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Role of Social Sector Expenditure in Empowering Rural India: An Analytical Study

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Abstract:
India's vast rural population remains central to the nation's socio-economic development, with social sector expenditure playing a pivotal role in empowering these communities. This study investigates the impact of social sector investments on rural empowerment by analyzing key expenditure components such as education, healthcare, nutrition, family welfare, and rural development from 2010-11 to 2022-23. Drawing on secondary data from reputable sources including the Economic and Political Weekly Research Foundation and Reserve Bank of India reports, the study employs Pearson correlation and multiple linear regression models with Principal Component Analysis (PCA) to address multicollinearity among variables. Findings indicate that overall social sector expenditure is strongly associated with reduced rural unemployment and increased rural wages, highlighting the critical role of integrated investments in nutrition, family welfare, education, and health. PCA revealed distinct expenditure patterns influencing economic outcomes, while regression analysis confirmed that aggregate social spending intensity significantly shapes rural labor market conditions. However, persistent challenges such as leakage, corruption, and ineffective program delivery limit the full potential of these investments.
The study concludes that optimizing and balancing social sector expenditures through enhanced governance, cross-sector coordination, and targeted policy measures is essential for sustainable rural empowerment. This research underscores the need for comprehensive and strategic social investments to foster inclusive growth and improve quality of life in rural India.

Keywords: Rural empowerment, social sector expenditure, Human capital, Poverty alleviation, Rural unemployment, Rural wages, Education, Healthcare, Nutrition, India, Rural development, Gender disparities, social capital, Program implementation

Introduction:

India, home to a significant rural population, has witnessed steady progress in recent years through various government initiatives aimed at empowering its rural citizens. The role of social sector expenditure in this process cannot be understated, as these investments are intended to enhance human capital, reduce poverty, and promote inclusive growth. Despite the considerable resources allocated to the social sector, the impacts have been mixed, with several challenges undermining their effectiveness, particularly in rural areas.

A key issue identified by Goswami and Bezbaruah (2011) is that despite the rising income levels in India, social sector expenditure has had limited impact on human development due to inadequate funding and ineffective delivery systems. This mismatch between resource allocation and results reflects broader inefficiencies within India's governance mechanisms that hinder the positive outcomes expected from

social sector investments. As India continues to allocate significant amounts to social sector spending, there is a need for more effective strategies in implementing these investments to ensure tangible improvements in quality of life for its rural populations.

Research has also highlighted the crucial role of human capital development in poverty alleviation. Kurosaki and Khan (2001) emphasize that education is one of the most effective ways to reduce rural poverty by increasing non-farm employment opportunities. However, the lack of risk management mechanisms and barriers in the accumulation of human capital, such as limited access to quality education and healthcare, prevent many rural households from breaking the cycle of poverty. The role of social capital in fostering inclusive growth is also vital, as demonstrated by Morris (1997), who showed that states with stronger social capital have better success in reducing poverty. Higher levels of social capital allow for greater cooperation and support networks that are essential in addressing the challenges faced by rural communities.

In rural India, the relationship between poverty, education, and gender is complex and interdependent. Biswas and Banu (2022) highlight that rural woman, despite facing numerous challenges, are more economically empowered than their urban counterparts. However, persistent gender disparities in access to opportunities, including education and employment, continue to limit the full potential of rural women. Additionally, studies by Dao (2007) and Adekoya (2018) reveal that poverty alleviation is closely linked to improving gender equality, reducing child malnutrition, and ensuring skilled healthcare delivery. These findings emphasize the need for integrated social sector policies that address the multifaceted nature of poverty in rural India.

Moreover, targeted programs aimed at rural development have demonstrated some success, as noted by Chattopadhyay (2017) in his analysis of social sector expenditure trends. However, despite higher fiscal autonomy in recent years, state-level spending on social welfare has not been consistently prioritized, suggesting a lack of political will to further invest in rural welfare. Programs such as the Mahatma Gandhi National Rural Employment Guarantee Act (MANREGA) and Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY) have shown positive impacts on rural populations by creating job opportunities and improving livelihoods (Indwar, 2024). However, as highlighted by Shah and Guru (2003), region-specific challenges such as chronic poverty in isolated areas require more focused and tailored policy interventions to address the unique socio-economic conditions of rural regions.

The inefficacies of social sector expenditures are further compounded by issues such as leakages and corruption in delivery systems, as identified by Chadha and Chadda (2020). These challenges often result in benefits not reaching the intended populations, thus hindering the objectives of social sector development. Addressing these structural issues is crucial to ensure that the benefits of increased social sector spending translate into tangible improvements in rural empowerment.

In conclusion, the role of social sector expenditure in empowering rural India is shaped by a range of factors, including human capital development, social capital, gender equality, and effective program implementation. While there have been some positive outcomes from increased social sector spending, the overall impact has been uneven, and much work remains to be done in ensuring that rural India reaps the full benefits of these investments. This paper aims to explore the various dimensions of social sector expenditure and its role in empowering rural communities, focusing on both the challenges and opportunities for improvement.

1.1 Reviews of literature:

In examining the role of social sector expenditure in empowering rural India, it becomes clear that the

impact of such investments is complex and multifaceted, influenced by various factors ranging from human capital development to governance and program effectiveness. Several studies highlight the importance of both human and social capital in poverty alleviation, the limitations of current social sector expenditure, and the need for more targeted, efficient approaches to improve outcomes.

In the late 1990s, the concept of social capital began gaining traction as a crucial component in rural development. Morris (1997) explored the importance of social capital, particularly how Indian states with strong community networks were more successful in reducing poverty. This early work emphasized the role of cooperation and community engagement in improving economic well-being, signaling that human capital alone was insufficient to drive rural empowerment. Social capital, it was argued, had a significant role in fostering a more cohesive and supportive environment for rural populations, facilitating better outcomes in poverty alleviation.

Building on this, research in the early 2000s started recognizing the importance of human capital development in rural poverty alleviation, particularly through education. Kurosaki and Khan (2001) examined how education could open up non-farm employment opportunities, thus playing a key role in reducing rural poverty. However, their findings also highlighted a crucial limitation: the lack of risk management mechanisms prevented rural populations from fully capitalizing on the benefits of education. This insight pointed to the need for a more holistic approach to human capital development that went beyond education to include measures for managing economic risks, ensuring that rural communities could effectively benefit from their educational investments.

By 2007, gender disparities emerged as a focal point in understanding the broader dynamics of rural poverty. Dao's research highlighted the interconnectedness of human capital, gender equality, and poverty. He argued that improvements in factors such as education for women, maternal health, and child malnutrition were essential to reducing poverty and income inequality. Gender inequality, especially in rural areas, remained a major barrier to empowering women, and Dao's study underscored the need for social sector policies to address these issues alongside traditional focus areas like education and health. These findings added another layer to the understanding of rural poverty, advocating for gender-sensitive policies that could better empower women and improve their socio-economic conditions.

The critical evaluation of social sector expenditure came into focus with Goswami and Bezbaruah's work in 2011, which assessed the effectiveness of India's social sector investments. While they acknowledged that income growth had been a key driver of human development, they found that social sector spending had made only limited impacts, primarily due to ineffective delivery systems and insufficient funding. This study called for a significant increase in funding and a reform of the service delivery mechanisms, arguing that without these changes, the potential of social sector investments to bring about tangible improvements for rural communities would remain unfulfilled.

As the research progressed into the mid-2010s, a more comprehensive understanding of the role of social sector expenditure began to take shape. Kumar (2016) examined India's Social Development Index (SDI) and noted that although the SDI showed an upward trend from 2002 to 2011, it grew at a slower pace than other economic indicators. This suggested that the increase in social sector spending had not translated into rapid improvements in rural development, primarily due to weaknesses in the implementation of social sector schemes. Kumar's work emphasized the need for a sharper focus on effective program implementation to ensure that social sector investments were truly making a difference in rural areas.

A few years later, Chattopadhyay (2017) expanded on this by examining the political and fiscal challenges that hindered the effectiveness of social sector spending. He found that while both central and state-level

spending on social sectors had increased, the prioritization of these investments remained weak due to political obstacles and limited fiscal autonomy at the state level. This pointed to the need for more robust political will and fiscal decentralization to ensure that social welfare and rural development remained top priorities. The study suggested that addressing these challenges was key to making social sector expenditures more impactful and effective at the grassroots level.

As the decade progressed, the role of government expenditure in reducing rural unemployment became a topic of interest. Nepram et al. (2021) found that while increased government expenditure generally suggested a larger government size, it did not always correlate with reduced unemployment. Specifically, non-development spending was often associated with increased unemployment, highlighting the importance of prioritizing development-oriented expenditure. Their research reinforced the idea that it was not the size of government spending that mattered most, but the composition of that spending, with a clear emphasis on development-focused initiatives to empower rural communities.

More recently, Khosla and Jena (2019) explored the dynamics of poverty in rural India through the lens of livelihood diversification and social capital. Their study found that rural households that diversified into non-farm activities, supported by strong social capital, were more likely to escape poverty. This underscored the need for policies that not only foster non-farm livelihoods but also enhance social capital, allowing rural communities to build stronger support networks and more resilient economic strategies.

In 2024, Indwar's study of rural development programs like Mission Antyodaya, MANREGA, and DDU-GKY provided valuable insights into the positive impacts of these initiatives on rural livelihoods. These programs have created jobs, enhanced skills, and improved living standards. However, their success remains uneven, with regions facing chronic poverty and socio-political marginalization requiring more focused and region-specific interventions. Indwar's research thus emphasized the importance of tailored approaches that take into account the unique challenges faced by different rural regions.

At the same time, Kumar et al. (2016) examined microfinance initiatives, particularly Self-Help Groups (SHGs), as an effective tool for empowering rural women. They found that microfinance programs provided women with access to income generation, social status, and decision-making power within households. While many loans were used for domestic purposes, the study suggested that fostering entrepreneurship through SHGs could lead to more sustainable growth and empowerment for women, highlighting the critical role of financial inclusion in promoting rural development.

1.2 Research Gap

Overall, the studies reviewed here collectively suggest that while social sector spending in India has shown some positive impacts, its effectiveness in empowering rural populations is hindered by governance challenges, inadequate funding, and limited targeting of specific regional and demographic needs. Addressing these issues, along with enhancing human and social capital development, will be crucial for creating sustainable empowerment in rural India.

The existing literature on social sector expenditure and rural empowerment in India highlights several important insights, but a clear research gap remains in understanding the specific interplay between targeted social sector investments and the long-term sustainability of rural empowerment. While numerous studies have examined the role of human capital, social capital, and program effectiveness in poverty reduction, there is limited research on the comparative effectiveness of different social sector expenditures (such as education, healthcare, and infrastructure) in addressing the unique challenges of rural areas. Additionally, although some studies focus on the challenges of governance, corruption, and leakage in the implementation of social sector programs, there is a lack of comprehensive analysis on how to enhance

the efficiency of delivery mechanisms to ensure that resources reach marginalized rural populations. Furthermore, the role of gender and regional disparities in influencing the outcomes of these programs remains underexplored, particularly in terms of how social sector expenditure can more effectively empower rural women and marginalized communities in different agro-climatic and socio-political contexts. Thus, there is a pressing need for research that bridges these gaps by offering a holistic understanding of how different dimensions of social sector expenditure can be optimized to foster sustainable rural empowerment in India.

1.3 Research Objectives:

1.3.1 To examine the correlation among social expenditure and on Rural unemployment and Rural wage rate.

1.3.2 To analyze the impact of social sector expenditure on Rural unemployment and Rural wage rate.

1.4 Data Source and methodology:

The present study is based entirely on secondary data collected from reputable sources, including the Economic and Political Weekly Research Foundation (EPWRF), Reserve Bank of India (RBI) state finance reports, Handbooks of Indian Statistics, and RBI annual reports. The data covers a period from the fiscal year 2010-11 to 2022-23, providing a comprehensive longitudinal dataset for analysis.

The primary variables considered in this study encompass social sector expenditure components such as Education, Sports, Art and Culture, Family Welfare, Water Supply and Sanitation, Housing, Urban Development, Social Security and Welfare, Nutrition, and Rural Development. Additionally, rural unemployment and rural wage rates have been included to capture key economic indicators influencing rural empowerment. All expenditure variables are expressed in crore rupees.

To stabilize variance and achieve normality in the data distribution, all variables have been transformed using natural logarithms. This transformation facilitates more reliable statistical inference.

To explore the degree of association among the variables, the Pearson Correlation Coefficient (r) has been employed. The Pearson correlation coefficient between two variables, X and Y, is computed as:

The Pearson correlation coefficient (r) between two variables X and Y is given by:

$$r = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}}$$

Where:

- n = number of data points
- X_i and Y_i = individual data points of variables X and Y
- $\bar{X}$ and $\bar{Y}$ = mean (average) of X and Y

Further, to examine the impact of various independent variables on the dependent variable, a multiple linear regression model has been utilized. The general form of the regression model is:

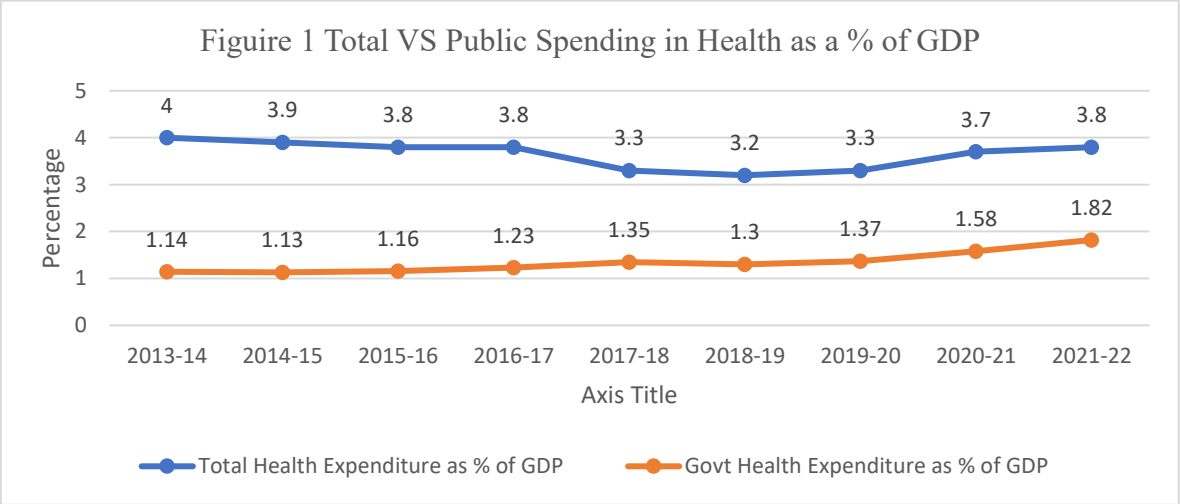
$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_p X_p + \epsilon$$

Where:

- Y = dependent variable (what you're trying to predict)
- β_0 = intercept (constant term)
- $\beta_1, \beta_2, \ldots, \beta_p$ = regression coefficients (slopes) for each independent variable
- $X_1, X_2, \ldots, X_p$ = independent variables (predictors)
- ϵ = error term (residual)

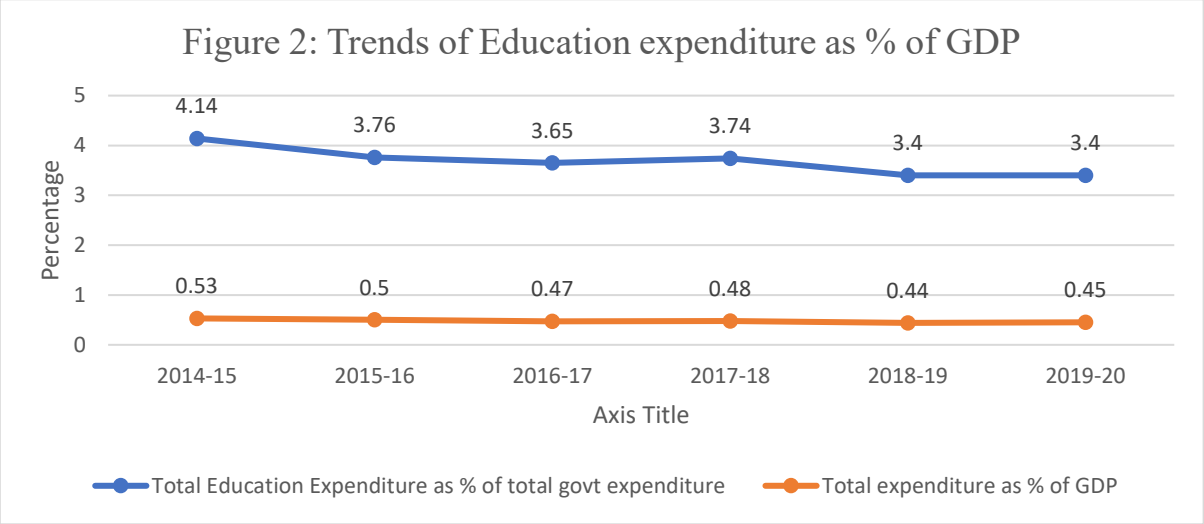
1.5 Discussion and Analysis:

Understanding the patterns and changes in social sector expenditure over time is crucial for evaluating its role in empowering rural India. The following analysis explores the trends in key expenditure areas such as health and education, which are foundational to improving human capital and overall well-being in rural communities. Examining these trends provides insight into government priorities and resource allocation, as well as highlights potential gaps and areas needing increased focus to support sustainable rural development.



Source: Author's own estimation

Figure 1 illustrates the total versus public spending on health as a percentage of GDP from 2013-14 to 2021-22. While total health expenditure has remained relatively stable, fluctuating between 3.2% and 4.0% of GDP, government health expenditure has shown a gradual increase from 1.14% to 1.82%. This indicates a positive trend in public health investment, reflecting efforts to improve healthcare accessibility and infrastructure in rural areas. However, the gap between total and government spending highlights the continued reliance on private or out-ofpocket expenditures, which may limit equitable access to health services for rural population.



Source: Author's own estimation

Figure 2 presents the trends in education expenditure as a percentage of GDP over the period 2014-15 to 2019-20. Total education expenditure as a share of government expenditure decreased from 4.14% to 3.4%, while education expenditure as a percentage of GDP also slightly declined from 0.53% to 0.45%. This downward trend suggests a relative deprioritization of education within overall government spending during this period, raising concerns about the sufficiency of public investment in education—a key driver of human capital and rural empowerment. Conclusion:

Summary statistics: Table 1

	RURAL U...	RURAL W...	EDUCATI...	MEDICAL ...	FAMILY W...	HOUSING	NUTRITION	SOCIAL S...	URBAN D...	WATER S...	RURAL D...
Mean	7.605000	5.617428	12.97600	11.63306	9.977589	10.04484	10.12235	11.64509	11.01508	10.29733	11.70162
Median	7.830000	5.632093	13.00776	11.68432	9.995237	10.18771	10.08860	11.65907	11.08241	10.38130	11.81192
Maximum	8.160000	5.852202	13.37890	12.16839	10.52525	11.05680	10.53710	12.23608	11.55725	10.58513	12.01185
Minimum	6.380000	5.275458	12.51918	10.94003	9.224224	9.071951	9.881763	11.09047	10.35871	9.592496	10.79494
Std. Dev.	0.631634	0.169649	0.273104	0.416347	0.400584	0.562350	0.194934	0.364721	0.403794	0.320969	0.361307
Skewness	-1.282928	-0.560642	-0.226316	-0.224485	-0.382163	-0.067596	0.813595	0.001718	-0.443782	-1.155983	-1.708821
Kurtosis	3.004916	2.756429	1.988712	1.898650	2.301673	2.644834	3.071285	2.028877	1.979093	3.301152	5.060790
Jarque-Bera	2.743185	0.548585	0.511492	0.589394	0.446606	0.060175	1.105344	0.392955	0.762509	2.264948	6.636306
Probability	0.253703	0.760110	0.774339	0.744757	0.799872	0.970361	0.575410	0.821620	0.683004	0.322235	0.036220
Sum	76.05000	56.17428	129.7600	116.3306	99.77589	100.4484	101.2235	116.4509	110.1508	102.9733	117.0162
Sum Sq. Dev.	3.590650	0.259027	0.671273	1.560105	1.444208	2.846136	0.341994	1.197192	1.467444	0.927189	1.174883
Observations	10	10	10	10	10	10	10	10	10	10	10

Source: Author's own estimation

The descriptive statistics summarize the key characteristics of the variables related to rural empowerment and social sector expenditures over the study period. The mean values indicate that rural unemployment averages around 7.61, while rural wages have a mean of 5.62. Education expenditure shows a relatively higher mean of approximately 12.98, reflecting its significant share among the variables studied. Medical and family welfare expenditures have mean values of about 11.63 and 9.98, respectively, indicating

moderate investment levels. Housing and nutrition expenditures are also noteworthy, with means of roughly 10.04 and 11.64.

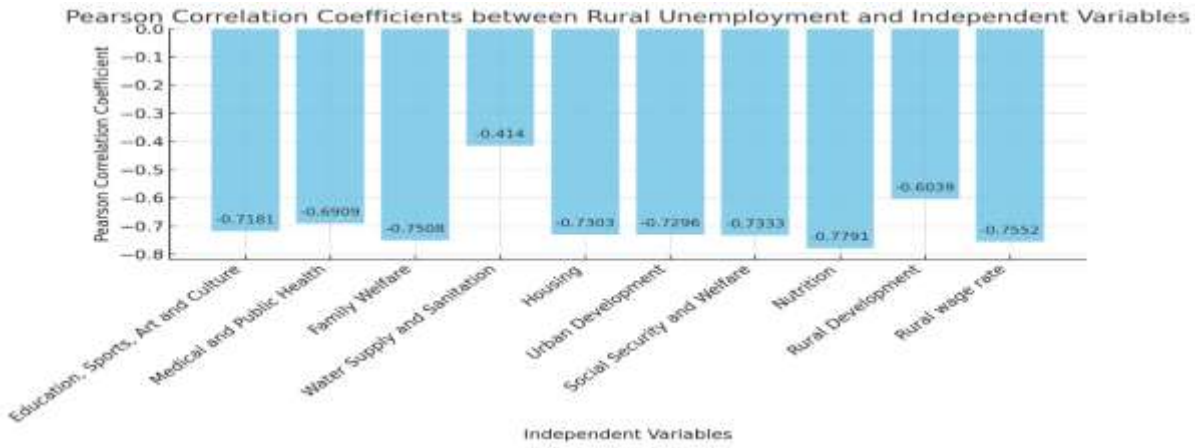
The standard deviations indicate variability in the data, with education and medical expenditures showing higher variation (0.27 and 0.42 respectively), while rural wages display relatively low variability (0.17). Negative skewness values for most variables suggest a distribution skewed to the left, indicating that extreme low values are more common than high ones. The kurtosis values for rural unemployment and rural wages (3.00 and 2.75) suggest a leptokurtic distribution, meaning the data have heavier tails compared to a normal distribution.

The Jarque-Bera test for normality shows that none of the variables significantly deviate from normality at conventional levels, as indicated by relatively high p-values (all above 0.05 except rural development), suggesting the data distribution is approximately normal for most variables. The sample size for each variable is 10 observations, reflecting data across the selected time period.

Overall, these statistics provide an essential foundation for further correlation and regression analysis, highlighting the distributional characteristics and variability of social sector expenditures

Relationship between Social sector Variables and Rural Unemployment and Rural Wage Rate: A Correlation Analysis

Figure 3



Source: Author's own estimation

This Figure 3 provides a detailed look at how various independent variables correlate with rural unemployment through Pearson correlation coefficients, which measure the strength and direction of a linear relationship between two variables. The coefficients range from -1 to 1, where values closer to -1 indicate a strong negative correlation, meaning that as one variable increases, the other tends to decrease. Here, all variables have negative correlations with rural unemployment, highlighting that improvements in these factors are associated with decreases in unemployment levels in rural areas.

The most substantial negative correlation is observed with Nutrition (-0.7791), implying that better nutritional status in rural populations is strongly linked with lower unemployment rates. This could be due to better nutrition enhancing physical and cognitive abilities, thus increasing employability and productivity.

Following nutrition, the Rural wage rate (-0.7552) also shows a very strong negative correlation. This suggests that higher wages in rural areas are linked to reduced unemployment, potentially because better

pay attracts more participation in the labor market or reflects healthier economic conditions fostering job availability.

Other important variables include Family Welfare (-0.7508) and Education, Sports, Art and Culture (-0.7181), both strongly negatively correlated. Improvements in family welfare, which may include financial support, social safety nets, and overall wellbeing, can reduce unemployment by providing stability that enables people to seek and maintain employment. Education and cultural engagement likely improve skills and social capital, making individuals more employable.

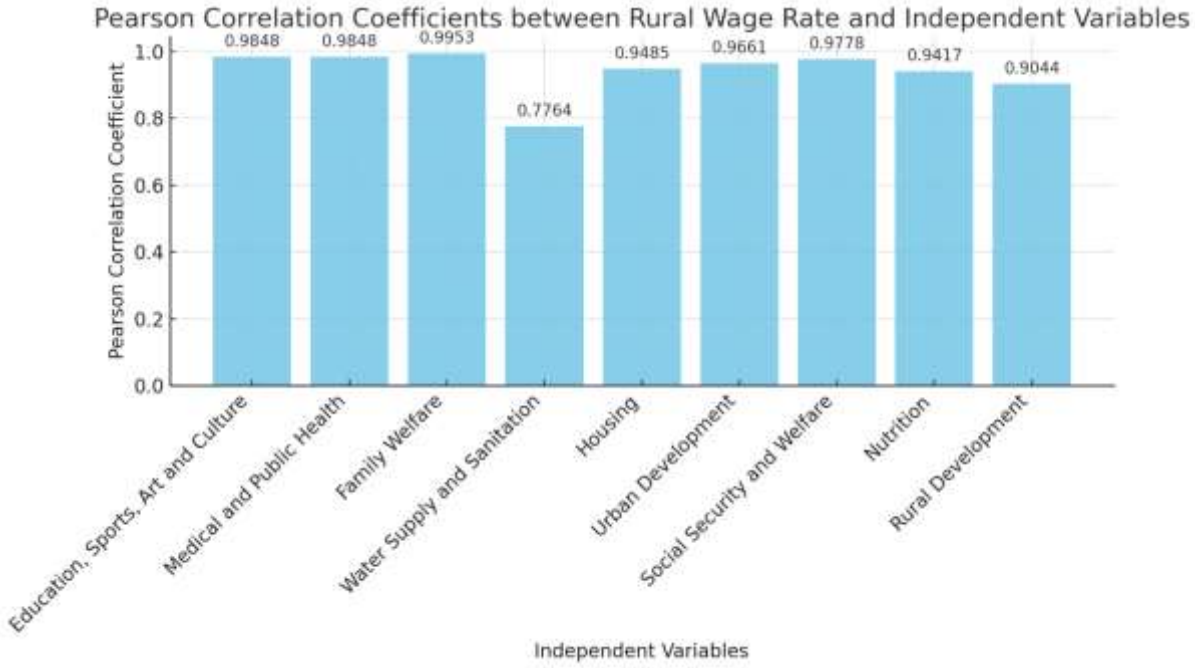
Urban Development (-0.7296) and Social Security and Welfare (-0.7333) are similarly significant, suggesting that infrastructural and social safety improvements contribute to employment by possibly creating better job opportunities and reducing vulnerability.

Interestingly, Water Supply and Sanitation (-0.414) has the weakest negative correlation. Although it still inversely correlates with rural unemployment, its impact might be less direct compared to other variables or influenced by other mediating factors.

Overall, the data suggests that socio-economic development — particularly in nutrition, wages, family welfare, education, and urban infrastructure — plays a critical role in reducing rural unemployment. This supports the idea that multi-dimensional investments in rural areas can improve employment outcomes by addressing health, income, education, and social support collectively rather than in isolation.

Relationship between Social sector Variables and Rural Wage rate:

Figure 4



Source: Author's own estimation

This Figure 4 shows the Pearson correlation coefficients between the rural wage rate and various independent variables related to social, health, and economic development sectors. Unlike the previous chart where correlations with rural unemployment were negative, here all correlations with the rural wage rate are strongly positive, ranging from about 0.78 to nearly 1. This indicates a very strong direct relationship: as each independent variable improves, the rural wage rate tends to increase correspondingly.

The highest correlations, all exceeding 0.98, are with Family Welfare (0.9953), Education, Sports, Art and Culture (0.9848), and Medical and Public Health (0.9848). These near-perfect correlations suggest that enhanced family welfare programs, educational and cultural development, and improvements in health services are almost perfectly aligned with increases in rural wages. This could mean that these factors strongly influence economic well-being and labor market conditions in rural areas.

Social Security and Welfare (0.9778) and Urban Development (0.9661) also show very high positive correlations, indicating that better social safety nets and urban infrastructure growth support higher wage rates in rural regions.

The lowest positive correlation is with Water Supply and Sanitation (0.7764), which, while still strong, is comparatively less influential than other factors. This could reflect that while clean water and sanitation are important for quality of life and productivity, their direct effect on wage levels may be less pronounced or mediated through other variables.

Overall, this chart highlights that improvements in welfare, education, health, social security, and development sectors strongly coincide with higher rural wages. This suggests a multifaceted approach to rural development — combining social welfare, health, education, and infrastructure — is crucial for improving income levels in rural communities.

Principal Component Analysis (PCA)

The Variance Inflation Factor (VIF) analysis revealed severe multicollinearity among the social sector expenditure variables, with several variables exhibiting VIF values far exceeding the commonly accepted thresholds of 5 or 10. Such high multicollinearity can lead to unstable and unreliable estimates in multiple regression analysis.

To address this issue and reduce the dimensionality of the dataset, Principal Component Analysis (PCA) was employed. PCA transforms the original correlated variables into a smaller set of uncorrelated components, known as principal components, which capture most of the variability in the data.

By using these principal components as predictors in regression models, we can obtain more stable, interpretable, and reliable estimates of the impact of social sector expenditure on rural unemployment and rural wage rates.

Table 2

Variables	PC1	PC2	PC3
Education, Sports, Art and Culture	-0.34548	0.151631	0.086747
Medical and Public Health	-0.34238	0.141807	0.247051
Family Welfare	-0.34289	0.107672	0.377304
Water Supply and Sanitation	-0.29529	-0.71596	-0.42101
Housing	-0.34013	-0.03327	-0.44789
Urban Development	-0.34311	0.035313	0.032325
Social Security and Welfare	-0.3423	0.213073	-0.09453
Nutrition	-0.32489	0.435238	-0.35248
Rural Development	-0.32018	-0.44218	0.526316

Source: Author's own estimation

The Principal Component Analysis (PCA) conducted on the social sector expenditure variables yielded

three principal components (PCs) that collectively explain the majority of the variance in the data. The loadings associated with each component provide insight into the underlying patterns of expenditure:

PC1 exhibits strong negative loadings across all social sector expenditure variables, indicating that it represents an overarching combined social sector expenditure factor. The consistent magnitude of these loadings suggests that all variables contribute nearly equally to this component. It is important to note that the negative sign is arbitrary due to the nature of PCA and does not affect the substantive interpretation; rather, PC1 reflects the overall intensity of social sector spending.

PC2 displays greater variation among loadings, characterized by strong negative contributions from Water Supply and Sanitation (-0.72) and Rural Development (-0.44), contrasted with positive loadings on Nutrition (0.44) and Social Security and Welfare (0.21). This pattern suggests that PC2 differentiates between infrastructure-related expenditures and health and social welfare investments, effectively capturing a contrast in government spending priorities within the social sector.

PC3 reveals a more nuanced expenditure pattern, with strong positive loadings on Rural Development (0.53) and Family Welfare (0.38), alongside negative loadings on Housing (-0.45) and Water Supply and Sanitation (-0.42). This component appears to encapsulate a trade-off between social welfare and development programs versus physical infrastructure spending, highlighting the complexity of budget allocation decisions across different social sectors.

Collectively, these components provide a parsimonious and interpretable representation of social sector expenditure patterns, facilitating robust subsequent regression analyses aimed at understanding their impact on rural unemployment and wage dynamics.

Impact of Social Sector Expenditure on Rural Unemployment and Rural Wage Rate: A Regression Analysis

To quantify the impact of social sector expenditure on rural unemployment and rural wage rates, multiple linear regression models were estimated using principal components derived from the expenditure variables to address multicollinearity.

Table 3 presents the regression coefficients, standard errors, t-statistics, and p-values for the models predicting rural unemployment and rural wage rates.

Table 3

Model	Variable	Coefficient (β)	Standard Error	t-Statistic	p-Value	R^2	Adj. R^2
Rural Unemployment	Constant	7.605	0.151	50.28	< 0.001	0.62	0.43
	Principal Component 1	0.15	0.053	2.85	0.029		
	Principal Component 2	-0.273	0.217	-1.26	0.256		
	Principal Component 3	-0.044	0.369	-0.12	0.909		
Rural Wage Rate	Constant	278.658	1.716	162.37	< 0.001	0.99	0.99
	Principal Component 1	-14.803	0.598	-24.74	< 0.001		

	Principal Component 2	5.41	2.462	2.2	0.07		
	Principal Component 3	9.037	4.181	2.16	0.074		

Source: Author's own estimation

Regression Models

Model for Rural Unemployment:

$$\hat{Y}_{unemployment} = \beta_0 + \beta_1 \times PC1 + \beta_2 \times PC2 + \beta_3 \times PC3$$

Where:

- $\beta_0 = 7.605$ (Intercept)
- $\beta_1 = 0.150$
- $\beta_2 = -0.273$
- $\beta_3 = -0.044$

So,

$$\hat{Y}_{unemployment} = 7.605 + 0.150 \times PC1 - 0.273 \times PC2 - 0.044 \times PC3$$

Model for Rural Wage Rate:

$$\hat{Y}_{wage} = \beta_0 + \beta_1 \times PC1 + \beta_2 \times PC2 + \beta_3 \times PC3$$

Where:

- $\beta_0 = 278.658$
- $\beta_1 = -14.803$
- $\beta_2 = 5.410$
- $\beta_3 = 9.037$

So,

$$\hat{Y}_{wage} = 278.658 - 14.803 \times PC1 + 5.410 \times PC2 + 9.037 \times PC3$$

The model explaining rural unemployment achieved an R^2 of 0.62, indicating that 62% of the variation in rural unemployment rates can be explained by the three principal components derived from social sector expenditures. Notably, Principal Component 1 (PC1) was a statistically significant predictor ($\beta = 0.150$, $p = 0.029$), suggesting that the combined variation in social sector spending strongly influences rural unemployment levels.

The regression model for rural wage rates demonstrated excellent explanatory power, with an R^2 of 0.99. PC1 again emerged as a highly significant predictor ($\beta = -14.803$, $p < 0.001$), indicating that the overall social expenditure captured by PC1 is strongly associated with wage increases in rural areas. Although Principal Components 2 and 3 showed marginal significance ($p \approx 0.07$), their effects were less pronounced. These results validate the importance of aggregated social sector expenditure in shaping rural economic outcomes. The contrasting sign of coefficients for PC1 in the two models reflects the directionality of the PCA transformation and should be interpreted as demonstrating strong inverse relationships: as social expenditure increases, rural unemployment tends to decrease while wages increase.

Summary of Findings:

This study examined the influence of social sector expenditure on rural unemployment and rural wage rates in India, utilizing data from 2013 to 2022. Initial Pearson correlation analysis revealed strong, statistically significant associations between increased social spending—particularly in Nutrition, Family Welfare, Education, and Medical Public Health—and improved rural economic outcomes. Specifically, these expenditures correlated negatively with rural unemployment and positively with rural wage rates, underscoring their integral role in rural empowerment.

However, the presence of severe multicollinearity among expenditure variables, as evidenced by extremely high Variance Inflation Factor (VIF) values, necessitated the use of Principal Component Analysis (PCA) to reduce dimensionality and ensure robust regression modeling. PCA identified three principal components accounting for over 97% of the total variance. The first principal component (PC1) represented an overall social expenditure intensity factor, while PC2 and PC3 captured contrasting patterns between infrastructure and welfare-related spending.

Subsequent multiple regression analyses, incorporating these principal components as predictors, yielded significant explanatory power for both rural unemployment ($R^2 = 0.62$) and rural wage rates ($R^2 = 0.99$). PC1 consistently emerged as the strongest predictor, indicating that the aggregate level of social sector expenditure plays a critical role in shaping rural labor market outcomes. Marginal effects of PC2 and PC3 on wage rates suggest that specific allocation patterns within social spending also impact rural incomes.

These findings highlight the multidimensional nature of rural economic development, where coordinated investments across health, education, nutrition, and infrastructure sectors are essential. The study provides empirical support for integrated policy approaches aimed at reducing unemployment and enhancing wages through targeted social sector expenditures.

In conclusion, the research affirms that optimized and balanced social sector investments can significantly empower rural communities in India by fostering improved employment and income conditions. This evidence underscores the necessity for continued and strategically aligned social spending to achieve inclusive and sustainable rural development.

Conclusion & Policy recommendation:

This study demonstrates that social sector expenditure plays a vital role in empowering rural India by significantly influencing rural unemployment and wage rates. Through rigorous correlation and regression analyses using principal components, it is evident that overall social sector spending intensity is strongly associated with reductions in rural unemployment and increases in rural wages. The findings highlight the importance of comprehensive investments across multiple social sectors—particularly nutrition, family welfare, education, and healthcare—in driving rural economic progress. Moreover, nuanced spending patterns that balance infrastructure and welfare investments further impact rural wage dynamics. Addressing multicollinearity through PCA allowed for more robust modeling, confirming that integrated and well-coordinated social expenditures are essential for sustainable rural development.

1. **Enhance Integrated Social Sector Investment:**

Governments should prioritize balanced increases in expenditures across nutrition, family welfare, education, and medical health sectors to maximize rural employment opportunities and wage growth.

2. **Focus on Holistic Development Strategies:**

Policies should simultaneously address physical infrastructure (water supply, housing, rural development) and social welfare programs to ensure comprehensive rural empowerment.

3. **Improve Program Implementation and Deliver**:
Strengthen governance, monitoring, and transparency mechanisms to reduce leakages and corruption, ensuring social sector funds effectively reach targeted rural populations.
4. **Promote Cross-Sector Coordination:**
Encourage collaboration among ministries and departments responsible for health, education, rural development, and social welfare to align strategies and amplify outcomes.

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