This index has been designed to capture women's disadvantage in three dimensions – empowerment, economic activity, and reproductive health.

Reproductive Health
Reproductive health is a tremendously significant component for evaluating women's well-being particularly in less developed economies. To capture the reproductive health situations, two indicators have been chosen, viz., the maternal mortality ratio (MMR) and the adolescent fertility rate (AFR). These two indicators seem to be important to capture women's well-being in the reproductive health sphere in Indian context. In India maternal health has improved over the years but MMR is still typically high in states of Assam, Bihar, Madhya Pradesh, Orissa, Uttar Pradesh and Rajasthan (MMR > 200). The country needs to work harder to achieve the target MMR of 150. Moreover AFR becomes a great cause of concern when early marriage is a common phenomenon. Though early marriage of girls has fallen owing to the success of 'education for all' campaign (Sarva Shiksha Abhiyaan) and various other state government initiatives but it is still practised in some parts of the country.

Empowerment
The second component is empowerment which is very vital to judge women's well-being because with empowerment gender bias gradually fades away. The indicators chosen for the GII are educational attainment measured by secondary level and above (SE) and parliamentary representation (PR). Education is an essential factor that contributes to the creation of human capital, self-confidence and open mindedness. It is widely acknowledged that education is a necessary condition to escape poverty. On the other hand, PR is globally acknowledged as the most common measure of women's access to power.

Economic Activity
On the economic activity frontier, the GII uses the gender-specific labor force participation (LFP) rates. It is more plausible to use the participation rates instead of the gender-specific earned income component that was used earlier. For the construction of GII the methodology suggested by Permanyer (2013) has been followed. The values of GII should be interpreted as the loss in human development due to gender inequality. The Gender Inequality Index will be equal to 0 if women and men fare equally well in each dimension. The Gender Inequality Index tends to 1 if the gap between women's and men's achievement is increasing. Thus the GII ranges from 0 to 1. The formula for the construction of GII is as followed:

$$GII = 1 - 4 \times \frac{\left[\left(\sqrt[3]{(\frac{1}{MMR}\frac{1}{AFR})^{1/2}(PR_W SE_W)^{1/2}LFP_W}\right)^{-1} + (\sqrt[3]{(PR_M SE_M)^{1/2}LFP_M})^{-1}\right]^{-1}}{\sqrt[3]{\left(\sqrt[2]{\frac{1}{MMR}\frac{1}{AFR}} + 1\right)\left(\sqrt[2]{PR_W SE_W} + \sqrt[2]{PR_M SE_M}\right)(LFP_W + LFP_M)}}$$

(1)

Data Sources

Data are used from various secondary sources. Data on reproductive health variables are taken from Sample Registration System, Registrar General, Government of India. For data on economic activity i.e. labor force participation rates and education related variables are taken from NSS Employment and Unemployment Survey round. Also, data on political representation are gathered from the report of Election Commission of India, Government of India.

Empirical Result and Discussion:-

The Result

The GII value for India is 0.64 i.e. the welfare loss due to gender inequality amounts to 64% for overall India. The GII values for all the states are within the range 0.537 to 0.823. Punjab, Andhra Pradesh and Haryana occupying the top three positions i.e. showing gender bias is less severe (see Table 1 for details). That is why, loss in human development due to gender inequality is lower in these states. There exists strong gender-bias in states of Bihar, Orissa and Assam. In Kerala also, loss of welfare due to gender discrimination is higher than the national average (76 percent). Kerala's performance is largely affected by the poorest representation of women in politics as per the election data.

Criticisms of GII

When it comes to the methodology, an innovative aspect of GII is the introduction of reproductive health variables in the evaluation of gender inequality (Permanyer, 2013). Unfortunately, this measure is also not free from criticisms. Let us describe briefly about the flaws of this index and try to estimate other indices to give a more accurate reflection of the gender inequality issue in India. Firstly, the GII incorporates indicators which are absolute women-specific (MMR, AFR) with indicators that are computed for men and women (SE, PR, LFP). This implies that increase in MMR or AFR leads to worsening of gender gap meanwhile decrease in women's education or workforce participation does not signify the worsening trend as long as men also performs poorly in terms of education and LFP. Secondly, due to lack of men's reproductive health measures, the values of MMR and AFR are arbitrarily taken as 1 which is the perfect achievement level to be attained in case of no gender inequality. This leads to the conclusion that we are arbitrarily fixing men's health status at the highest possible level. As pointed out by Permanyer (2013), in case of achievement levels of men and women in PR, SE, LFP exactly match then one way to have GII=0 is to impose MMR=AFR=1 which is an unrealistic assumption. It has never been observed in any country yet. In general with MMR=AFR≠1, the GII will always be more than 0. Alternatively, if both AFR and MMR approach the value of zero (i.e. absence of maternal mortality and adolescent fertility) then GII would approach 1. Since, the values of GII critically depend on MMR and AFR when SE, PR and LFP are equal for men and women then it seems like penalizing the states with bad reproductive health conditions for women. It may be the case that performance of the states in those areas is influenced by a myriad of factors other than gender-related issues. For instance, both MMR and AFR are strongly and negatively associated with Net State Domestic Product (NSDP) per capita (see Figures 1 and 2). Other things being equal, richer states have better health facilities that helped to reduce MMR. Analogously, richer states tend to have education and production systems that discourage pregnancies at very young ages, thus lowering the corresponding AFRs (Figure 2). As a consequence, the GII is implicitly penalizing poorer states for their structural backwardness that are not always associated with gender discrimination against women.

Further the relationship between GII and per capita NSDP is strong and negative (Figure 3). The close association between GII and per capita NSDP has been criticised in the literature (Dijkstra and Hanmer, 2000; Permanyer, 2013). This trigger from the fact that MMR and AFR are strongly related to NSDP per capita, and these indices have no counterparts for men. If MMR and AFR were dropped altogether from the GII (therefore only using the variables with women's and men's achievement levels: SE, PR, and LFP), the correlation coefficient between such "capped GII" and NSDP per capita would drop to (−0.37), therefore indicating a much weaker relationship between gender inequality and per capita income levels.

As the GII completely disregards men's average health status hence to encounter this problem we can use life expectancy instead of MMR if strong correlation between them is observed in case of India (Permanyer, 2013). Figure 4 depicts that higher MMR values are strongly associated with low life expectancy of men in India. Thus we can use gender-specific life expectancy (though imperfect substitutes of reproductive health variables). By doing this at least GII values will not be inflated artificially because of lack of health variables for men. Lower life expectancy of women will only increase inequality if the corresponding life expectancy of men is higher. Moreover, life expectancy is also used in calculating human development indicators globally.

Some Constructive Proposals

To overcome the problems with GII and for more robust assessment of gender bias in India following Permanyer (2013), let us estimate two new indices, named Gender Relative Status (GRS) index and Women's Disadvantage (WD) index. Let us denote x_i, y_i the average women's and men's achievement levels in indicator i and let $I_M = \{i \mid x_i < y_i\}$ be the list of indicators for which the corresponding gender gap strictly favors men. Then the functional forms are defined as follows:

$$GRS = \prod_{i=1}^{n} \left(\frac{x_i}{y_i}\right)^{w_i} \qquad (2)$$

$$WD = \prod_{i \in I_M} \left(\frac{x_i}{y_i}\right)^{w_i} \qquad (3)$$

Where $\prod$ denotes multiplication, n is the number of indicators under consideration and w_i is the weight attached to indicator i (representing its relative importance vis-à-vis other indicators). The interpretation of GRS is that it is an average of all gender gaps – whenever GRS <1, men are on average better off than women; and when GRS >1, women are on average better off than men. The problem with the GRS is that it is a combination of gender gaps running in opposite directions, that is, some gender gaps favoring men and the others favoring women ultimately leading to distorted picture of the existing levels of gender inequality. This problem is avoided using WD, an index that only averages the gender gaps favoring men. The values of WD are an average ratio of women's versus men's achievement levels in those dimensions where men outperform women, so they can be interpreted as a measure of the extent to which women are disadvantaged with respect to men. Another interesting fact is that WD can be decomposed by subcomponents which are not plausible in case of GRS because the opposing directions of the gender gaps which will cancel each other out. Given that in India men outperform women in all (or almost all) well-being dimensions, the differences between GRS and WD will be negligible.

Following Klasen and Schuler (2011), gender parity is achieved when gendered parliamentary shares equal gendered population shares we need to introduce the variables POP_w and POP_m depicting women's and men's share in the total population respectively with the PR component. Also, following the definitions used in the GDI, normalized gender-specific life expectancy indices are considered, i.e. LEI_w and LEI_m. Thus, the GRS is defined as

$$GRS = \left(\frac{SE_w}{SE_m}\right)^{w_1} \left(\frac{PR_w/POP_w}{PR_m/POP_m}\right)^{w_2} \left(\frac{LFP_w}{LFP_m}\right)^{w_3} \left(\frac{LEI_w}{LEI_m}\right)^{w_4} \qquad (4)$$

where the powers (w_1, w_2, w_3, and w_4) introduced in the formula reflect the weights that are attached to the different dimensions. WD is defined with the same variables and weights, but with the functional form shown in Equation 3. Now, the next question is regarding the optimal w_i. Traditionally, UNDP indices assign the same weight to each dimension, implicitly assuming that all dimensions are equally relevant. In this context, if one assigns the weight 1/3 to each of the three dimensions and considering the empowerment dimension has two equally weighted sub-indicators (SE and PR), then the corresponding weights for Equation (4) would be $w_1 = 1/6$, $w_2 = 1/6$, $w_3 = 1/3$, and $w_4 = 1/3$. If equal weights are assigned to all dimensions, then the values of the composite index are largely driven by the values of the dimensions with largest variability. In order to reduce the extent of this problem, a simple procedure is followed where weights will be chosen whose magnitudes are inversely proportional to the standard deviation of the corresponding variable (Hausmann, Tyson, and Zahidi, 2007). The optimal weights in this case are the following: $w_1^* = 0.2$, $w_2^* = 0.12$, $w_3^* = 0.13$, and $w_4^* = 0.55$. As per the data, life expectancy has least variability hence weight is larger whereas PR has the highest variability hence smaller weight is assigned. Though the weights w_i and w_i^* are so contrasting, the corresponding state rankings derived from them are quite similar. Therefore, the empirical results for GRS and WD presented on this paper are based on the values of w_i^* alone.

Discussion:-

The two-way scatter diagram in Figure 5 compares the behavior of GII, Capped GII, GRS, and WD (for values see Table 1). There is a stark similarity between GRS and WD values and because of this we will only discuss the behavior of WD, which can also be decomposed by subcomponents. Since the values of GRS and WD only differ in cases where women outperform men in some well-being dimensions, this illustrates the disadvantaged situation of women vis-à-vis men in most dimensions incorporated into the indices. Figure 5 also shows the strong negative relationship of the GII with GRS as well as with WD. It is interesting to note that when the absolute/women-specific components are dropped from the GII, measuring gender inequality (as is done by GRS and WD) or measuring welfare losses due to gender inequality (as is done by GII) is basically the same exercise. The negative relationship between the GII and WD implies that with larger gender gaps the GII increases while WD decreases.

Figure 6 shows the evidence that some high income states occupy the lower positions with WD while some low-income states occupy lower positions with GII when plotted against per capita NSDP. To illustrate, low-income states like Madhya Pradesh and Uttar Pradesh are the greatest gainers when shifting from GII to WD ranking. On the contrary, high-income states like Maharashtra, Tamil Nadu, and Haryana are slipped down to lower rank. These results empirically support the claim that the GII penalizes low-income states for poor performances in reproductive health indicators that are not entirely explained by gender-discriminatory practices. Though a low income state, Madhya Pradesh has better women representatives in politics as per 2009 election data and less gender gap in education. Also, gap in proportion of women in total population is less compared to states like Haryana, Gujarat, Maharashtra, and Rajasthan. West Bengal has performed better in WD. AFR is reported to be the highest in this state and after removing the reproductive health variables the performance has thus improved. The same thing has worked for Uttar Pradesh also, where MMR is found strikingly high. Women are found to be in a relatively disadvantaged position as per the WD values in high income states of Maharashtra, Kerala, Haryana and Tamil Nadu because of poor political representation. In Haryana the gender gap in economic participation is quite high (Figure 8).

While GII advocates might reasonably argue that Madhya Pradesh and Uttar Pradesh should not get such a privileged position because of women's poor health status, it is worth pointing out that men's health status in these states are also poor, so the corresponding health gender gap as measured with gender-specific life expectancies is not that large after all. As illustrated in Figure 8, the percentage contributions of PR gaps are the largest, the variability is higher particularly for those states with higher levels of income. The gap in economic participation is also very high except in states like Tamil Nadu, Rajasthan, Orissa, Maharashtra, Kerala, Karnataka and Andhra Pradesh where gender bias in economic participation is less comparatively. However, the health and education gaps have a weaker contribution to WD values (i.e., they play a less influential role in the aggregate values of the index). In other words, the gender inequality levels measured by WD are largely driven by the PR component.

The scatter diagram, showing the association between the WD values and per capita income values illustrates almost absence of any correlation, r = 0.18 (Figure 7). This implies that WD is not biased for higher income states and thus capable of capturing the true picture of gender inequality. This is clear by comparing the performances of Haryana, Tamil Nadu, Maharashtra and Madhya Pradesh. The first three states score lower values on WD but have a very large NSDP per capita, while Madhya Pradesh scores a better value on WD but has an extremely low NSDP per capita.

Table 1:-Values of GII, Capped GII, GRS and WD for 2011

States	GII	Capped GII	GRS	WD
Andhra Pradesh	0.599851	0.007914	0.555858	0.370102
Assam	0.726968	0.011767	0.412681	0.295616
Bihar	0.751694	0.015673	0.287717	0.183228
Gujarat	0.600149	0.00917	0.510196	0.367692
Haryana	0.608405	0.009425	0.486567	0.370196
Karnataka	0.686123	0.01009	0.404635	0.223299
Kerala	0.765999	0.017263	0.235325	0.073202
Madhya Pradesh	0.638014	0.009572	0.531808	0.403653
Maharashtra	0.610481	0.008849	0.480069	0.296237
Orissa	0.822705	0.01986	0.207388	0.062156

Punjab	0.537486	0.008385	0.605329	0.530268
Rajasthan	0.639295	0.009277	0.532058	0.345250
Tamil Nadu	0.631417	0.010012	0.41434	0.219095
Uttar Pradesh	0.664797	0.010632	0.472947	0.346067
West Bengal	0.654971	0.01036	0.483039	0.355973
India	0.643407	0.00962	0.485683	0.330265

Source: Author's own calculation using the formulae
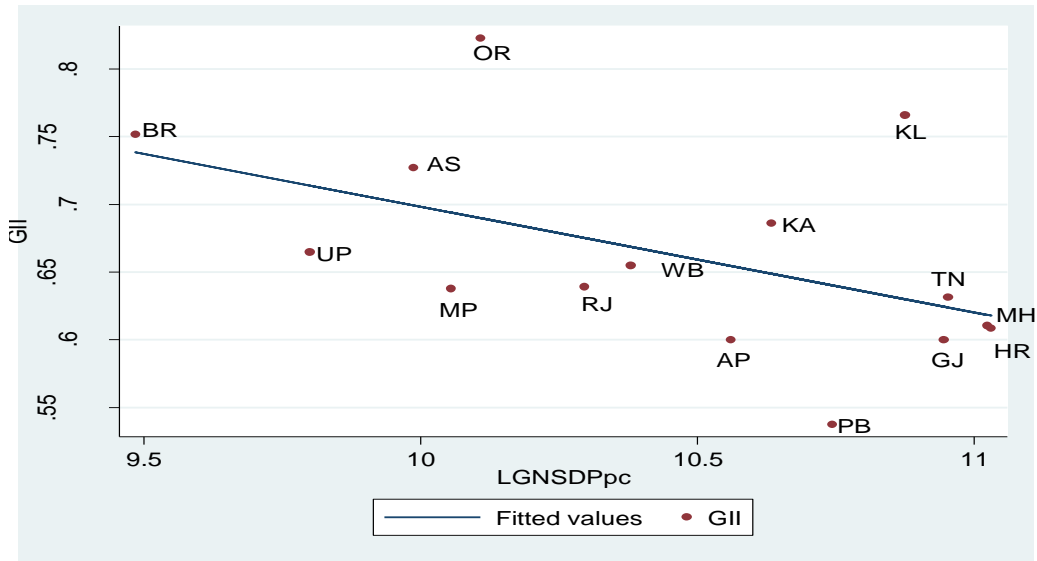
Figure 1:-Scatter Diagram of MMR versus Log of Per Capita NSDP
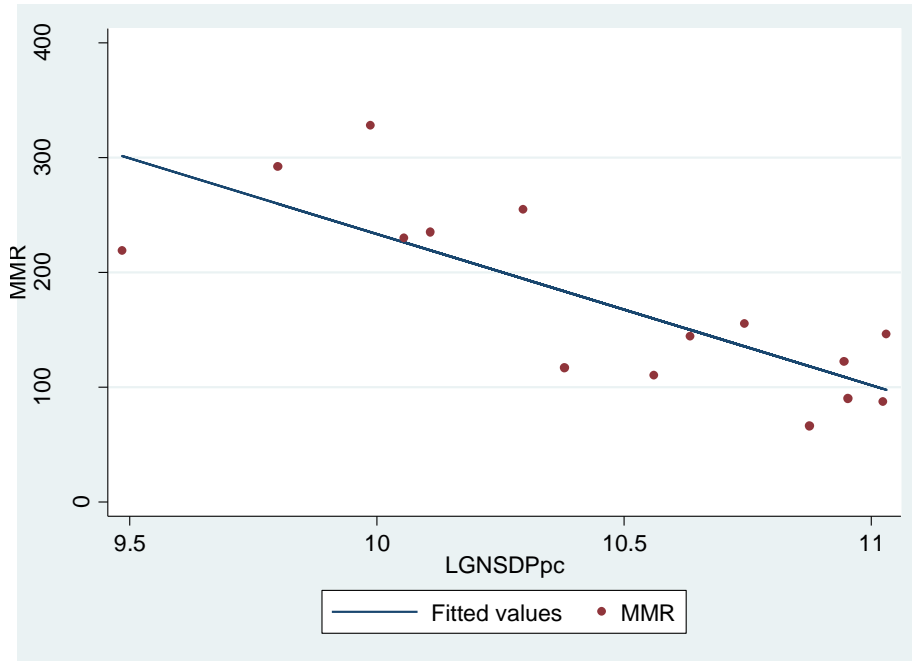
Source: Author's calculation using the data

Figure 2:-Scatter Diagram of AFR versus Log of Per Capita NSDP
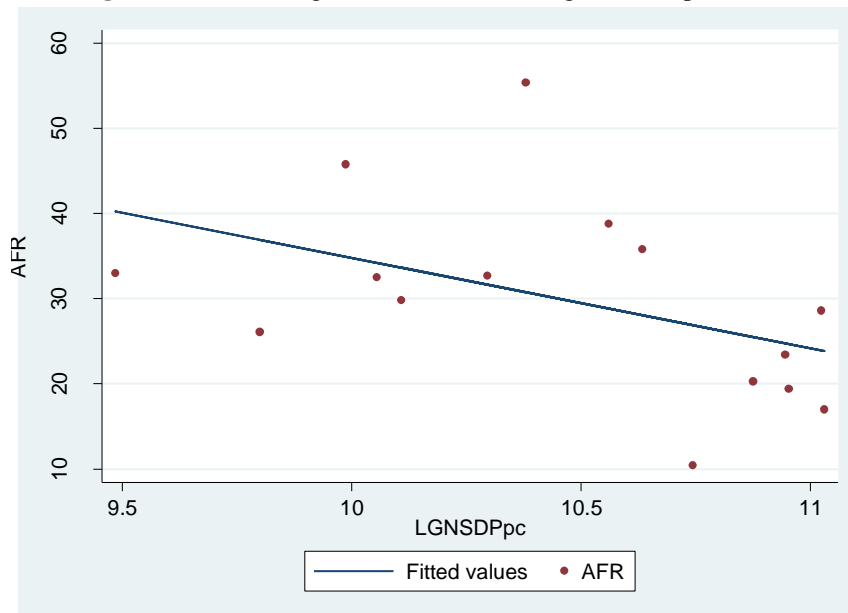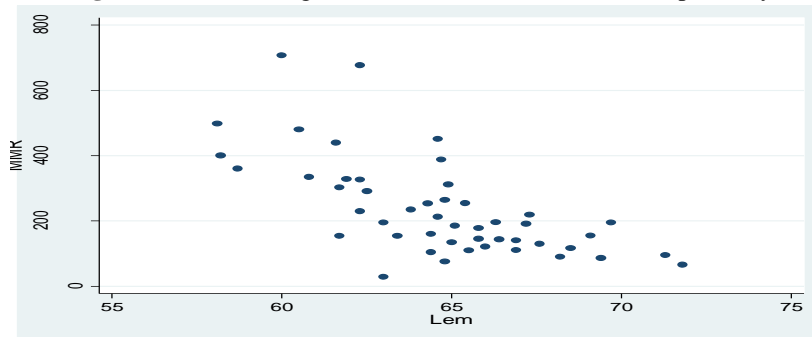

Source: Author's calculation using the data

Figure 3:-Scatter Diagram of GII versus Log of Per Capita NSDP

Footnote:The state abbreviations are: AP= Andhra Pradesh, AS= Assam, BR= Bihar, GJ= Gujarat, HR= Haryana, KA= Karnataka, KL= Kerala, MH= Maharashtra, MP= Madhya Pradesh, OR= Orissa, PB= Punjab, RJ= Rajasthan, TN= Tamil Nadu, UP= Uttar Pradesh, WB= West Bengal.
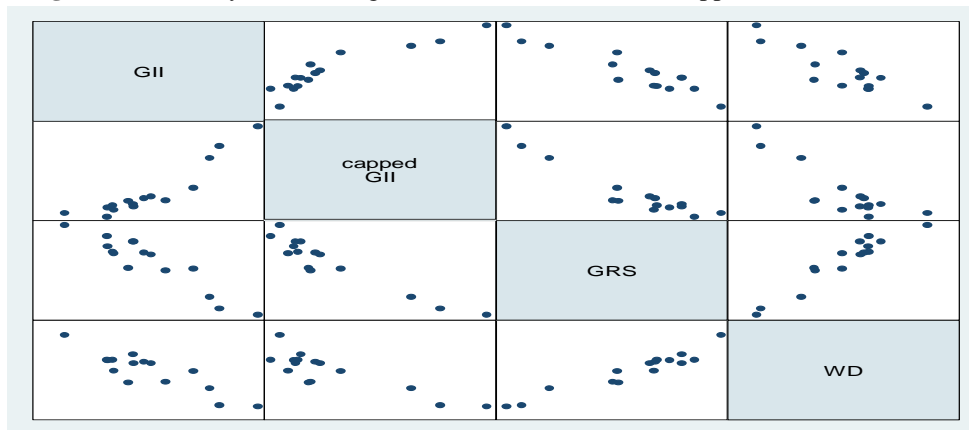Source: Author's calculation using the data

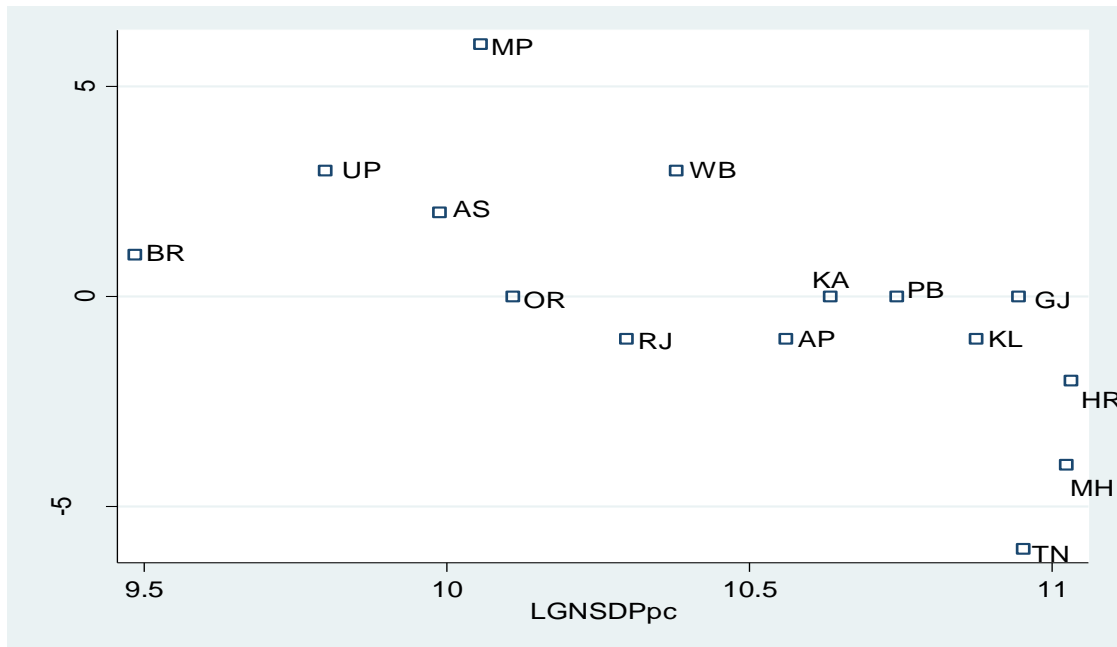**Figure 4:-**Scatter Diagram of MMR versus Male Life Expectancy

Source: Author's calculations from the SRS Life Tables and SRS Reports

Figure 5:-Two-way Scatter Diagrams for the values of GII, Capped GII, GRS, and WD


Source: Author's calculation using the data

**Figure 6:-**Scatter Diagram of the Difference between GII rank and WD rank versus log of per capita NSDP

Footnote: The state abbreviations are: AP= Andhra Pradesh, AS= Assam, BR= Bihar, GJ= Gujarat, HR= Haryana, KA= Karnataka, KL= Kerala, MH= Maharashtra, MP= Madhya Pradesh, OR= Orissa, PB= Punjab, RJ= Rajasthan, TN= Tamil Nadu, UP= Uttar Pradesh, WB= West Bengal.
Source: Author's calculation using the data

Figure 7:-Scatter Diagram showing the Association between WD and Log of Per Capita NSDP
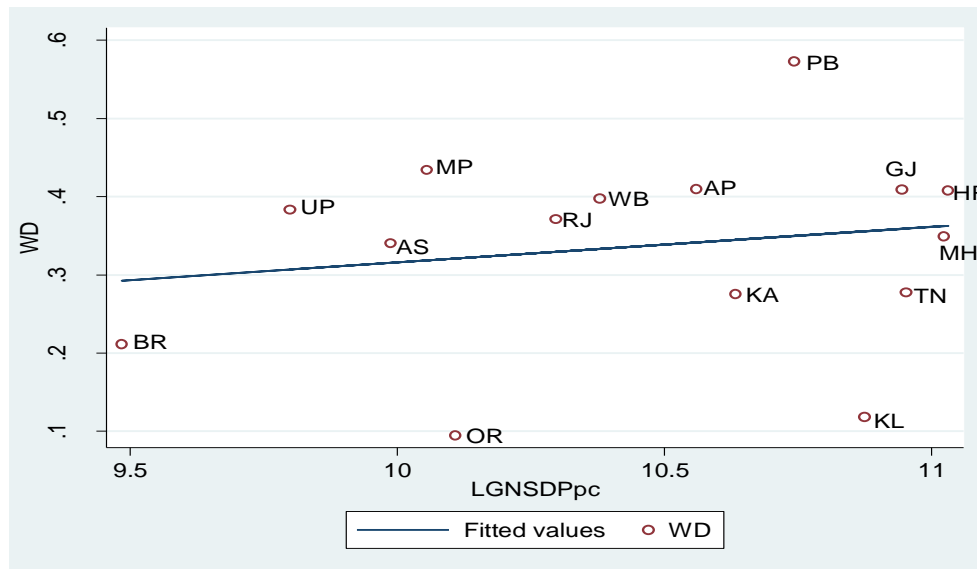
Footnote: The state abbreviations are: AP= Andhra Pradesh, AS= Assam, BR= Bihar, GJ= Gujarat, HR= Haryana, KA= Karnataka, KL= Kerala, MH= Maharashtra, MP= Madhya Pradesh, OR= Orissa, PB= Punjab, RJ= Rajasthan, TN= Tamil Nadu, UP= Uttar Pradesh, WB= West Bengal.
Source: Author's calculation using the data

Figure 8:-The Contribution of the Components of Women's Disadvantage Index (WD)
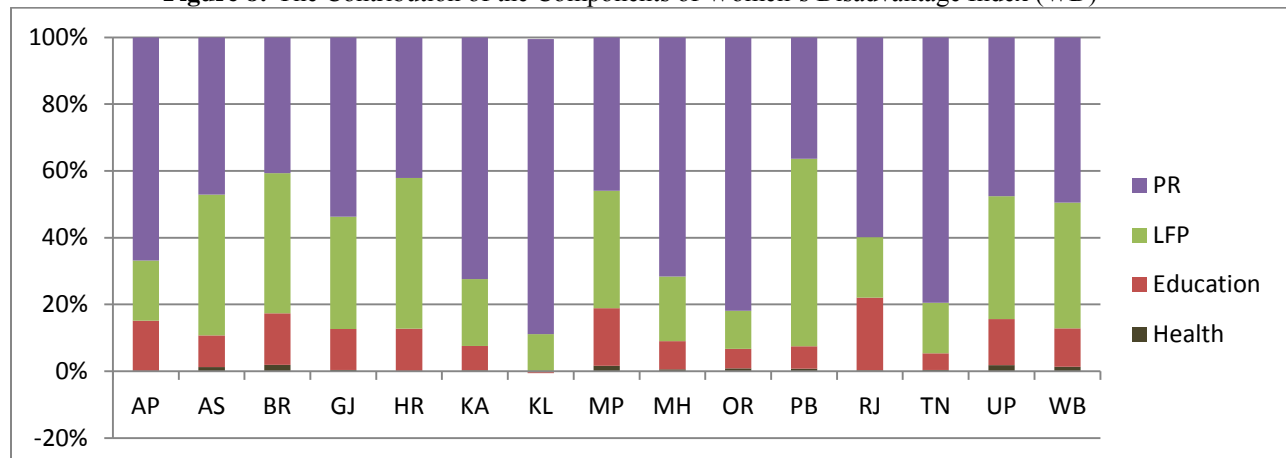
Source: Author's calculation using the data

Conclusion:-

To conclude, two facts are evolved through this entire discussion. Firstly, the very confusing GII methodology is unnecessary, since a much simpler and intuitively appealing index like WD leads to analogous results. Even the capped GII and GRS have also shown similar result to that of WD. However, through the study, WD has come up more successfully explaining the gender-gap in Indian states. WD has the further advantage of being decomposable into its components, thus facilitating the understanding of the internal structure of the index. Any index is not free of defects and so care has to be taken while interpreting it. Still it remains a challenge to incorporate reproductive health conditions for both women and men, as it is extremely important, into gender-inequality indices which will be internationally comparable as well. Since WD values are largely driven by the PR component it will be better if the political participation at the community and local levels are also incorporated. Secondly, the study has well established the fact that gender-bias is still persistent in India. It is the most important agenda now for India to make significant strides to reduce gender-disparity by creating ample job opportunities for women, labour market reforms, campaign against early marriage of girls, encouraging involvement of women at local governing bodies, attempt to increase educational attainment of women etc. Otherwise, India will fail to realise the much trumpeted demographic dividend.

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