
**DETERMINANTS OF WOMEN'S PARTICIPATION IN AGRICULTURE
IN INDIA WITH SPECIAL FOCUS ON THE ROLE OF EDUCATION**

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ABSTRACT

Using data from the National Sample Survey on Employment and Unemployment in the 68th round, i.e. in 2011-12, in this paper we have explored several variables as possible determinants of rural women's participation in agriculture in India. We have estimated a maximum likelihood probit model to examine the contribution of different factors. Women coming from land owning households and households deriving their income mainly from agricultural sector are more likely to work in agriculture. However, the most important determinant is education. As the educational level attained increases, the participation of women in agriculture declines sharply. Other variables like economic status, age, marital status and belonging to scheduled caste/ tribe are not found to be strong determinants. This could be due to the fact that the rural areas offer limited employment opportunities, other than agriculture - based activities. The literature has emphasized the role of women in providing labour to this sector. But our analysis shows that with the increase in education, working women withdraw from agriculture, and possibly withdraw from the labour force in the absence of other employment avenues. Therefore, the agricultural sector is in great need of special attention. Schemes for diversification, modernization and increasing farmers' income are required to be implemented and not confined to the rhetoric so that it becomes attractive to educated women. This will go a long way towards expanding the employment opportunities of rural women, thereby contributing to women's empowerment, ensuring food security and rural development at large.

Keywords: women's workforce participation, agriculture, education, binary probit model.

1. INTRODUCTION

The objective of this paper is to analyse the determinants of rural women's participation in agriculture in India. We have identified some individual and household characteristics as possible factors. These are economic status, age, marital status, land owning status, education, means of livelihood and caste/ tribe. Using data from the National Sample Survey on Employment and Unemployment in the 68th round, i.e. in 2011-12, we attempt to study the extent to which each of the determinants contributes to the likelihood of women working in agriculture. This is done by way of an econometric exercise in which we have estimated a maximum likelihood probit model.

Women play a pivotal role in agriculture as agricultural labourers, as farmers, co-farmers, female family labour, as managers of farms and as farm entrepreneurs (Siddiqui, 2004). They play an important role in the field and are also engaged as main workers in farm operations. It has been noted that between the year 1983 and 2004-05, nearly 72 percent of the incremental rural female workforce was absorbed in agriculture, when compared to 40 percent of the male workforce (Srivastava & Srivastava, 2009). In developing countries like India, agriculture continues to absorb and employ two-thirds of the female work force (Ghosh & Ghosh, 2014). Rustagi (2010) asserted that the primary sector in India still provides employment to the bulk of women workforce in spite of the gradual decline in the percentage of women workers; their share when compared to male workers in agriculture remains significant and has in fact risen due to the shift of male workers away from agriculture.

However, the widespread stagnation in agriculture sector in India that set in the late 1990's and which continues even today has adversely affected the earnings of the farm households, demand for labour and rural wage rate. The total share of employment in the agriculture sector had declined from 77 percent of the workforce in the year 1983 to 66 percent in 2004-05. The female dependence on agriculture sector, however, declined by just 5 percentage points during the said period. An overwhelming share of more than 81 percent stills depends on agriculture as the main source of employment while only 19 percent depends on rural non-farm sector employment (Abraham, 2011). Women have therefore remained very substantially dependent on agriculture.

Nevertheless, with the increase in population and changes in agriculture productivity it is increasingly difficult to absorb the growing rural labour force. Further due to the growth of non-agricultural activities in the rural areas workers tend to get employed in those activities due to higher wage rates. With the advancement of technology, education opportunities, more employment opportunities and higher wages, women tend to withdraw themselves from their main work, that is, agriculture. In fact the work participation of women is seen moving from the agricultural sector to non-farm sector and household based industries in the rural areas. The

structure of employment in the economy is in fact expected to shift relatively away from agriculture and towards industry and services with economic growth (Unni, 1989).

Therefore, it is imperative to look into the factors that lead women to work in agriculture. Conversely, it is also important to study the factors that cause women workers to withdraw from agriculture. Understanding these rural dynamics will contribute towards making informed policy decisions with regard to women empowerment, increasing farmers' income and rural development at large.

The rest of the paper is organized as follows. In section 2 we analyse how the labour force participation rates of men and women as well as their participation in agriculture vary with the level of education. In section 3 we carry out an econometric exercise by estimating a binary probit model to find out the extent to which the factors influence the probability of women working in agriculture. Section 4 concludes the paper.

2. EDUCATIONAL ATTAINMENT AND WOMEN'S PARTICIPATION IN AGRICULTURE IN RURAL INDIA

Work is defined as participation in any economically productive activity with or without compensation, wages or profit. Such participation may be physical and/or mental in nature. Work involves not only actual work but also includes effective supervision and direction of work. It even includes part time help or unpaid work on farm, family enterprise or in any other economic activity. All persons engaged in 'work' as defined above are workers. Persons who are engaged in cultivation or milk production even solely for domestic consumption are also treated as workers (Census of India, 2011).

The number of persons in the workforce, that is, the supply of labour depends on their rate of participation. The work participation rate is defined as the percentage of total workers to the total population. To get an idea of female work participation in the rural areas we looked at the trends on work participation during the period 1981 to 2011 based on the census data by gender. The work participation rate among the rural females has gradually increased from 23.2 percent in 1981 to 30.0 percent in 2011. On the other hand there was a slight decline in male work participation rate from the period 1981 to 2001 from 53.8 percent to 52.1 percent; however it increased to 53.0 percent in the year 2011. Out of the male main workers 69 percent were engaged in agriculture compared to 76 percent of female main workers. Out of the total female workers, 44.4 percent were marginal workers and 79 percent of them worked in agriculture as cultivators or agricultural labourers. On the other hand, 21.5 percent of total male workers were marginal workers out of which 73 percent were engaged in agriculture in 2011 (Primary Census Abstract of India 1981, 1991, 2001 & 2011).

The work participation of women in the rural areas in general and in the agricultural sector in particular, has been to a certain extent influenced by the advent of education system in the rural areas. Women mostly from the educated background prefer to send their children to school rather than making them a helping hand in agricultural activities. With development, many households in the rural areas are educating women. Further, with higher level of educational attainment, women tend to opt out of the agricultural activities thereby decreasing their participation in various agricultural works. In fact education is considered as an important determinant which influences women's participation in agriculture (Chayal & Dhaka, 2010). Education has a positive effect on women's share in the overall economy (Nguyen, 2015). It is one of the most important factors influencing female labour force participation. Educational attainment has an important effect on an individual's decision to participate in the labour market (Tansel, 2001).

Therefore we need to study the level of educational attainment of the population and the corresponding labour force participation rate (LFPR). Table 1 shows the percentage distribution of population, the LFPR and the distribution of workers in agriculture aged 15 years and above by education level and by gender in the rural sector in 2011-12. We see that the percentage of female illiterates is more than the male illiterates and the gender gap is substantial. If we look at the labour force participation rate of female we can see that there is a distinct U-shaped pattern that has been widely reported in the literature [see for example, Tansel (2001)]. The LFPR of women is almost 42 percent for the illiterates and declines as the level of education increases. It is the lowest for women who have completed higher secondary level. Thereafter, the LFPR starts to pick up and increases as the level of education increases. Of course, the proportion of rural women with higher level of education is much lower compared to men. Out of all the women working in agriculture, 61.5 percent are illiterate, about 10 percent are illiterate but below primary and 11 percent have completed only primary level of schooling.

Therefore, it appears that even in the 21st century, women work in agriculture because they have no other skill to take up other employment. As education level increases they withdraw from agricultural activities. Since economic status is positively correlated with educational level, we may infer that the poor and the illiterate work in agriculture due to distress factors. As economic status (and hence educational status) improves, they withdraw from the labour force. When the level of education is sufficiently high, the LFPR increases but they will not work in agriculture. Thus, agriculture which suffers from low productivity and is beset with several other problems, has relatively more women as workers, and that too, illiterate and poor women. This perpetuates the vicious cycle of low productivity and rural poverty. Further, since rural areas offer limited non-farm employment avenues, the employment opportunities for educated women are indeed limited.

Table 1: Percentage distribution of population, LFPR and distribution of workers in agriculture aged 15 years and above by education level and by gender in the rural sector in India in 2011-12

Education	Distribution of population		LFPR		Distribution of workers in agriculture	
	Male	Female	Male	Female	Male	Female
1	25.31	47.52	88.42	41.85	32.13	61.55
2	11.25	9.91	91.19	35.34	13.86	9.73
3	13.48	11.37	89.20	37.05	14.80	11.38
4	19.70	13.82	78.45	28.29	18.38	9.90
5	15.43	9.38	68.08	23.52	11.56	5.00
6	8.54	5.15	63.82	19.30	6.23	1.81
7	4.69	2.27	84.41	34.87	0.00	0.53
8	1.20	0.43	81.53	50.52	3.03	0.10
9	0.39	0.15	80.75	61.55	0.00	0.01
Total	100.00	100.00	81.33	35.82	100.00	100.00

Notes: Education Codes: 1 -Illiterate, 2 - Literate below Primary, 3 - Primary, 4 - Middle, 5 - Secondary, 6- Higher Secondary, 7- Graduate and above in General Subjects, 8- Diploma/certificate course, 9- Graduate and above in Professional Subjects.

Source: Authors' calculations on the basis of NSSO 2011-12 unit level data on Employment and Unemployment.

The percentage distribution of female workers in agriculture by education and employment status in rural India may be seen in Table 2. Overall, 44 percent and 42 percent worked as unpaid family workers and casual labourers respectively. As the level of education increases from being literate to higher level the proportion of self employed female workers increased. It is only at higher level of education that the proportion of casual labourers substantially declines. But for the case of unpaid family workers, even for graduates, the proportion is significant. This underscores the oft-repeated statement that women's work is underpaid and remains largely unrecognized.

Table 2: Percentage distribution of rural female working in agriculture by education level and employment status

Education level	Self Employment	Unpaid Family Worker	Regular Salaried/Wage earners	Casual labourers	Total
1	13.31	41.51	0.53	44.65	100
2	10.19	43.89	2.55	43.38	100
3	11.74	46.26	1.64	40.36	100
4	14.32	47.75	0.88	37.05	100
5	12.96	55.06	0.30	31.68	100
6	21.55	59.82	1.15	17.49	100
7	21.80	62.34	0.00	15.86	100
8	43.66	54.86	0.00	1.48	100
9	89.94	10.06	0.00	0.00	100
Total	13.06	43.87	0.90	42.18	100

Note: Notes: Education Codes: 1 -Illiterate, 2 - Literate below Primary, 3 - Primary, 4 - Middle, 5 - Secondary, 6- Higher Secondary, 7- Graduate and above in General Subjects, 8- Diploma/certificate course, 9- Graduate and above in Professional Subjects.

Source: As in Table 1.

3. DETERMINANTS OF WOMEN'S PARTICIPATION IN AGRICULTURE

In this section we discuss the results of an econometric exercise that was carried out to examine the contribution of different factors to women's participation in agricultural activities. We use a *maximum likelihood probit* model that is specially suited for such an analysis. The dependent variable is a binary variable assuming value 1 if working women are in agriculture, zero otherwise. This variable was regressed on the independent variables discussed below. These variables are individual and household characteristics that are hypothesized (and tested herewith) to have an influence on the dependent variable. It may be noted that the list of the chosen independent variables is constrained by the availability of the information collected by the NSSO.

3.1: The Variables

Quintile

=The entire population in rural areas has been divided into 5 quintiles based on the per capita monthly expenditure. Quintile1 is the first quintile consisting of the poorest 20 percent of the

	population. Quintile2 is the second quintile and so on and Quintile5 consists of the richest 20 percent. Quintile2 is a binary variable taking value 1 if the woman belongs to the second quintile, zero otherwise. Similarly for the other quintiles. Quintile1 has been taken as the reference or control category.
Age	= The age variables are binary, taking value 1 if the woman belongs to the specified age group and zero otherwise. The reference age group in this exercise is the age group 15 – 29 years.
Marital status	= The variables ‘currently married’ and ‘widowed/ separated’ are binary variables taking value 1 if the woman is currently married or widowed/ separated respectively; zero otherwise. The reference category is the never married women.
Female head of household	= If the household is headed by a female, variable takes value 1, and is zero otherwise.
Education below primary	= This variable is binary, 1 if the woman is literate but below primary level. Zero otherwise.
Education primary	= This variable is binary, 1 if the woman is educated upto primary level. Zero otherwise.
Education middle	= This variable is binary, 1 if the woman is educated upto middle level. Zero otherwise.
Education secondary	= This variable is binary, 1 if the woman is educated upto secondary level. Zero otherwise.
Education hr secondary	= This variable is binary, 1 if the woman is educated upto higher secondary level. Zero otherwise.
Education diploma	= This variable is binary, 1 if the woman is educated and holds a diploma (not equivalent to a degree). Zero otherwise.
Education graduate	= This variable is binary, 1 if the woman is graduate or above. Zero otherwise.
Owned marginal land	= If a woman comes from a household that has some land but the holding is upto 2 hectares, the variable takes value 1, zero otherwise.
Owned small land	= If a woman comes from a household that has land between 2 - 10 hectares, the variable takes value 1, zero otherwise.
Owned large land	= If a woman comes from a household that has land greater than 10 hectares, the variable takes value 1, zero otherwise.
Selfemp agri	= If the main source of the household income is the household’s own farm the variable takes value 1, zero otherwise.

- Selfemp non-agri = If the main source of the household income is self employment in non agriculture, this binary variable takes value 1, zero otherwise.
- Regular wage/salary = If the main source of the income is from regular wage/salary earning, this binary variable takes value 1, zero otherwise.
- Agri labour = If the main source of the income is by agricultural labour, this binary variable takes value 1, zero otherwise.
- Other labour = If the main source of the income is from other kind of labour income, this binary variable takes value 1, zero otherwise.
- ST = This is a binary variable. If the woman belongs to Scheduled Tribe household, it is 1. Zero otherwise.
- SC = This is a binary variable. If the woman belongs to Scheduled Caste household, it is 1. Zero otherwise.

The reference or control group for the education variables is the illiterate woman; for land ownership status, it is the landless household; for main source of household income, it is the household with other (mixed) income sources; and the reference for tribe/ caste variable is the Forward Caste category.

Table 3: Results of Maximum Likelihood Probit Model in 2011-12

Dependent Variable: women working in agriculture in the rural areas

Independent variables	dF/dx	Z
quintile2	0.0021	11.31
quintile3	0.0126	68.28
quintile4	-0.0013	-7.02
quintile5	0.0285	149.03
Age 5 -14	-0.0408	-80.33
Age 30 -49	-0.0085	-54.65
Age 50 – 59	-0.0156	-71.90
Age 60 plus	0.0068	25.93
currently married	0.1205	509.00
widowed/ separated	0.0395	148.62
female head of household	0.0027	16.12
education below primary	-0.0277	-139.09
education primary	-0.0765	-376.49
education middle	-0.1251	-560.11

education secondary	-0.2281	-748.29
education hr secondary	-0.3197	-704.55
education diploma	-0.7503	-599.41
education graduate	-0.7283	-1133.79
Owned marginal land	0.1174	427.66
Owned small land	0.1390	557.35
Owned large land	0.1264	151.46
selfemp agri	0.2256	336.15
selfemp non-agri	-0.3357	-347.21
regular wage/ salary	-0.1366	-155.68
agri labour	0.1899	312.38
other labour	-0.2372	-255.96
ST	0.0233	137.32
SC	0.0127	92.46
Number of observations		23413

Notes: Df/dx are marginal effects, i.e., the change in probability of working in agriculture with a one-unit change in the right side variable. Z is the test of the underlying coefficient being 0. All the coefficients are seen to be statistically significant at 5% level. Regression is done with state dummies and restricted to rural women who are working according to the usual principal status approach.

Source: Estimation employs unit record data from the National Sample Survey on Employment and Unemployment of the 68th (2011-12) round.

3.2: The Determinants

Economic Status: There is no clear cut linear relationship between economic status and women’s participation in agriculture. It is seen from Table 3 that the probability to be engaged in agriculture increases by 0.21 percent for a woman from the second quintile as compared with a woman from the poorest quintile. The marginal effect is small but positive for the third and fifth quintile, and negative for the fourth quintile. Thus in the rural areas, with limited employment opportunities, the probability that women work in agriculture is not significantly different between poor and non-poor women.

Age, Marital Status and Being Household Head: Comparing to the reference age group of 15 – 29 years, children of less than 15 years of age are less likely to work in agriculture by 4 percent. For the other age groups, the marginal effects are very small, indicating that there is not much difference in the probability. The currently married woman is more likely (12 percent more) to be working in agriculture compared to the never married woman. For the widowed or separated woman, the probability is 4 percent more. The marginal effect of household headship by a female is positive, though small at 0.27 percent.

Education: The most important determinant of working in agriculture is education (or lack of it) as evident from the substantial negative marginal effects, which increase (in absolute sense) with the increase in education level. Compared with an illiterate working woman, the probability of working in agriculture decreases by about 3 percent for a woman who is literate but completed below primary level. The probability decreases by 8 percent for a woman who has completed primary level, then by 12.5 percent if she has completed middle level, by 23 percent if she has completed secondary level and by 32 percent if she has completed higher secondary level. The probability that a graduate working woman will be engaged in agriculture is 73 percent less than that of an illiterate woman. The probability is 75 percent less in case a woman has completed a diploma or certificate course in some technical fields.

Land Ownership: Compared to a woman belonging to a landless household, the probability that a woman will be engaged in agriculture increases by 12 percent, 14 percent and 13 percent if she comes from a household that owns marginal land, small land and large land respectively. As already discussed, substantial proportion of women are working as unpaid family labourers. Therefore, it is obvious that if a household owns cultivable land it is most likely that women will be working in the family farm.

Main Source of Household Income: Households are classified into several types according to their main source of income. For instance, if 50 percent or more of the income of a household is derived from self - employment in agriculture, then that household is classified as self employed in agriculture. Similarly for the other categories which include self - employment in non-agriculture, regular wage/ salary earning, agricultural labour and other (non-agricultural) labour. If a household's income is derived from several sources and none of each source contributes 50 percent, then it is classified as 'others', which may be taken to mean 'mixed'. 'Others' code is also given to those households which do not have income from economic activities (eg. Pension). As seen in Table 3, the probability that a woman will be employed in agriculture is higher for households whose main means of livelihood is agriculture, that is, self - employment in agriculture and agricultural labour. Conversely, the probability is less for women from households that derive their livelihood from non-agricultural activities. The practice of agriculture in India is largely a family affair in which every able-bodied member is involved. Thus whether a woman is the main earner of the household or not, it is most likely that she will participate in agricultural operations of her household.

Caste/ Tribe: Being a member of a Scheduled Tribe (ST) or Scheduled Caste (SC), leads to little increase in probability of working in agriculture by 2 percent and 1 percent respectively compared to a woman belonging to 'Others' (non-scheduled) category.

4. CONCLUSION

In this paper we have explored several variables as possible determinants of rural women's participation in agriculture in India. Women coming from land owning households and households deriving their income mainly from agricultural sector are more likely to work in agriculture. However, the most important determinant that emerges from our analysis is education, or rather, the lack of education. As the educational level attained increases, the participation of women in agriculture declines sharply. Other variables like economic status, age, marital status and belonging to scheduled caste/ tribe are not found to be strong determinants. This could be due to the fact that the rural areas offer limited employment opportunities, other than agriculture - based activities. Our findings have profound implications for the agricultural sector. The literature has emphasized the role of women in providing labour to this sector. But our analysis in this paper shows that with the increase in education, working women withdraw from agriculture, and possibly withdraw from the labour force in the absence of other employment avenues. Therefore, the agricultural sector is in great need of special attention. Schemes for diversification, modernization and increasing farmers' income are required to be implemented and not confined to the rhetoric so that it becomes attractive to educated women. This will go a long way towards expanding the employment opportunities of rural women, thereby contributing to women's empowerment, ensuring food security and rural development at large.

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