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Socio-economic Implications on Rural Female Work Participation Rate

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Abstract

The inter-mandal and inter-divisional variations existing in Rural Female Workers Participation Rate [RFWPR] among the different revenue divisions, gave scope for specific factors analysis of determining RFWPR in each revenue division of Chittoor district. There are number of studies on the determinants of rural labour force, each study considering its own explanatory variables to determine the rural labour participation rate. The present study, proposes to establish the relationship between rural female work participation rate and some important variables, influencing the female work participation rate. This study aims to identify and analyze the determinants of Rural Female Work Participation Rate (RFWPR) and its socio-economic implications in three revenue divisions of Chittoor district, Andhra Pradesh. For study of the inter-relationship between the RFWPR and the selected explanatory variables, five alternative equations have been formulated and studied. For study of the inter-mandal variations in RFWPR, multiple regression analysis is carried out. The step-wise regression analysis is also used to study the impact of economic variables and demographic variables. The estimated regression co-efficients and their standard errors, the multiple correlation co-efficients are also studied. The required data for explanatory and explained variables have been collected from the Census of India 1991: Population Census and also from Handbook of Statistics and other unpublished official records of the Chief Planning Officer, Chittoor. The study revealed that, the influence of Socio-economic variables is more than the influence of demographic variables. The effect of the demographic variables in determining the RFWPR is much less. Among the Socio-economic variables, RMWPR shows significant effect in determining the RFWPR followed by cropping intensity (both positive and negative). The new agricultural technology is not adopted by the cultivators in Chittoor division whereas moderate agricultural technology is adopted in Tirupati division.

Keywords: Rural Female Work Participation Rate, Regression Co-efficients, Female Agricultural Workers, Socio-economic Variables, Demographic Variables.

1. Introduction

Agriculture is an important engine of growth and poverty reduction. Indian women play a crucial and contributory role in the field of agricultural production. Historians believe that it was women who first started cultivation of crop plants and initiated the art and science of farming. Beyond economic benefits, women's participation in the labour force can be seen as a signal of declining discrimination and increasing empowerment of women [1].

Rural Indian women are extensively involved in agricultural activities. However the nature and extent of their involvement differs with the variations in agro production systems. The mode of female participation in agricultural production varies with the landowning status of farm households. Their role ranges from managers to landless laborers. In over all farm production, women's average contribution is estimated at 55% to 66% of the total labour with higher percentages in certain regions. In India, Himalayan pair of bullocks works 1064 hours, a

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man 1212 hours and a woman 3485 hours in a year on a one hectare farm, a figure that illustrates women's significant contribution to agricultural production [2].

The operations performed by female labour in agriculture are varying from region to region and from one social group to another [3]. There are number of studies on the agricultural sector in Chittoor district. Among these studies, the research is very limited on agricultural labour. Empirical investigations are needed to study the agricultural labour problems-: scientific, inductive, factor-finding investigational study of rural female work participation rate in the rural economy of Chittoor district is an important phenomena. As inter-mandal and inter-divisional variations exist in RFWPR among the different revenue divisions, gave scope for specific analysis of the factors determining RFWPR in each revenue division of Chittoor district. This study aims to identify and analyze the determinants of Rural Female Work Participation Rate (RFWPR) and its socio-economic implications in three revenue divisions of Chittoor district, Andhra Pradesh.

2. Objectives

The following are the objectives of the study:

- To study the Inter–Mandal variations in rural female work participation rate in three revenue divisions of Chittoor District, Andhra Pradesh.
- To study the influence of some of the socio- economic variables on rural female work participation rate.

3. Methodology

For study of the Rural Female Work Participation Rate (RFWPR), the following methodology is adopted. Some of the economic and demographic variables, which are likely to influence RFWPR have been incorporated in the present study to determine the RFWPR. For explaining Inter-Mandal variations in RFWPR in three revenue divisions of Chittoor district, the multiple regression analysis has been applied.

There are number of studies on the determinants of rural labour force, each study considers its own explanatory variables to determine the rural labour participation rate [4, 5, 6, 7]. In the present study, it is proposed to establish the relationship between rural female work participation rate and some important variables which are influencing the female work participation rate. Among these independent variables first four are economic variables and the next three are demographic variables. To facilitate the study, the following seven quantifiable variables are identified and incorporated in the model,

3.1 Determinants of RFWPR

3.1.1 Rural Female Work Participation Rate (RFWPR)

Rural Female Work Participation Rate is the percentage of rural female workers engaged in agricultural sector. The females normally are engaged in household duties except when the economic compulsions drive them to take up jobs. It is logical to expect that, if females take up wage employment, almost all of their male family members in working age groups will also follow to do so [8]. For, in Indian cultural value system, it is difficult to expect males to be dependent on the earnings of their females, resulting rural female work participation rate is low as compared to rural male work participation rate [9].

$$\text{RFWPR} = \frac{\text{Total female agricultural workers}}{\text{Total agricultural workers}} \times 100$$

3.1.2 Rural Male Work Participation Rate (X_1)

Generally, Rural Male Work Participation Rate acts as a determinant to the rural female work participation rate. In a labour surplus economy like Chittoor, where wide spread unemployment is prevalent as employment opportunities are very scanty, a higher male work participation rate is likely to result with a low RFWPR. Therefore, an inverse relationship between rural male work participation rate and RFWPR is expected.

$$X_1 = \frac{\text{Total male agricultural workers}}{\text{Total agricultural workers}} \times 100$$

3.1.3 Structure of Rural Female Agricultural Employment (X_2)

The rural economy of Chittoor district is characterized by a high incidence of employment in the agricultural sector, whereas, the non-agricultural sectors like secondary and tertiary sectors are less developed. Since the agricultural sector does not require educated, skilled workers, women find an easy access to low-income yielding traditional jobs of this sector. Most of the rural females are less educated/uneducated. The rural female literacy rate in Chittoor

district is 13.54 percent. Therefore, a positive relationship between RFWPR and structure of rural female agricultural employment is expected.

$$X_2 = \frac{\text{Total female agricultural workers}}{\text{Total agricultural workers}} \times 100$$

3.1.4 Cropping Intensity (X_3)

The cropping intensity is generally considered as a proxy for agricultural development. Increasing cropping intensity is mainly the outcome of higher irrigation intensity, multiple cropping and increasing use of modern inputs. Higher cropping intensity leads to higher income. As income of the family increases, women may withdraw from work force and the introduction of new agricultural technology result in substitution of female workers by male workers. Therefore, an inverse relationship between RFWPR and cropping intensity is expected.

$$X_3 = \frac{\text{Gross area sown}}{\text{Net area sown}} \times 100$$

3.4.5 Percentage of Irrigated area (X_4)

Percentage of irrigated area is an important determinant for agricultural development. More irrigated area leads to higher cropping intensity and multiple cropping and also leads to more employment opportunities in agricultural sector, whereby rural female work participation rate also increases. Therefore, a positive relationship between RFWPR and percentage of irrigated area is expected.

$$X_4 = \frac{\text{Net irrigated area}}{\text{Net area sown}} \times 100$$

3.4.6 Rural Sex Ratio (X_5)

It is generally believed that a higher sex ratio has a strong and positive relationship with female work participation rate. If the sex ratio is high i.e., there are more females than males, there is greater scope for female work participation rate and vice-versa. Therefore, a positive relationship between RFWPR and sex ratio is expected. Sex ratio is considered as the number of female population to thousand male population.

3.4.7 Rural Female Literacy Rate (X_6)

This is an important determinant of RFWPR. Spread of education results in mental and social development of individuals and regarded as one of the most important instrument for elevating the status of the women in society. Spread of education motivates the women and gives them an advantage in the labor market. Positive relationship may be expected between RFWPR and the rural female literacy rate.

3.4.8 Percentage of Scheduled Castes and Scheduled Tribes Female Population (X_7)

Most of the scheduled castes and scheduled tribes females in rural areas enter into agricultural sector as labourers. A positive relationship between RFWPR and the percentage of scheduled castes and scheduled tribes female population is expected.

$$X_7 = \frac{\text{Total SC and ST female population}}{\text{Total female population}} \times 100$$

The functional relationship between the rural female work participation rate and the explanatory variables is shown in the functional form.

$$RFWPR = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7) \quad (1)$$

where,

X_1= Rural Male Work Participation Rate
X_2= Structure of Rural Female Agricultural Employment
X_3= Cropping Intensity
X_4= Percentage of Irrigated Area
X_5= Rural Sex Ratio
X_6= Rural Female Literacy Rate
X_7= Percentage of Scheduled Castes and Scheduled Tribes Female Population

Initially it is proposed to fit the multiple linear regression model to fulfil the objectives of the study. The proposed regression model is

$$RFWPR = a_0 + a_1X_1 + a_2X_2 + a_3X_3 + a_4X_4 + a_5X_5 + a_6X_6 + a_7X_7 \quad (2)$$

where, a_0 = intercept

a_is are the co-efficients of corresponding variables. a_o represents the influence of the variables which are not included in the model on dependent variable (RFWPR).

To estimate the log-linear model of equation (1) we have to consider the logarithmic values of the observations of the variables. The proposed log-linear model is of the form,

$$\text{Log REWPR} = a_0 + a_1 \log X_1 + a_2 \log X_2 + a_3 \log X_3 + a_4 \log X_4 + a_5 \log X_5 + a_6 \log X_6 + a_7 \log X_7 \quad (3)$$

Between these two regression equations (2) and (3) the log-linear model is a suitable model to decide the exact influence of independent variables on the dependent variable. Equations (2) and (3) are fed with the data and the results are analysed according to the estimated regression co-efficients.

To determine the effects of economic and demographic (Socio-cultural) variables separately on rural female work participation rate, the step-wise regression analysis is carried out independently for both types of variables. It is also proposed to study the effect of some of the important combinations of independent variables on explained variable are as follows.

$$RFWPR = f(X_1, X_2, X_3, X_4) \quad (4)$$

$$RFWPR = f(X_5, X_6, X_7) \quad (5)$$

$$RFWPR = f(X_1, X_5, X_6, X_7) \quad (6)$$

$$RFWPR = f(X_1, X_3, X_4, X_6, X_7) \quad (7)$$

Along with the estimated regression co-efficients and their standard errors t-test statistic is calculated to test the significance of each independent variable on dependent variable.

$$t = \frac{\text{Estimated regression co-efficient}}{\text{S.E. of regression co-efficient}}$$

$$t = \frac{\hat{a}_i}{SE(\hat{a}_i)} \rightarrow t_{(n-k)}$$

where,

n = Number of observations
k = Number of variables
i = refers to the variables

The combined effect of all independent variables on dependent variable is represented by 'R^2'. It is called as multiple correlation co-efficent. Which expresses the collective influence of all explanatory variables on the explained variable. To test the significance of all these variable's effect, F-test statistic is carried out.

$$R^2 = 1 - \frac{\sum e_i^2}{\sum y_i^2}$$

$$F = \frac{R^2(k-1)}{(1-R)/(n-k)} (or) F = \frac{ESS(k-1)}{RSS(n-k)}$$

where,

R^2 = Multiple correlation co-efficient
ESS = Error Sum of Squares
RSS = Residual Sum of Squares
n = Total number of observations (sample size)
k = Total number of variables.

In the present study, the relevant data for explanatory and explained variables is collected from the Census of India 1991: Population Census and also from handbook of statistics and other unpublished official records of the Chief Planning Officer, Chittoor.

4. Findings

To study the inter-relationship between the RFWPR and the selected explanatory variables, five alternative equations have been formulated. The first equation deals with the effect of seven selected explanatory variables (X_1, X_2, X_3, X_4, X_5, X_6 and X_7) on the explained variable RFWPR. The second equation deals with the effect of four economic variables (X_1, X_2, X_3 and X_4) on the dependent variable RFWPR. The third equation establishes the functional relationship between three demographic variables (X_5, X_6 and X_7) and the explained variable. The fourth equation assumes, RFWPR is a function of one economic variable and three demographic variables (X_1, X_5, X_6 and X_7). The fifth equation establishes the relationship between RFWPR and the independent variables X_1, X_3, X_4, X_6 and X_7.

4.1 Chittoor Division

The estimated regression co-efficients along with their standard errors and multiple correlation co-efficient of these five equations for Chittoor division are given in the Table 1.

Equation I establishes the functional relationship between RFWPR and the all selected explanatory variables in the study. Viz., rural male work participation rate (X_1), structure of rural female agricultural employment (X_2), cropping intensity (X_3), percentage of irrigated area (X_4), rural sex ratio (X_5), rural female literacy rate (X_6) and the percentage of SC and ST female population (X_7). The collective effect of the seven explanatory variables in this equation is 0.9991. It explains the 99.9 percent of intermandal variation in RFWPR. From the F-test statistic this variation is found to be significant at 5 percent probability level. The value of the intercept term is 11.7089.

Type of the variables and expected relation

Variables	Description of Variables	Type of Variable	Expected relationship with RFWPR
Y	Rural Female work participation rate	Explained	–
X_1	Rural Male work participation rate	Explanatory	Negative
X_2	Structure of rural female agricultural employment	Explanatory	Positive
X_3	Cropping intensity	Explanatory	Negative
X_4	Percentage of irrigated area	Explanatory	Positive
X_5	Rural sex ratio	Explanatory	Positive
X_6	Rural female literacy rate	Explanatory	Positive
X_7	Percentage of scheduled castes and scheduled tribes female population	Explanatory	Positive

Equation II establishes the functional relationship between RFWPR and the four economic variables. Viz., X_1, X_2, X_3 and X_4. The collective effect of all these four economic variables explaining 99.8 percent of variation in RFWPR. From F-test statistic the variation is found to be significant at 5 percent probability level. The value of the constant term is 11.6612.

Comparing the equations I and II, the effect of all demographic variables on RFWPR is totally negligible. Hence it may be concluded that the four economic variables effect on RFWPR is quite high and significant also.

Equation III assumes RFWPR to be a function of all demographic variables, viz., X_5, X_6 and X_7. The collective effect of the three demographic variables on explained variable is 0.1057. It expresses 10.57 percent of variation in RFWPR. But this variation is not significant. The value of intercept term is 3.5676.

Comparing the equations I and III, the demographic variables collectively explained very less effect than the economic variables. It means almost 90 percent of variation in RFWPR is explained by only the economic variables. Hence, it may be concluded that the economic variables are more powerful than the demographic variables in determining the RFWPR.

The equation IV explains inter-mandal variations in RFWPR in terms of three demographic variables (X_5, X_6 and X_7) along with one economic variable rural male work participation rate (X_1). The combined effect of all these four variables on RFWPR makes a significant equation. These four variables shows 99.8 percent of variation in RFWPR. The value of intercept term is 11.6114.

Comparing the equations I and IV, it is observed that the exclusion of three economic variables X_2, X_3 and X_4 shows very negligible effect (0.12 percent) on RFWPR. It is also identified that the incorporation of the variable rural male work participation rate with the demographic variables, shows maximum variation in RFWPR.

Equation V assumes RFWPR to be a function of all selected variables except structure of rural female agricultural employment (X_2) and Rural sex ratio (X_5) i.e., X_1, X_3, X_4, X_6 and X_7. The collective effect of all the variables considered in this equation explained 99.88 percent of variation in RFWPR. From F-test statistic this variation in RFWPR is found to be significant at 5 percent probability level. The co-efficient of the constant term is 11.6159.

Comparing the equations I and V, it may be observed that 0.03 percent of variation is decreased by excluding the two variables X_2 and X_5. It is also observed that, the effect of these two variables is negligible.

4.2 Tirupati Division

To study the inter-mandal variations in RFWPR, multiple regression analysis is carried out. The step-wise regression analysis is also used to study the impact of economic variables and demographic variables. The estimated regression co-efficients and their standard errors, the multiple correlation co-efficients are also furnished in the Table 2.

Equation I establishes the functional relationship between RFWPR and the all selected explanatory variables in the study. Viz., X_1, X_2, X_3, X_4, X_5, X_6 and X_7. The total effect of the seven explanatory variables considered in the first equation shows an insignificant variation in the explained variable i.e., 77.02 percent of variation in RFWPR. The value of the intercept term is 22.2086.

Equation II establishes the functional relationship between RFWPR and the all economic variables, Viz., X_1, X_2, X_3 and X_4. The collective effect of these economic variables is 0.8269. This value shows a variation of 83 percent in RFWPR. From F-test statistic this variation is found to be significant at 5 percent probability level. The value of constant term is 14.5808.

Table 1. Estimated regression co-efficients of RFWPR : Chittoor division

Equation Number	Intercept	Regression Co-efficients							R^2
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	
I	11.7089	−1.9644* (0.0205)	-0.0007 (0.0042)	0.0185* (0.0059)	−0.0063* (0.0021)	−0.0062** (0.0034)	0.0041 (0.0051)	0.0003 (0.0031)	0.9991*
II	11.6612	−1.9462* (0.0224)	-0.0035 (0.0037)	0.0113** (0.0063)	−0.0057* (0.0021)	–	–	–	0.9984*
III	3.5676	–	–	–	–	0.0581 (0.0742)	−0.0424 (0.0974)	−0.0514 (0.0812)	0.1057
IV	11.6114	−1.9373* (0.0238)	–	–	–	0.0001 (0.0037)	0.0089* (0.0038)	0.0014 (0.0041)	0.9979*
V	11.6159	−1.9512* (0.0203)	–	0.0144* (0.0057)	−0.0045* (0.0019)	–	0.0089* (0.0037)	0.0021 (0.0031)	0.9988*

* Significant at 5 percent probability level
** Significant at 10 percent probability level
Note: Figures in the parenthesis are standard errors of the co-efficients.

Comparing the equations I and II, it is observed that equation II explains 5.67 percent of more inter-mandal variation. From this, one can observe that, the economic variables are more powerful than the demographic variables in determining the female work participation. None of the demographic variables explains sufficient variation. Among the economic variables, X_1 and X_4 are the dominant factors in determining the rural female work participation rate.

Equation III assumes RFWPR to be a function of all demographic variables, viz., rural sex ratio (X_5), rural female literacy rate (X_6) and percentage of SC and ST female population (X_7). The combined effect of these demographic variables is not upto the mark (0.1586). It means, the variation in RFWPR is only 16 percent by all the demographic variables. But it is not significant. The value of intercept term is 8.5809.

From the equations I and III, the inter-mandal variations are decreased to maximum extent by deleting the economic variables. Around the 61 percent of inter-mandal variation in female participation is decreased by eliminating the economic variables from the model. Among these demographic variables, the variable 'X_7' shows significant variation in negative direction.

In equation IV, the RFWPR is a function of one economic variable (X_1) and three demographic variables (X_5, X_6 and X_7). The total effect of the explanatory variables, considered in the fourth equation, shows an insignificant variation in this explained variable i.e., 26.5 percent of variation in RFWPR. The value of intercept term is 11.1081.

From the equations I and IV, the economic variable X_1 is continuing its dominance in determining the female participation rate. From the total variation, it is observed that, nearly 50 percent of less variation is identified in equation IV than in equation I. The effect of demographic variables in both the equations is the same. In equation IV, the variable 'X_7' is significant.

Equation V assumes RFWPR to be a function X_1, X_3, X_4, X_6 and X_7 variables i.e., it is a function of three economic variables (X_1, X_3 and X_4) and two demographic variables (X_6 and X_7). The collective effect of the explanatory variables in the equation is 0.8071. It explains the 80.71 percent of inter-mandal variation in RFWPR. From F-test statistic, this variation is found to be significant at 5 percent probability level. The value of intercept term is 13.9121.

The equations I and V reveals a higher variation of 3.7 percent in equation V than in equation I. The three economic variables individually show significant variation in equation V. The two demographic variables show insignificant effect in both the equations. Finally, it may be concluded that the variables – X_1 and X_4 are the predominant variables in determining the rural female work participation rate in Tirupati division.

4.3 Madanapalle Division

Inter-mandal variations in rural work participation rate for Madanapalle division has been studied with the help of multiple regression analysis. The effects of economic variables and demographic variables is analysed independently by step-wise regression analysis. The co-efficients

Table 2. Estimated Regression Co-Efficients of RFWPR : Tirupati Division

Equation Number	Intercept	Regression Co-efficients							R^2
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	
I	22.2086	−3.6274* (1.3657)	0.1333 (0.2329)	0.4999 (0.7183)	−0.6881* (0.1991)	−1.3939 (2.8785)	−0.2405 (0.2262)	−0.1873 (0.3279)	0.7702
II	14.5808	−2.4640* (0.9264)	0.0739 (0.0894)	0.5908** (0.3001)	−0.7428* (0.1439)	–	–	–	0.8269*
III	8.5809	–	–	–	–	−0.5729 (3.7098)	−0.4026 (0.3377)	−0.3669** (0.1873)	0.1586
IV	11.1081	−3.3526* (1.2786)	–	–	–	−0.7992 (3.9621)	−0.4054 (0.3529)	−0.3945** (0.2014))	0.2649
V	13.9121	−2.1079* (0.9284)	–	0.5824** (0.3084)	−0.7413* (0.1589)	–	-0.2281 (0.2042)	−0.0682 (0.1821)	0.8071*

* Significant at 5 percent probability level
** Significant at 10 percent probability level
Note: Figures in the parenthesis are standard errors of the co-efficients.

of the variables in each equation and their standard errors, the correlation co-efficient, intercept term are given in the Table 3.

The effect of all independent variables considered in the model, on rural female work participation rate is established in equation I. The value of multiple correlation co-efficient is 0.9963. It means 99.63 percent of inter-mandal variation in RFWPR is explained by the all seven explanatory variables. By F-test statistic, this variation is found to be significant at 5 percent probability level. The value of the intercept term is 10.5813.

Equation II establishes the functional relationship between RFWPR and four economic variables viz., X_1, X_2, X_3 and X_4. The total effect of all explanatory variables considered in the second equation shows collectively the significant inter-mandal variation in RFWPR. i.e., 99.55 percent of variation in female participation rate is observed by these independent variables. The value of constant term is 10.2479.

Comparing the equations I and II, the exclusion of three demographic variables from the model shows very negligible variation, i.e., 0.08 percent, in rural female work participation rate. Hence, it may be concluded that the four economic variables are dominant in determination of RFWPR than demographic variables in Madanapalle division.

The equation III assumes RFWPR to be a function of three demographic variables, viz., rural sex ratio (X_5), rural female literacy rate (X_6) and percentage of SC and ST female population (X_7). The collective effect of the independent variables in this equation is 0.1371. It explains 13.71 percent of variation in RFWPR. But this variation is not significant. The value of intercept term is 5.3235.

Observing the equations I and III, exclusion of the economic variables will decrease the 86 percent of total inter-mandal variation in RFWPR. From this, it is also observed that the demographic variables effect on rural female work participation rate is very less and insignificant.

The equation IV explains inter-mandal variation in RFWPR in terms of one economic variable (X_1) and three demographic variables (X_5, X_6 and X_7). The combined effect of the independent variables used in this equation is 0.996. From this value, 99.6 percent of inter-mandal variation in RFWPR is observed. This variation is a significant. The value of constant term is 10.4294.

By observing the collective effects of variables of the models I and IV, 0.03 percent of less variation is noticed in equation IV than in the equation I. Among the economic variables exclusion of three variables X_2, X_3 and X_4 shows a negligible variation in RFWPR when comparing to first equation. Hence, it may be concluded that the variable 'X_1' is continuing its superiority in determination of RFWPR.

The equation V is the function of three economic variables (X_1, X_3 and X_4) and two demographic variables (X_6 and X_7). The collective effect of these explanatory variables explaining 99.61 percent of inter-mandal variation in RFWPR. From F-test statistic, the variation in RFWPR is found to be significant at 5 percent probability level. The value of intercept term is 10.2542. Comparing the equations I and V, a negligible variation (0.02 percent) is observed.

Table 3. Estimated Regression Co-Efficients of RFWPR: Madanapalle Division

Equation Number	Intercept	Regression Co-efficients							R^2
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	
I	10.5813	−1.5754* (0.0222)	0.0079 (0.0097)	−0.0278 (0.0297)	0.0145* (0.0045)	−0.0865 (0.0766)	0.0162* (0.0040)	0.0055 (0.0054)	0.9963*
II	10.2749	−1.5553* (0.0214)	−0.0010 (0.0086)	−0.0485* (0.0199)	0.0133* (0.0038)	–	–	–	0.9955*
III	5.3235	–	–	–	–	−0.2598 (0.9420)	−0.0695 (0.0477)	−0.1035* (0.0445)	0.1371
IV	10.4294	−1.5681* (0.0209)	–	–	–	−0.0784 (0.0653)	0.0067** (0.0034)	0.0089** (0.0047)	0.9960*
V	10.2542	−1.5701* (0.0214)	–	-0.0683** (0.0277)	0.0015 (0.0039)	–	0.0056 (0.0033)	0.0073 (0.0053)	0.9961*

* Significant at 5 percent probability level
** Significant at 10 percent probability level
Note: Figures in the parenthesis are standard errors of the co-efficients.

4.4 Chittoor District

To study the inter-mandal variations in female participation rate, multiple regression analysis is adopted. The step-wise regression analysis is also used to study the impact of economic variables, demographic variables and some combinations of these variables separately. The estimated regression co-efficients and their standard errors, the multiple correlation co-efficient of each equation are given in the Table 4.

Equation I assumes that, RFWPR is a function of all selected seven explanatory variables. The total effect of seven explanatory variables on explained variable RFWPR is observed as 38.96 percent. This variation in RFWPR is significant at 5 percent probability level. The value of constant term is 8.4202.

Equation II establishes the functional relationship between RFWPR and all economic variables viz., X_1, X_2, X_3 and X_4. The value of multiple correlation co-efficient is 0.381. It means 38.1 percent of inter-mandal variation in RFWPR is explained by the four economic variables. By F-test statistic, this variation in female participation is found to be significant at 5 percent probability level. The value of intercept term is 8.6142.

Comparing the equations I and II, the exclusion of three demographic variables from the model explains the variation in RFWPR is negligible (0.86 percent). It may be concluded that, the effect of four economic variables on RFWPR is more and significant.

The equation III assumes RFWPR to be a function of three demographic variables, viz., X_5, X_6 and X_7. The combined effect of all these three demographic variables on RFWPR makes the equation is an insignificant equation. These three variables reveals 15.74 percent of variation in RFWPR. The value of intercept term is 4.3491.

From equations I and III, the demographic variables collectively explained less variation in RFWPR than economic variables. The effect of demographic variables on variation in RFWPR is 50 percent in total variation of all economic variables.

In equation IV, the RFWPR is a function of three demographic variables (X_5, X_6 and X_7) along with one economic variable (X_1). The total effect of these demographic variables along with one economic variable considered in this equation is significant i.e., 28.69 percent of variation is observed by these independent variables. The value of intercept term is 8.3501.

By comparing the equations I and IV, 10.27 percent of less variation is observed in equation IV. This is due to exclusion of three economic variables – X_2, X_3 and X_4.

In equation V, RFWPR is a function of all variables except structure of rural female agricultural employment (X_2) and rural sex ratio (X_5). The Collective effect of all explanatory variables considered in fifth equation explained 38.77 percent of inter-mandal variation in RFWPR. From F-test statistic, this variation in female participation rate is found to be significant at 5 percent probability level. The value of constant term is 8.4791.

From equations I and V, it is observed that the difference in variation is 0.19 percent. This difference is caused by exclusion of the one economic variable (X_2) and one demographic variable (X_5). Finally, it may be concluded

that the male work participation rate is an important factor in determining the inter-mandal variation in RFWPR.

It is evident from the Table 5 that, the estimated co-efficient of the rural male work participation rate (X_1) is negative and significant in three revenue divisions and in the district as a whole. This indicates that the expected and the observed relationships are the same. So, as the male work participation rate increases the female work participation rate will be decreased significantly. The maximum decrease in RFWPR by RMWPR is observed in Tirupati division followed by Chittoor and Madanapalle divisions. The least variation in RFWPR is observed in entire Chittoor district. The estimated co-efficient of the variable 'X_1' reveals that, every one unit increase in male work participation rate will decrease the female work participation rate by more than one and half units in three revenue divisions. But such a relationship is not in the case of Chittoor district as a whole, as it is all most equal to RMWPR. Generally, male wages are more than the female wages. For the same reason the male labour is attracted to the agricultural labour market. The female labour is migrating from agriculture to non-agricultural sectors due to non-encouraging wages in agricultural sector. Hence, the RFWPR is decreasing by increasing the RMWPR.

The co-efficient of structure of rural female agricultural employment (X_2) is positive but not significant in two revenue divisions namely, Tirupati and Madanapalle and in the Chittoor district as a whole. The observed and expected relationships between X_2 variable and the RFWPR are one and the same. It means, positive relationship is observed between dependent and independent variables. Tirupati division accounts for more variation in RFWPR when compared with Madanapalle division. In case of Chittoor division, the observed negative relationship between X_2 and RFWPR is contradictory to the expected relationship.

The co-efficient of the variable 'cropping intensity (X_3)' is positive in two divisions namely, Chittoor and Tirupati. But it is significant in Chittoor division only. Whereas in Madanapalle division, negative relationship is observed. Every one unit increase in cropping intensity will increase the RFWPR to the maximum in Tirupati division followed by Chittoor division. It is evident that the observed and expected relationships are contradictory in these two divisions. But these relationships are coinciding in Madanapalle division. According to the expected relationship, the cultivators in Chittoor and Tirupati divisions are not adopting the new technology in agricultural sector. Hence, the RFWPR is increasing by raising the cropping intensity. In Madanapalle division RFWPR is decreasing due to the increase in cropping intensity. It reveals that the farmers are adopting the new agricultural technology in Madanapalle division. But it is not significant. In the case of Chittoor district as a whole, negative and significant relationship is observed between cropping intensity (X_3) and RFWPR. Expected and observed relationships are coinciding in this case. This significant relation explains that the cultivators in the district are adopting the new agricultural technology at significant level.

The co-efficient of the percentage of irrigated area (X_4) is negative and significant in two revenue divisions

Table 4. Estimated Regression Co-Efficients of RFWPR : Chittoor District

Equation Number	Intercept	Regression Co-efficients							R^2
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	
I	8.4202	−1.1067* (0.3388)	0.0316 (0.0826)	−0.3318* (0.1335)	0.0028 (0.0439)	−0.0069 (0.1383)	0.0029 (0.0667)	−0.0601 (0.0726)	0.3896*
II	8.6142	−1.1439* (0.2873)	−0.0048 (0.0592)	−0.0298 (0.0187)	-0.0441* (0.0187)	–	–	–	0.3810*
III	4.3491	–	–	–	–	−0.0233 (0.1351)	−0.0932* (0.0422)	−0.1182* (0.0423)	0.1574
IV	8.3501	−1.0727* (0.3222)	–	–	–	−0.0168 (0.1253)	−0.0134 (0.0541)	−0.0547* (0.0237)	0.2869*
V	8.4791	−1.0787* (0.3253)	–	(0.0187) (0.1134)	-0.0041 (0.0392)	–	−0.0084 (0.0577)	−0.0471 (0.0053)	0.3877*

* Significant at 5 percent probability level

** Significant at 10 percent probability level

Note: Figures in the parenthesis are standard errors of the co-efficients.

namely, Chittoor and Tirupati. But it is positive and significant in Madanapalle division. The observed and expected relationships between irrigated area and RFWPR are contradictory in Chittoor and Tirupati divisions. But it is coinciding in Madanapalle division. The contradictory relationship explains that the female agricultural wages are comparatively less than the female wages in non-agricultural sectors. So that, female labour is attracted to the non-agricultural sectors for their employment. Hence, the RFWPR in agricultural sector is decreasing significantly. Regarding the Madanapalle division RFWPR is increasing due to increasing percentage of irrigated area. It explains that female participation is more in agriculture i.e., the female labour is attracted to the higher wages in agricultural sector than the wages in non-agricultural sectors. In the case of entire Chittoor district, positive relationship is observed between the variables - X_4 and RFWPR. But this positive relation is not significant. The observed and expected relationships are the same. An increase in irrigated area will increase the RFWPR.

The co-efficient of the variable 'rural sex ratio (X_5)' is negative in three revenue divisions as well as in the district as a whole. Hence, the negative relationship is observed between rural sex ratio and RFWPR. Every increase in rural sex ration will decrease in RFWPR. The observed relationship is contradictory to the expected relationship. The decrease in RFWPR is caused by the lower sex ratio i.e., there are less females than males. Hence, RFWPR is decreasing due to the less female population than the male population.

It is expected that, the relation between rural female literacy rate (X_6) and RFWPR is positive. Since, the literacy (minimum education) motivates the women to seek employment opportunities in agricultural sector as it promotes their economic and social status. The expected and the observed relationships between female literacy rate and RFWPR are coinciding in the case of Chittoor and Madanapalle (Significant) divisions as well as in the district as a whole. But it is contradictory in the case of Tirupati division. The contradictory relationship reveals that the literacy rate is low in rural female labour.

The results pertaining to X_7 – RFWPR studies is same as that of X_6 - RFWPR studies in all the study areas except in Chittoor district, where the insignificant negative relationship is observed. Hence, expected and observed relationships are contradictory in Chittoor district.

The collective effect (R^2) of all independent variables on dependent variable is significant in Chittoor and Madanapalle divisions and in the Chittoor district as a whole. But it is not significant in Tirupati division. The maximum variation is observed in Chittoor division followed by Madanapalle and Tirupati divisions. Thirty nine (39) percent of variation in RFWPR is observed in entire Chittoor district.

5. Conclusions

To study the effect of selected socio-economic variables and the demographic variables on RFWPR, the multiple regression analysis is adopted. The effect of these two types of the variables is analysed separately. This analysis is carried out in each revenue division and the district as a whole.

In case of Chittoor revenue division, the estimated co-efficients of the variables – rural female literacy rate and the percentage of SC and ST female population are positive, but not significant. The observed and expected

Table 5. Estimated regression co-efficients of RFWPR

Division	Intercept	Regression Co-efficients							R^2
		X_1	X_2	X_3	X_4	X_5	X_6	X_7	
Chittoor	11.7089	−1.9644*	−0.0007	0.0185*	−0.0063*	0.0063**	0.0041	0.0003	0.9991*
		(0.0205)	(0.0042)	(0.0059)	(0.0021)	(0.0034)	(0.0051)	(0.0031)	
Tirupati	22.2086	−3.6274*	0.1333	0.4999	−0.6881*	−1.3939	−0.2405	−0.1873	0.7702
		(1.3657)	(0.2329)	(0.7183)	(0.1991)	(2.8785)	(0.2262)	(0.3279)	
Madanapalle	10.5813	−1.5754*	0.0079	−0.0278	0.0145*	−0.0865	0.0162*	0.0055	0.9963*
		(0.0222)	(0.0097)	(0.0297)	(0.0045)	(0.0766)	(0.0040)	(0.0054)	
District as a whole	8.4202	−1.1067*	0.0316	−0.3318*	0.0028	−0.0069	0.0029	−0.0601	0.3896*
		(0.3388)	(0.0826)	(0.1335)	(0.0439)	(0.1383)	(0.0667)	(0.0726)	

* Significant at 5 percent probability level

** Significant at 10 percent probability level

Note: Figures in the parenthesis are standard errors of the co-efficients.

relationships of these variables with RFWPR are coinciding. Every increase in each of these variables will increase the RFWPR. The observed relation between RMWPR and RFWPR is negative and significant. This relationship is coinciding with the expected relationship. Every increase in the RMWPR will significantly decrease the RFWPR. Contradictory relationship is observed between the variable 'structure of rural female agricultural employment' and RFWPR. It is insignificant relation. The positive and significant relationship is observed between cropping intensity and RFWPR, which is contradictory to the expected relationship. It indicates that the cultivators in Chittoor division are not adopting the new agricultural technology such as tractors, machineries for planting, weeding, sowing, harvesting, etc., Hence, the RFWPR is increasing with increase in cropping intensity. The estimated co-efficient of the percentage of irrigated area is negative and significant. Hence, negative relationship is observed between the percentage of irrigated area and RFWPR, which is contradictory to the expected relationship. More irrigation facilities lead to higher cropping intensity which in turn lead to more employment opportunities for females in agriculture. But the female wages are not encouraging to absorb women in agricultural sector. Hence, the female labour is migrating from agriculture to non-agricultural sectors. The co-efficient of the variable 'Rural sex ratio' is negative and significant. Therefore, negative relationship is observed between sex ratio and RFWPR. This observed relationship is contradictory to the expected relationship. This contradictory relation is caused by the lower sex ratio. In other words, the female population is less than the male population. All the selected seven variables collectively show a variation of 99.91 per cent in RFWPR. This variation is significant in Chittoor division.

The combined effect of all four socio-economic variables on RFWPR is significant. These variables recorded a variation of 99.84 per cent in RFWPR. Similarly, the aggregate effect of all three demographic variables on RFWPR is insignificant. These three variables recorded negligible variation (10.57 percent). It is observed that the role of demographic factors, in determining the RFWPR is not considerable. The addition of one socio-economic variable RMWPR with demographic variables show collectively 99.79 per cent of variation in RFWPR. Hence, one can say that the RMWPR is a dominant variable in determining the RFWPR.

In case of Tirupati revenue division, the structure of rural female agricultural employment establishes an insignificant positive relationship with RFWPR and is coinciding with the expected relationship. The variable RMWPR establishes a significant negative relationship with RFWPR. It reveals that every one unit increase in RMWPR will decrease the RFWPR to the maximum level. This observed relationship coincides with the expected relationship. The independent variables – cropping intensity, rural sex ratio, rural female literacy rate and percentage of SC and ST female population, individually, establishes positive, negative, negative and negative relationship with RFWPR respectively. But these relationships are insignificant. The observed relationships of these variables are contradictory to the expected relationships of these variables are contradictory to the expected relationships. Every increase of the three demographic variables will decrease the RFWPR. But one unit increase in the variable 'cropping intensity' will increase the RFWPR by nearly half unit. The estimated co-efficient of the variable 'cropping intensity' reveals that, much advanced agricultural technology is not adopted in Tirupati division. The estimated co-efficient of the variable percentage of irrigated area establishes the significant negative relationship with RFWPR. Every one unit increase in the percentage of irrigated area will decrease the RFWPR by 0.69 units. But this observed relationship is contradictory to the expected relationship. This contradictory relationship is due to the migration of female labour from agricultural sector to non-agricultural sectors in search of higher wages. The aggregate effect of the independent variables on dependent variable RFWPR is approximately 77 percent. This variation is not significant.

The combined effect of four socio-economic variables on RFWPR is 82.69 per cent and it is significant. Similarly, the collective effect of three demographic variables on RFWPR is insignificant. These three variables recorded negligible variation (15.86 percent) in RFWPR. The role of these demographic variables in determining the RFWPR is very meager. The combination of socio-economic variable 'RMWPR' with these three demographic variables recorded a variation of 26.5 percent in RFWPR. Which is 10 per cent more than the variation recorded by these three demographic variables. But ten per cent of variation is very less when compared to that of Chittoor division. It is also observed that the variation in RFWPR by the two Socio-economic variables, cropping intensity and irrigated area, is predominant.

In case of Madanapalle revenue division, the variables – Structure of rural female agricultural employment, cropping intensity and percentage of SC and ST female population, individually, establishes positive, negative and

positive relationships with RFWPR respectively. The observed and expected relationships of each of these variables with RFWPR are coinciding. The explanatory variables – RMWPR, percentage of irrigated area and rural female literacy rate show significant effect on RFWPR. The observed relationships between RFWPR and each of these variables are also coinciding with the expected relationships. For one unit increase in RMWPR, RFWPR will be decreased by about one and half unit. Every one unit increase in irrigated area and female literacy rate will enhance the RFWPR by about one-forth of the unit. But this increase is significant. The variable 'rural sex ration' is negatively related to RFWPR. But this is insignificant. The contradictory relationship with RFWPR is noticed. This is due to less female population than male population in this revenue division. The aggregate effect of the selected variables shows a variation of 99.63 per cent in RFWPR. But this variation is significant.

The collective effect of four socio-economic variables is 99.55 percent and is significant. A variation of 13.71 percent is recorded by the three demographic variables on RFWPR, which is insignificant. It is observed that the demographic variables show meager effect on RFWPR. Addition of one economic variable 'RMWPR' to demographic variables increases the variation in RFWPR by 99.6 percent, which is significant. It may be concluded that the male work participation rate plays a crucial role in determining the RFWPR.

In case of Chittoor District as a whole, the variables-structure of rural female agricultural employment, percentage of irrigated area and rural female literacy rate show positive and insignificant effect on RFWPR. The positive relationship is observed with RFWPR, which is coinciding with the expected relationship. Significant negative relationship with RFWPR is observed by the variables – RMWPR and cropping intensity. This observed relationship is coincides with the expected relationship i.e., every one unit increase in each of these variables – RMWPR and cropping intensity will decrease the RFWPR by about one unit and less than half unit respectively. The insignificant negative relationship is observed by the variables-rural sex ratio and percentage of SC and ST female population with RFWPR. This relationship is contradictory to the expected relationship. The collective effect of all these independent variables on RFWPR is about 39 percent and is significant.

About 38.1 percent of variation in RFWPR is recorded by the Socio-economic variables. It is observed to be a significant variation. Similarly, the effect of demographic variables on RFWPR is 15.75 percent, which is an insignificant variation. RMWPR is the dominant factor in determining the RFWPR in the entire district as a whole. The observation is similar to that made in the case of three revenue divisions.

Finally, this study reveals that, the influence of Socio-economic variables is more than the influence of demographic variables. The effect of the demographic variables in determining the RFWPR is much less. Among the Socio-economic variables, RMWPR shows significant effect in determining the RFWPR followed by cropping intensity (both positively and negatively). The new agricultural technology is not adopted by the cultivators in Chittoor division whereas moderate agricultural technology is adopted in Tirupati division.

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