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Development, Education, and Female Labour Force Participation

A study of India

by

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Abstract

With the development and structural transformation of an economy the dynamics of labour force participation change. The female experience of development and labour force participation is different to that of the male. Different levels of development and educational attainment, compounded by social expectations, correspond differently in effecting the likelihood for a woman to participate in the labour force. Indian economic expansion is a prevalent example of decreasing female labour force participation despite structural transformation and a greater number of women becoming highly educated. Using micro-level data and a logit regression model, this study investigates the non-linear relationship between female labour force participation, and educational attainment. This study considers other social and cultural factors, like caste, which also effect the decision to participate in the labour force or not. By doing so, this study contributes to the discussion of the determinants of female labour force participation.

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1 Introduction

1.1 Research Problem

From the Industrial Revolution to the Asian Tiger economies, the development process is described as a structural transformation formed of two phases (Chaudhary & Verick, 2014). Firstly, there is a transition away from agricultural production towards manufacturing and the service sector, followed by urbanisation; the movement and migration of peoples to urban areas (Johnston, 1970). This means that with structural transformation, employment in agriculture falls, and is compounded by technological advancements in farming. Therefore, economic development changes the composition of the labour force (Schultz, 1990). Occupational structure change means manufacturing and white-collar work increases and absorbs the workers who were once agriculturally employed. The rise of manufacturing and white-collar employment changes the characteristics of employees; a certain level of education is required. Investment in education increases the quantity of skilled workers, eases the absorption of new technologies, and increases labour productivity and output of each worker (Barro & Lee, 2000).

Education is strongly associated with the development process and subsequent employment opportunities. Yet, the female experience differs greatly from the male, where male educational attainment happens first and to a greater extent (Klasen & Pieters, 2013). The World Bank (2012) estimates that only two-thirds of the world's countries have equal numbers of boys and girls in primary education. However, developing economies are pursuing policy in the catching-up of female schooling (Lincove, 2008). Investment in women's education decreases fertility rates and improves the health of children. The economic value of educated women is higher where they have greater choice, thus cutting the cycle of deprivation and reducing poverty (Lincove, 2008; Summers, 1992).

When women's experience of development is considered, there is a complex relationship between educational attainment, and labour force participation. Where improvements in literacy have contributed to the increase in worldwide numbers of women participating in the labour force by half a billion in 30 years, the share of women in work remains lower than that of men, at 40% female and 60% Male (World Bank, 2012; International Labour Office, 2010). Economic development and increasing educational attainment of women correspond to a change the female labour force participation rate. This is calculated by taking the total number of women participating in the labour force, over the total female population. Women's labour force participation and increasing educational attainment are non-linear. At low or non-existent levels of education which are indicative of poverty, women must work out of necessity in order to survive (Klasen & Pieters, 2013). With primary level education, the

greater benefit of home production and rearing high-quality children outweighs the benefit of women's wages if she were to work, and so here women leave the labour force (Lincove, 2008). At secondary level education women are more likely to return to the labour force where there are increased opportunities to work in the white-collar industry; wages exceed the value of home production, and so educational attainment is rewarded (Lincove, 2008; Pampel & Tanaka, 1986). For women, the structural transformation of an economy changes associations between educational attainment and labour force participation.

The precedent of gender roles for women and assuming responsibility for child-rearing continues and the expectation for women to forgo paid work prevails. Additionally, women experience different employment opportunities to men because they are more exposed to vulnerable and low-paid work, acting as buffers during times of hardship, or as secondary earners in households (ILO, 2011). Even when a woman participates in the labour force it is not always desirable. Claudia Goldin's (1994) theory of the U-Shaped female labour force participation rate curve explains that participation is high in early stages of development because of the necessity to work to survive. Participation decreases as economies shift away from agriculture towards industrialisation. As the economy improves further and women become more highly educated, their labour force participation increases. Development and educational attainment of women has a strong association with participation in the labour market and provides a framing device to this study.

Pampel and Tanaka's (1986) study of 70 countries from 1950 to 1960 suggests that the types of industries and the occupations they produce dominate the sex structure of the labour force; industrial expansion finds the labour force is dominated by men. In a study of 90 countries from 1970 to 1980, Mammen and Paxson (2000) find high labour force participation rates for women when incomes are either low or high, where development shifts the focus of women's work from family enterprises to paid employees. In this case, the richest and poorest economies have the highest female labour force participation rates in excess of 50% (Mammen & Paxson, 2000). Likewise, Lechman and Kaur (2015) consider 162 countries and their development between 1990 and 2012, concluding that a U-Shaped association between female labour force participation and economic development, although the extent of this varies by country.

Moreover, other social and cultural influences on labour participation exist besides that of educational attainment and structural transformation of an economy. Pampel and Tanaka (1986) note that occupational sex stratification, population sex ratios, family size, and region also play a role in their association with female labour force participation in emerging economies. Likewise, marriage and the specialisation of roles between wife and husband, and different norms placed on married and unmarried women surrounding blue-collar jobs, exist during industrialisation (Mammen & Paxson, 2000). Other obstacles to women's labour force participation include those specific to cultural institutions in a particular country, such as religion (Lincove, 2008). The role of context is important in the discussion surrounding female labour force participation.

1.2 Background on India

An advancing economy in the world where strong relationships between development and female labour force participation exist, are observed in India. India has low female labour force participation despite increasing levels of education. Compared to her neighbours, between 1999 and 2013 India has had falling labour force participation whereas Bangladesh, Pakistan, and Sri Lanka all saw increases (Verick, 2018). This section explains India's development history, subsequent female labour force participation, and the factors surrounding it.

Since economic reform in India during the 1980s, India's economy has seen increased rates of economic growth reaching 8% and above during the 2000s (Verick, 2018). The result has been rising living standards, growth in real wages, less child labour, falling fertility rates, increasing consumption of goods, a larger middle class, and a fall in poverty (Mehrotra et al, 2014). As a result, the Indian labour market has witnessed vast changes. The labour force has moved away from being agriculturally based, to focussing on manufacturing, fuelling urbanisation and industrialisation (Chaudhary & Verick, 2014). Structural transformation has shifted the focus from the rural to the urban, with an increasingly educated labour force (Rustagi, 2013). Employment opportunities have diversified as India has developed.

For India, the declining share that agriculture has as a proportion of Gross Domestic Product indicates that other sectors are a growing area of employment. Since 2000, employment in construction has increased in size, likewise, employment in manufacturing has consistently increased annually from 2000 to 2012 (Rustagi, 2013; Mehrotra et al, 2014). The service sector; such as communications, real estate, education, and healthcare, has risen by 1.8 million every year between 2004 and 2009, reaching 5.5 million a year after 2010 (Mehrotra et al, 2014; Rustagi, 2014). This structural transformation and movement towards non-agricultural employment has increased the Indian labour force from 381 million to 485 million between 1993 and 2012 (Mehrotra et al, 2014).

To support the diversifying sources of employment in India, certain levels of education and a variety of technologically oriented skills are required (Rustagi, 2013). Consequently the number of students is rising. For women, between 1980 and 1995, secondary level education doubled (Das & Desai, 2003). The absolute number of female students rose from 118 million to 151 million between 2004 and 2011 (Rustagi, 2013). For top levels of education at the bachelor and graduate levels, the number attending education rose between 2004 and 2009 from 14.9% to 22.5% for men and 7.6% to 12.8% for women (Mehrotra et al, 2014).

Education has produced a two-fold effect on labour force participation. Firstly it automatically removes students from the labour force because they are pursuing study instead of working. Secondly, education improves skills required for higher quality employment, undertaken after education is completed (Verick, 2018). With increased educational attainment there is a difference between men and women and their participation in the labour force; female labour force participation falls. After completing their education, women's labour force participation rate (hereafter, LFPR) is low across all age cohorts, where the same cannot be said for men (Motkuri, 2016). As such, educational attainment and the economic

development of India is associated with the fall in the female LFPR. In comparison to other economies, India is persistently low in the rankings for female LFPR across the years, where in 1994 India was in 68th place out of 84 countries with data available, and 84th place out of 87 in 2012 (Kapsos et al, 2014).

Indeed, there is a strong non-linear association between women's educational attainment and labour force participation. For those women who have not benefitted from rising provision of education who are illiterate, their LFPR is relatively high (Das & Desai, 2003; Klasen & Pieters, 2013). Female labour force participation is lower for women with intermediate levels of education but the highest for those at graduate level (Klasen & Pieters, 2013). Additionally, the effect of education is different between the urban and rural areas. In 2010 illiterate women in rural areas accounted for 49.8% of the rural female working age population (Kapsos et al, 2016). With structural transformation and the introduction of machinery in agriculture in combination with an income effect from male household workers, the need for distress driven labour has fallen and thus, the female LFPR has reduced in rural regions to under 30% (Dasgupta & Goldar, 2005; Motkuri, 2016; Rustagi, 2013). For the urban, a non-linear relationship exists between education and the female LFPR. In 2012, illiterate women accounted for 22.6% of the working age population in urban India, but urban women's LFPR stood at 15.5% (Mehrotra, 2015). A framework of understanding behind India's transition to development and its effects on women's work, requires observing how certain factors are associated with the female LFPR in both urban and rural settings. This is crucial for gaining a comprehensive understanding of low female labour force participation.

India is different in its context surrounding the female LFPR due to cultural and social norms associated with the role of women and their work. A study of the female LFPR in India must observe the presence of the patriarchal caste system, which in combination with educational attainment produces a combined effect. The majority Hindu population is characterised by a rigid and hierarchical caste system where individuals of each caste follow certain rules of how one ought to behave (Dunn, 1993, Srinivas, 1977). Caste has a significant impact regarding differing expectations of work by gender. For many communities, women mainly exist in the private sphere of the home whereas the public sphere is predominantly male (Chen and Dreze, 1992). Indeed, the lifestyle of women is considered an important indicator of social group and status which ultimately restricts women's employment (Srinivas, 1977). At the poles of the caste system deprivation is found in the lowest castes where survival is the motivator behind employment, but restrictions on women are far less marked (Dunn, 1993, Das & Desai, 2003). Women from the lowest castes also tend to have the lowest levels of literacy (Dunn, 1993). Women from these untouchable lower castes have higher rates of participation in the labour market even if their choice in work is limited to tasks such as street sweeping and sanitation. They also face a poor living conditions and discrimination (Dunn, 1993). Married women from lower caste groups work because their husband's income is insufficient to support the family unit, and as a result female employment is a sign of low family status (Dunn, 1993).

However at the higher levels of the caste system, there are greater restrictions on women and so their participation in the labour force is lower. The Sanskritisation of the upper castes means the lives of women are more rigid compared to lower castes, where a status symbol is to be wealthy enough for women to not need to work (Chen and Dreze, 1992). Educational attainment without the intention of employment afterwards for women in higher castes is

another symbol of status, where the prospect of marriage creates the requirement of a well educated high-quality wife (Anderson, 2003). In combination with economic development, increasing educational attainment, and a growing middle class, family units of lower castes immitate this symbol of status (Chen and Dreze, 1992). In contrast, with greater provision of education and economic development, women from lower castes have more freedom to choose employment and will remain in the labour market (Chen and Dreze, 1992). The caste system and its interaction with education, employment and economic development adds another dimension to female labour force participation in India.

1.3 Aim and Scope

Educational attainment and social norms are all related to female labour force participation. The variations in the levels of each combined with differences between the urban and rural, mean that generalisations about why women leave the labour force are not straightforward. There are different levels of economic development and educational attainment between the urban and rural regions of India, and therefore differing outcomes on women and their decision to join the labour market. These decisions combine factors which effect women at the individual level. Therefore, this study focuses on the determinants for Indian women and their decision to work. Using National Sample Survey Office data from 2011-2012, this study investigates these complexities, and contributes to the ongoing discussion of India's low female LFPR and factors associated with it. This study asks;

1. *What effect does educational attainment have on women's labour force participation in India?*
2. *What effect do other cultural factors such as caste, and its interaction with education, have on women's labour force participation?*

This study is organised as follows; the following chapter considers previous research and a theoretical framework. Chapter 3 looks at the data in use to conduct the study, including its limitations and descriptive statistics. Chapter 4 considers the methodology, explaining the logit and variables in use. Chapter 5 analyses results of the testing, and chapter 6 discusses and concludes.

This study finds that a non-linear relationship exists between educational attainment and female labour force participation. Furthermore, the educational attainment of women from the lowest social groups confirms a non-linear relationship. However the results and their magnitudes are highly dependent on context, such as the urban and rural context.

2 Previous Research

2.1 Literature Review

Many studies consider female labour force participation. Claudia Goldin's (1994) seminal work on female labour force participation contributes significant insight into the factors associated with rising and falling participation rates. Her study considers the changing factors behind American women and their labour force participation, over the period of structural transformation in the United States. Her results found a U-Shaped curve where in early stages of development during the early 19th century, women contributed to market production via a number of avenues, either in manufacturing, domestic services or unpaid agricultural production (Goldin, 1994). However, a combination of functions including a shift away from agricultural production towards industry as the economy developed, meant women's labour force participation fell (Goldin, 1994). As a greater amount of money could be earned in business and factory work, men would specialise in this type of labour, where women specialise in home production (Goldin, 1994). With social stigmas surrounding women working in industry, female labour force participation reached its lowest point at the bottom of the U-Shaped Curve, by the 1920s.

However, with the secondary school movement in the early 20th century, increasing educational attainment brought greater returns to female labour (Goldin, 1994). This was due to the prospect of white-collar employment which offered a better alternative to manufacturing, stigma was lower and deemed acceptable for married women. Therefore, her results found that increasing educational attainment in combination with a demand for an educated pool of labour to carry out office work, created a substitution effect of women's labour. Consequently, the female LFPR rises as an economy makes its transition to a post-industrial state.

For India in particular, the U-Shaped female labour force participation curve has been the focus of many studies, and acts as a framing device for this study. Hirway (2012) found that the high female labour force participation rate in India at low levels of development is caused by poverty and needs-must employment where women enter the labour force in order to cope with poverty during times of crisis. Dasgupta and Goldar (2005) found that needs-based work is high for rural families living below the poverty line, and as such, poverty has a positive effect on female LFPR. Secondly, as needs-based employment falls reliance on agriculturally based income falls (Hirway, 2012). Women in households with higher incomes are less likely to be in the labour force, and so the income effect has a negative impact on the female LFPR (Das et al, 2015).

Likewise, Motkuri (2016) considers the labour force participation of rural women in India and uses wage rates to account for an income effect in households. They found that male members of households that are below the poverty line have more employment opportunities, and so more women from the household reduce their labour participation and withdraw from the labour force because their returns from domestic duties are higher (Motkuri, 2016). As such, the perception that returns from domestic production are higher than that of employment, has a negative effect on female LFPR. There is a high opportunity cost of female labour because of a need to engage in domestic duties such as childcare, or because of cultural factors where there is a loss of a household's prestige when a woman has to engage in menial work (Motkuri, 2016). Rustagi (2013) found that the income effect has a greater impact on women who are from lower quintiles, and little effect for women in top quintiles, who work in regular secure employment. Additionally, Bhalla and Kaur (2011) found that the rise in middle class families, which are increasing in number in India, have a negative effect on the rate of female labour force participation, suggesting an income effect and, or, imitation of the values of higher castes.

Drawing on these studies therefore, a key factor associated with women's participation in the labour force is education. Education is a crucial determinant in human capital accumulation; the stock of skills and knowledge acquired and possessed in order to perform labour in the production of economic value (Schultz, 1961). In order to accumulate and increase the quality of human capital, investments must be made so that productivity of the labour market as a whole increases, with the result that individual's with higher education attainment maintain higher earnings profile throughout their lifetime (Mincer & Polachek, 1974). With regard to women and their participation in the labour force, Summers (1992) found that a lack of education explains the fewer employment opportunities for women worldwide. Conversely, the enormous benefits for women with higher education means their labour has higher economic value and they have greater choice (Summers, 1992). Pampel and Tanaka's (1986) study of 70 countries found that a crucial determinant of female labour participation is secondary level education. Similarly, the cross-country studies by Schultz (1993) found that at high levels of education, women supply more labour to the market.

Previous studies of India found different effects on female labour force participation at different levels of education. Rustagi (2013) found that labour force participation for women in India is high in low level of education, drops at a middle level, and rises one more for women with graduate level education or higher. In their investigations on the female LFPR in India, Mehrotra and Parida (2017) found a clear relationship between rising educational levels and falling female labour participation, where Chaudhary and Verick (2014) add that only at higher levels of education can women access regular salaried or waged jobs. Klasen and Pieters (2013) found that despite the positive selection of women into higher levels of education, the larger amount of women now with higher education has meant a crowding-out effect contributing to the decreasing labour force participation.

Nevertheless, Kapsos et al's (2014) study comparing the changing determinants of the falling female LFPR in India estimates that educational attainment only accounts for up to 18% of

the decline between 2005 and 2010, whereas this figure was significantly higher at 38% in years 1994-2010, indicating the balance of these components is changing. Similarly, Klasen and Pieters' (2013) found that over time, understanding female labour participation in India becomes more complicated. Whilst using the U-Shaped Curve to compare educational attainment and labour force participation, they note that there is a range of effects taking place on female labour, and that these effects depress participation in different amounts across the educational distribution (Klasen & Pieters, 2013). As such, there are a vast array of factors associated with falling female labour force participation.

Education attainment instead is considered access to a higher quality marriage and therefore higher prospective household income. Klasen and Pieter's (2013) found that female educational attainment is driven by marriage market returns where secondary and graduate level have the highest return on attracting a high-quality male partner, and that higher education increases marriage prospects more in 2009 than in 1987. Bhalla and Kaur (2011) note that women who are married to highly-educated men are less likely to work because of the high income of the partner. According to them therefore, the education of a spouse has a negative effect on a married woman's labour force participation than the positive effect of her own education (Bhalla & Kaur, 2011).

Similarly, educational attainment is not for increased access to higher paid work, but because education is a symbol of status. The negative effect of educational attainment on female labour force participation is driven by higher castes, according to Klasen and Pieters (2013). Das and Desai (2003) add that cultural factors prevent well educated women from joining the labour market because higher socio-economic status encourages women to withdraw (Das & Desai, 2003). Conversely, Bhalla and Kaur (2011) found that labour force participation is higher for women from scheduled castes and tribes because of this absence of expectations. Similarly, Sorsa et al (2015) found that it is urban women who are strongest impacted by the social and cultural factors of caste and religion, where women observing Islam are less likely to participate in the labour force. Bhalla and Kaur (2011) calculate Muslim women have a lower participation rate; by 10% in 1983, and 6% in 2011-2012.

Overall, a variety of studies have found several factors which are associated with female labour force participation in India, where effects operate differently in different contexts and to varying degrees over time. In this way, the U-Shaped female labour participation curve acts as a framing device from which the interactions of a variety of factors like educational attainment, household income, marriage and caste have different impacts on the female LFPR at their different levels.

2.2 Theoretical Framework

At different levels of development, there are different rates of female labour force participation, where labour force participation is classed as employment outside the domestic sphere. At low levels of development, labour force participation is distress driven and women often have no other productive resources to rely on (Motkuri, 2016). Women work in agriculture so that household income is supported and goods are provided for consumption (Goldin, 1994). However, as an economy begins to transition, there is an income effect as wages in industry are higher than those found in agriculture, where men specialise in wage labour (Goldin, 1994). In combination with social stigmas surrounding women, particularly married women, working in labour, industries are a male activity and therefore, there is an income effect where women withdraw from the labour force (Goldin, 1994). Yet, as development continues and the effects of increased educational attainment impacts women's human capital, there are increasing opportunities to work in the white-collar industry and female LFPR rises once more because the substitution effect of education outweighs the income effect (Goldin, 1994). The number of women in the labour force increases as an economy makes its transition to a post-industrial state, where there are greater opportunities for women and work. As such, Claudia Goldin's (1994) U-Shaped female LFPR curve assists as a framing device in this study acting as a way of comparing educational attainment and other factors which surround female labour force participation and illustrating how these factors operate different effects at different levels.

Education and its attainment becomes a crucial factor in changing the supply of female labour. Women with poor levels of education are forced to work and survive out of hardship, but as attainment rises and women achieve secondary level education, women's reservation wages; the lowest wage they are willing to accept in return for supplying their labour, increase and thus reduces willingness to work in lower forms of employment (Klasen & Pieters, 2013). White-collar work is seen as socially acceptable for women to do and so women specialise in the service sector (Klasen & Pieters, 2013; Rustagi, 2013). Women also seek the top levels of education because of positive selection bias; they have a greater taste for work (Klasen & Pieters, 2013). As such, educational attainment reduces the female LFPR directly, by increasing the amount of time women stay in education and therefore not working, and also by increasing a woman's reservation wage, limiting her desired job to be in the white-collar sector. However, when the economy continues to develop female labour is absorbed into the white-collar industry as the service sector grows.

However, other factors, such as marriage, interact with education, influencing women's labour force participation. Educational attainment reduces female labour force participation by increasing a woman's likelihood to marry a person who also has higher educational attainment, whose prospective income will be higher (Klasen & Pieters, 2013). Educated women are married to educated men, and so have greater access to financial resources, reducing the need to work in low paid jobs and thus reducing the female LFPR (Das & Desai, 2003). In combination with social stigmas associated with married women entering the labour force, predominantly manufacturing, and with the difficulty of combining market and household work, women who are married are less likely to participate in the labour force

(Klasen & Pieters, 2013). Because of care and reproductive responsibilities, married women have roles other than working, and so amongst the middle and higher income groups, gender based roles of the male breadwinner and the female care provider prevail (Rustagi, 2013).

However it is not only level of education or marriage that effects women's participation in the labour force, but also family background and the presence of social norms (Das & Desai, 2003). The different levels of caste mean different acceptable behaviours of women. There are limited choices for women from lower socio-economic backgrounds who must work out of necessity. But for higher status families, the presence of highly educated women who do not need to work indicate that education is a symbol of social status, rather than a tool in gaining higher paid work (Das & Desai, 2003). As such, women from families of lower castes are less subject to these controls, and so this premium on female's seclusion is not as heavily present when women from lower castes enter the labour force (Das & Desai, 2003). As such, understanding how different levels of caste interact with the female LFPR differently at different levels, sheds greater light on the labour force participation of Indian women.

3 Data

The National Sample Survey Office (hereafter, NSSO) is a key initiative of the Ministry for Statistics and Programme Implementation in India. It is responsible for large scale surveys across all regions of India, and considers multiple aspects of infrastructure such as agriculture, industries, and prices of goods.

The Employment and Unemployment Surveys of the NSSO, which began in 1972, gather and produce data approximately every five years, with the aim of recognising the changing characteristics over time of economic activities at both the state and regional level (NSSO, 2013). This means that a broad understanding of the multidimensional aspects such as age, gender, education, occupation, and standard of living, are significant in defining the labour force (NSSO, 2013). These aspects combined generate estimates for labour participation, unemployment, worker population ratio, wages, and working conditions (NSSO, 2013). By conducting the survey repeatedly every five years, the changing components of the labour force are measured. Therefore, the ultimate intention of the NSSO data collection is to gather nationally representative data which assists at an official level in making well informed decisions with regard to policy formulation and planning by government organisations at all levels, whether state, regional, or local.

3.1 Employment and Unemployment Survey 2011-2012

The most recent Employment and Unemployment survey by the NSSO takes place in the 68th round of data collection, between 1st July 2011 and 30th June 2012 (NSSO, 2013). The one-year period of surveying is divided into four sub-rounds where each are a three month period and include equal numbers of sample rural villages or urban blocks proportionate to each allotted sub-survey time period, so that a uniform number of surveys are carried throughout the year (NSSO, 2013). The survey covers all geographical areas of India, apart from the permanently inaccessible villages in the Andaman and Nicobar Islands (NSSO, 2013).

The survey gathers information regarding economic activity and household demographics for families and individuals at the time of the data collection. The survey is formed into different sections, such as the household demographics; social group, religion, household size, and land owned (NSSO, 2013). Other sections uncover the demographics of the individuals of each household, collecting information on age, sex, marital status, relation to head, educational level, and vocational training (NSSO, 2013). Furthermore, the survey collects information on individuals' principle activity status, location of workplace, type of job contract, method of payment, and social security benefits (NSSO, 2013).

In terms of calculating labour force participation, the economic activity status of each individual is determined via three different time periods, such as usual status of a one-year period, current weekly status, and current daily status. Those asked for activity status were between the ages of 15 and 59 years (NSSO, 2013). This measurement calculates labour force participation as the activity status determines the individual's labour force participation. For example, an individual's principal activity status of self-employed denotes participation in the labour force, whereas a status of attended domestic duties only, denotes the opposite. This information determines the overall labour force participation rate, LFPR.

In total, 101,724 households are surveyed where 59,700 are rural and 42,024 urban, and within this, 456,999 people are surveyed, with 280,763 as rural and 176,236 urban (NSSO, 2013). The survey is split into two parts; firstly are households the demographics of the household, and secondly, the subsequent individuals within each household and their individual demographics. When households are surveyed, all of the individual members of the household have their information captured and included in the survey. The head of the household's social group and religion determined the social group and religion of the rest of the individuals of the household. By conducting in-depth and comprehensive research across households, this survey gives a detailed and accurate insight of a large sample size, which means this set of data is the most reliable source available.

Not only this but, the data addresses the complexities that surround women's work. By providing more nuanced questions within the data collection, taken by the three different activity statuses, yearly, weekly, and daily, the survey provides accurate information on the way women work in India (Das & Desai, 2003). As such, this data is the most accurate source available, with special regard to the complexities of capturing and measuring female labour.

Nevertheless, the survey does not fully appreciate the levels of social groups in India, i.e. castes. Much of Indian Hindu society is organised by the caste system, which is rigid and hierarchical in nature. Broadly speaking, there are five major divisions of caste where the Brahmin is the highest level, followed by Kshatriyas, Vaishyas, Shudras and the Dalits (Dunn, 1993). This is an oversimplification of the system which in fact has many thousands of castes, and does not account for the extra 450 tribal and aboriginal social groups where India contains one of the largest tribal populations of any country (Dunn, 1993). The multitude of castes and tribes of India are complex and difficult to capture for surveyors. Yet, an absence of this information in the data collected means the hierarchical caste system, which greatly impacts the lives of individuals, is somewhat overlooked. However, Article 341 of the Indian Constitution does nonetheless designate the name of scheduled caste or scheduled tribe to the most disadvantaged caste or tribal populations, and it is this data classification instead that is captured by the survey (Dunn, 1993).

3.2 The Microdata

Of the data made freely available for public and academic use is a micro data set from the Ministry of Statistics and Programme Implementation Microdata Repository. Taken from part

of the Employment and Unemployment Survey 2011-2012, this data is split into household and micro-level; containing 1,680 households and 7,600 individuals. In this data, 608 households are urban with 2,445 individuals, where 1,072 households are rural and have 5,155 individuals. In size, this data is approximately 2% of total data set from the full survey. In order to use this data entirely at the individual level for this study, the data for demographics of the households, such as social group and household size, are merged with the individual level data, such as sex and age.

However, before discussing the descriptive statistics of this study, it is important to compare the microdata against the full survey data to allow for context when interpreting and analysing the results. See tables A.1, A.2 and A.3 in the Appendix for all measurements. The usual activity status is used to measure labour force participation in the models for this study. With regard to labour force participation, both the full survey data and micro data set in use for this study are completely reflective of one another, as both account that of the total population observed, including all ages, 36% are in the labour force, whereas 64% are not. The proportions of primary activity status of individuals is also similar between both data sets, where most common is attended education, followed by self-employed as second most common.

In comparison to the full data set, the micro set is similar in terms of proportion of urban and rural observations where 59% of households are Rural in the full data set, and 64% in the micro data set. The gender ratios are similar, where there are 51% and 52% males in the full and micro data set respectively. Likewise in terms of averages, either mean numerical values, household size and age are similar to the full data set, as well as the observations of general education and relation to head. In terms of quality of data, of the key control variables, only 22 values were missing in total.

3.3 Limitations of the Data

Despite many similarities in variables' proportions between the full and microdata sets, there is oversampling present for religion and castes variables represented in the latter. Religion in the full data has Hinduism as the faith of 75% of all households observed, but the micro data has this figure at 28%, where other is the largest proportion of religions. For caste, the microdata set is disproportionate. Where the full data set marks other backward class as the largest number of households at 40% of the observations, the micro data set has scheduled tribe as the largest proportion of households at 67%. Therefore, oversampling is present; see figures 3.2 and 3.3.

Figure 3.1: Proportion of Households in Urban or Rural Areas (Microdata Set, NSSO, 2013)

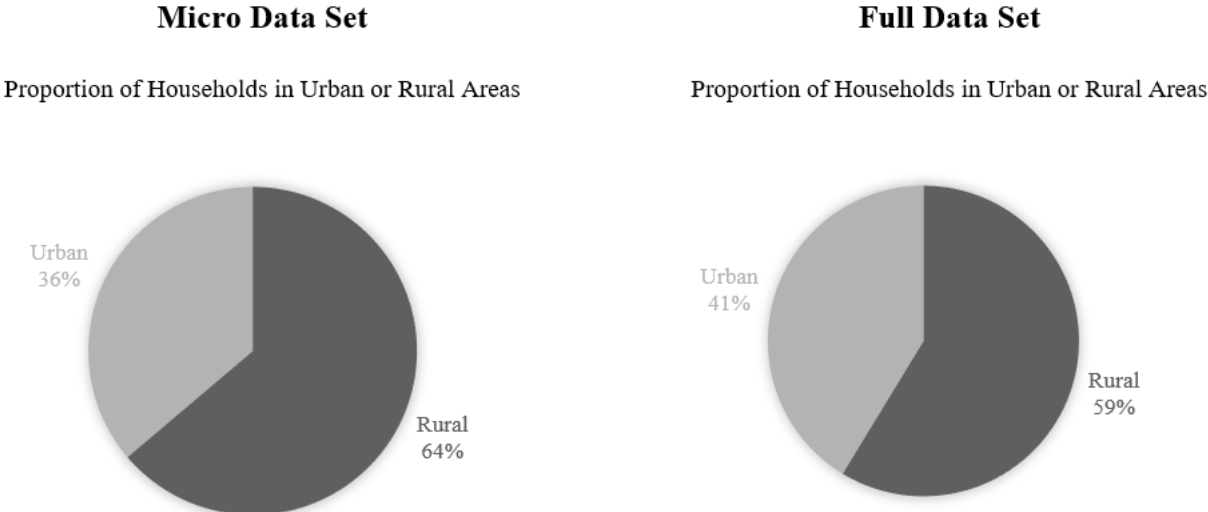


Figure 3.2: Proportion of Households in Social Groups (Microdata Set, NSSO, 2013)

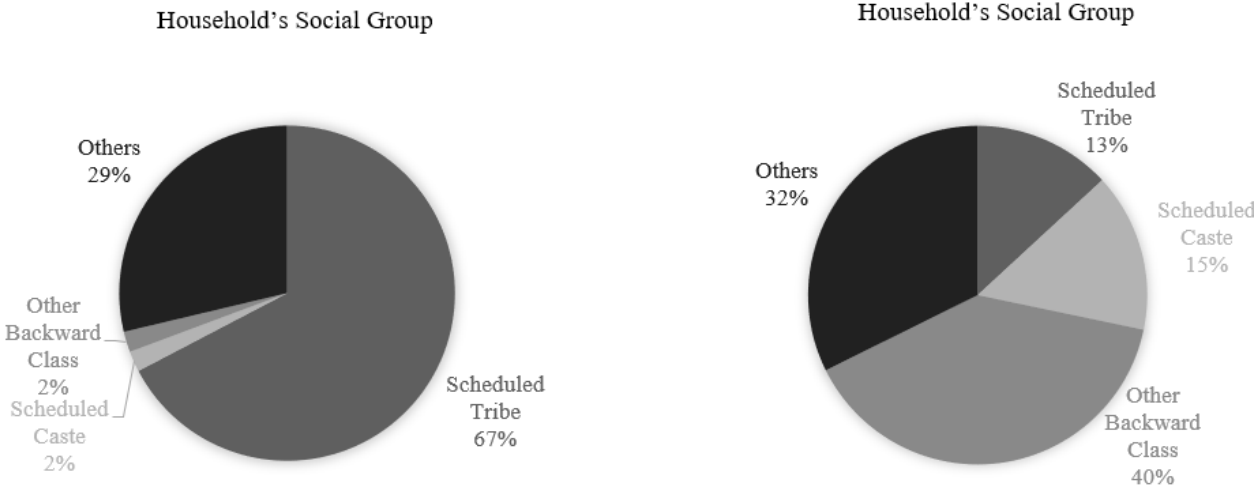
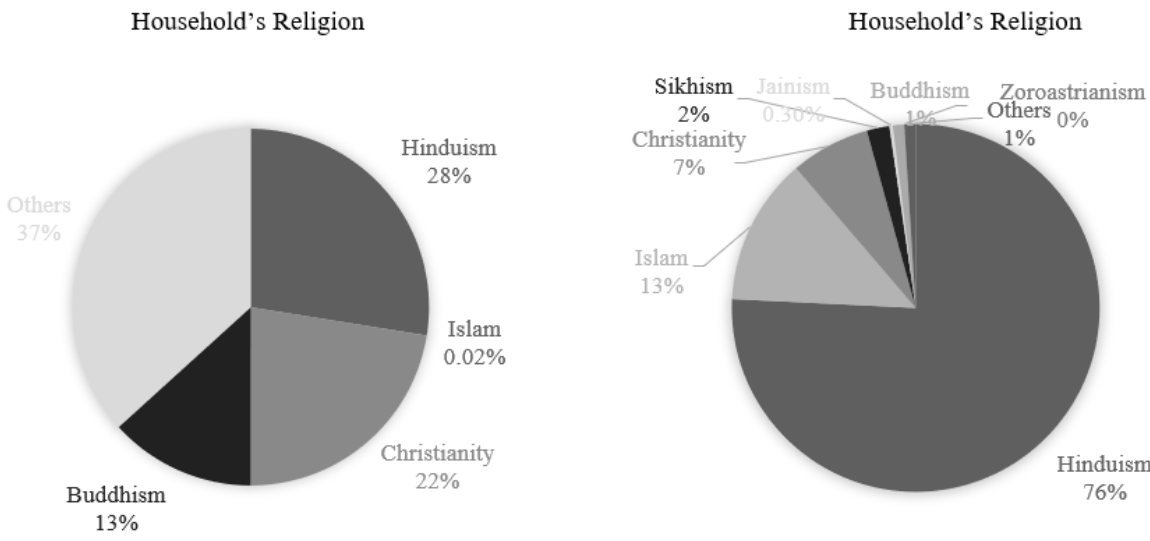


Figure 3.3: Proportion of Households in Religions (Microdata Set, NSSO, 2013)



Levels of caste are not accounted for in the data due to complexity of the caste system. This means that distinguishing levels of caste is not possible, merely if the individual is of a scheduled caste or tribe, or not.

Despite the same percentage for labour force participation and the same most common principle activity status between both data sets however, the proportions of each differ. Where both sets account for attended education as most common primary activity status, the full data accounts for this figure being at 29% of individuals observed, whereas the micro set indicates 38% likewise.

Additionally, human errors on account of the individuals carrying out the survey, and of the author when merging the data sets for households and individuals create discrepancies in the data, despite best efforts in thoroughly checking data after merging sets together and prior to testing models. The comparisons between the full and microdata set are on the household level because raw statistics at the individual level on caste and religion are not publicly available for the full data set. Therefore, comparisons of characteristics are made between households. Nevertheless, all data used for this study is at the individual micro-level because household demographics are merged with individual demographics. The author takes the household information from the data and merges it with every individual belonging to each household.

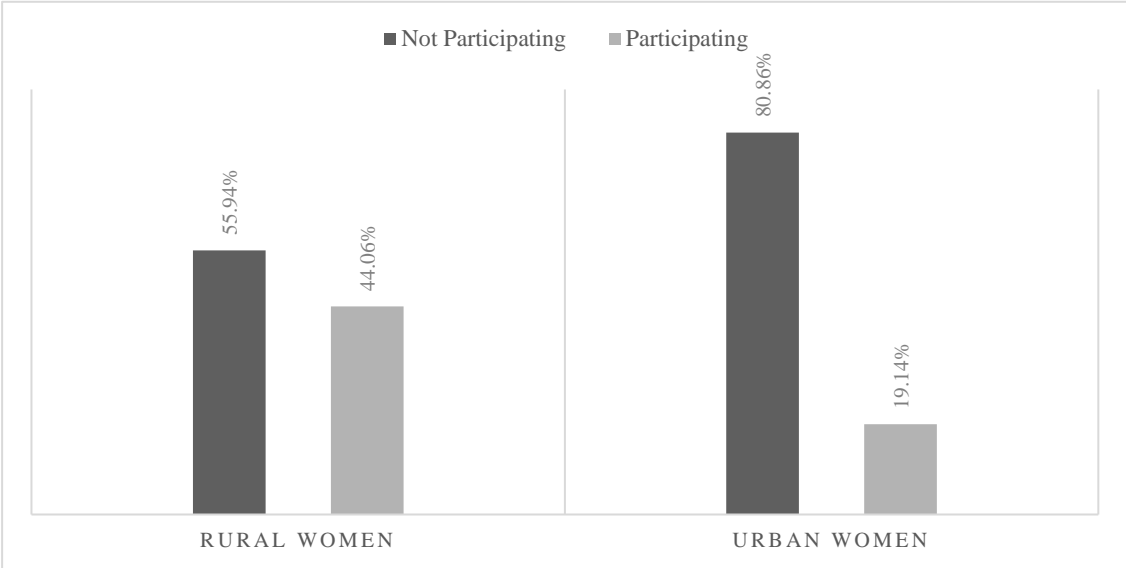
3.4 Descriptive Statistics

Because this study investigates the determinants associated with labour force participation, it interprets the information in the data set available in a number of ways. Understanding how educational attainment and cultural factors are associated and how their magnitudes differ, between different contexts is key to this study. This section therefore compares the raw statistics of the data between rural women and urban women, and between women of certain age cohorts.

3.4.1 Labour Force Participation

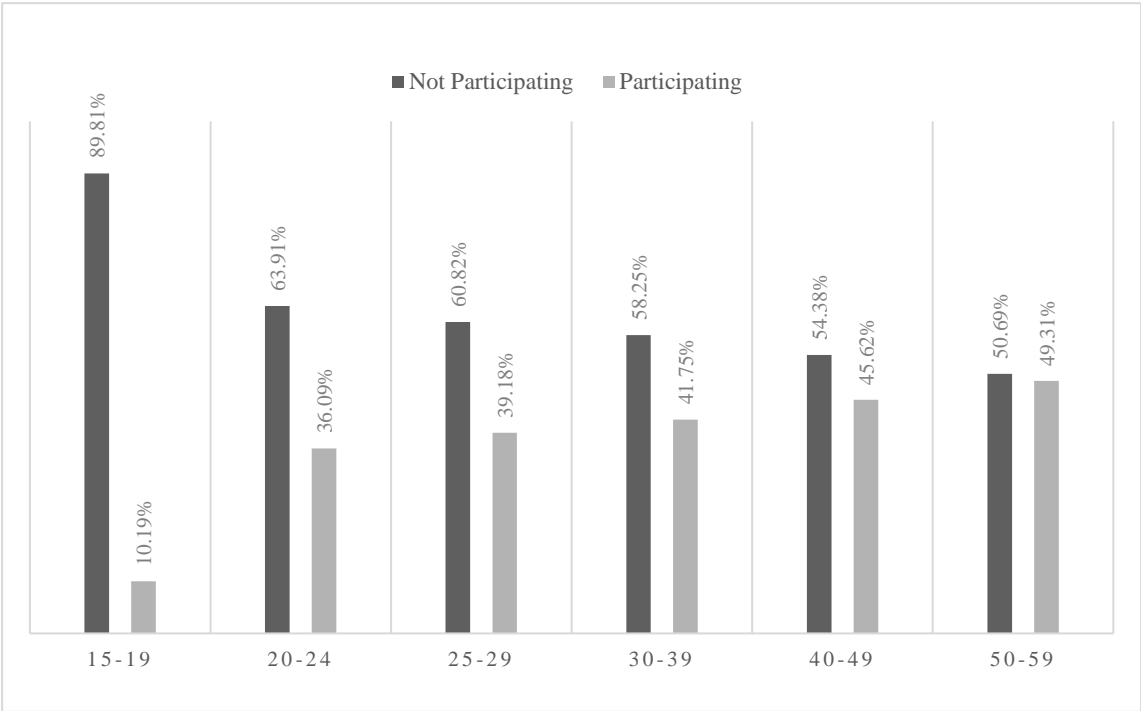
Considering labour force participation, 44% of rural and 19% of urban women aged 15-59 are in the labour force, see Figure 3.4 below. The usual principal activity status of the observations show that 33% of rural women are self-employed, and 37% attended domestic duties and, or, collection of free goods. Whereas for urban women 56% attend domestic duties and 8% of work a regular wage or salary job, see table A.5 in the Appendix.

Figure 3.4: Labour Force Participation of Those Aged 15-59 (NSSO, 2013)



By age group, the ratio of labour force participation increases with each cohort, see Figure 3.5 below. Lower participation in the younger age ranges is immediately explained by educational enrolment. However, as the cohort groups increase, labour participation increases, but does not reach over 50% of the ratio. As such, this study advances upon the other determinants associated with labour force participation, and how certain determinants differ in magnitude between urban and rural women, and women of different age cohorts.

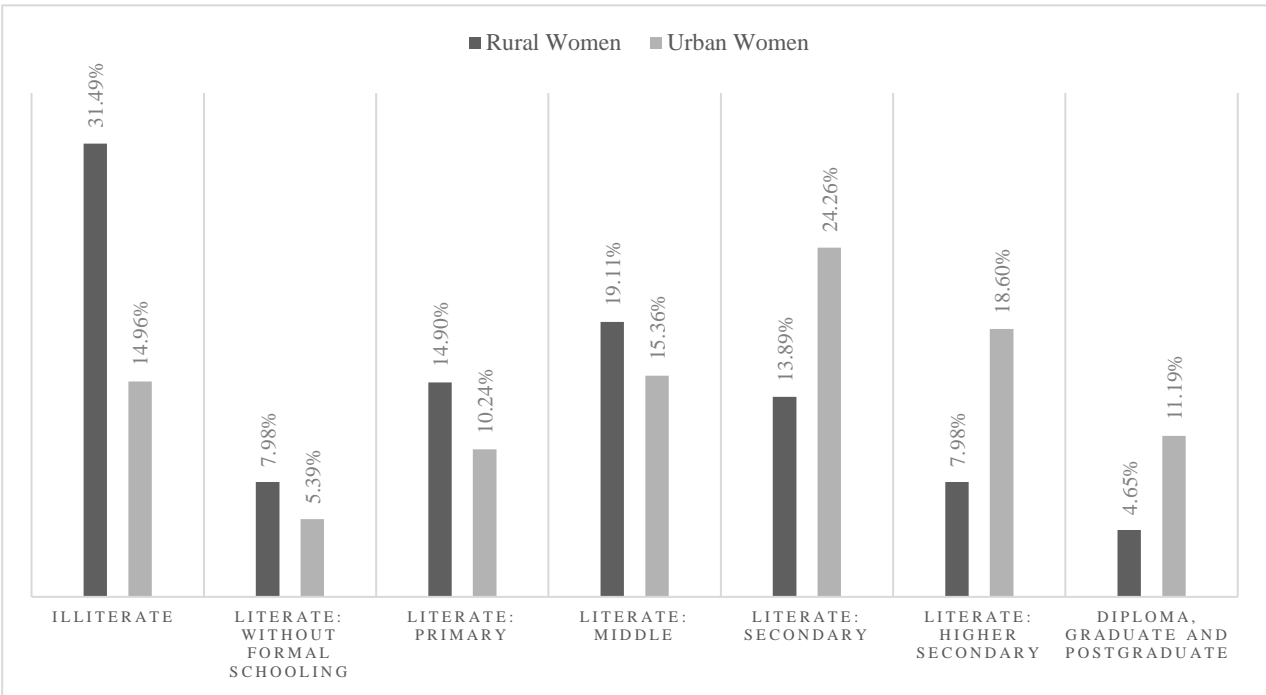
Figure 3.5 Labour Force Participation of Women by Age Group (NSSO, 2013)



3.4.2 General Education

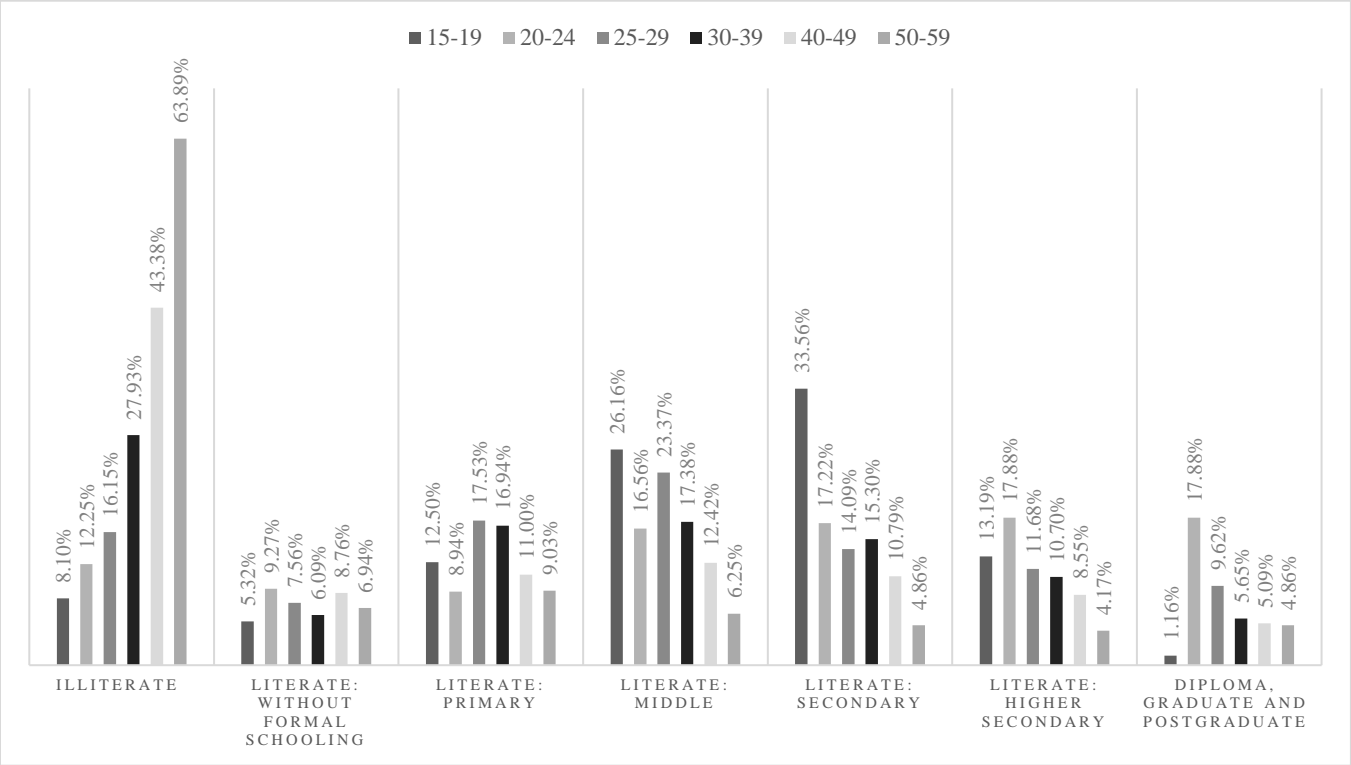
Educational attainment is associated with labour force participation, yet the attainment of education differs vastly for women across rural and urban areas. Considering Figure 3.6 below, women in rural areas have lower levels of educational attainment, whereas urban women have higher. Nearly a third of women, 31.49%, from rural areas are illiterate, whereas a quarter of urban women, 24.26%, secondary level. Over double the proportion of women with the highest level of education; diplomas, bachelor’s degrees and above, are from urban areas, 11.19%, compared to 4.65% in rural areas.

Figure 3.6: General Education of Women Aged 15-59 (NSSO, 2013)



When dividing the female population in the data into age cohort groups, further is understood with regards to educational attainment, see Figure 3.7. While the age group 50-59 has the highest ratio of participants in the labour force, it is also the age group with the highest proportion of illiteracy, at 63.89%, and the lowest group for top levels of education, at 1.16% of the cohort. Likewise, the youngest cohort has the lowest proportion of illiteracy and no formal schooling, at 8.10% and 5.32% of the cohort. Women in their twenties are more highly educated in comparison with older cohorts, as the highest proportions of women in 20-24 are found in secondary, higher secondary, and diploma and above, and for the 25-29 cohorts, the highest proportions of women are in primary, middle, and secondary. Cohort must be taken into account when investigating associations between general education and labour force participation, because of the vast differences between women of different ages.

Figure 3.7: General Education of Women by Age Group (NSSO, 2013)



4 Methods

This study considers the development, educational attainment and social norms that are associated with female labour force participation. The relationships these factors have on labour force participation and the differing magnitudes of each, vary between women of rural and urban areas. As such, generalisations about each are not easy to make, and so these relationships are considered thoroughly. Therefore, this study considers these determinants for Indian women and their decision to work using the data available to uncover the association that educational attainment has on women's labour force participation, and if this effect is non-linear. Additionally, this study aims to explore the association of social norms such as caste and how this interacts with education, and subsequently women's labour force participation.

This study uses a quantitative method to uncover the association of an individual's educational attainment, cultural background, and the degree to which these factors determine labour participation. The study aims to test the likelihood of labour force participation as a function of the independent variables in use.

4.1 The Logit

In order to uncover these associations, a Logistical Regression (hereafter, logit) is applied so that the relationship between the independent variables and the likelihood to participate in labour is examined. This is made possible by the use of the computer programme STATA.

The dependent variable in use; to participate in the labour force or not, is not linear; an increase in an independent variable of 'X', does not correspond in an increase in the dependent, 'Y'. It is instead a binary or dichotomous variable with a value of 1 to denote a possession or presence of an attribute, or a value of 0 which denotes an absence of the particular attribute (Gujarati & Porter, 2010; 386-7). In terms of labour force participation, there are only two values; an individual either participates in the labour force, or an individual does not. As such, there are only two options the dependent variable can take, 1 or 0. That being the case, the most appropriate model to estimate the function of labour force participation and the independent variables which seeks to predict its likelihood, is the logit because it recognises labour force participation as binary.

Additionally, the logit and its results are based on observed individual characteristics at the micro level. The NSSO data is a collection of individuals information, in which a set of variables illustrating characteristics of each observed individual is included. As such, by using the logit, the independent predictor variables, such as age, estimate the predicted probability of falling into one of the two groups; in the labour force, or not in the labour force. A logit considers the non-linear aspect to the relationship between the dependent and independent

variables where some are dummy, such as urban or rural, and categorical, educational attainment (Gujarati & Porter, 2010: 387). Therefore, the logit is most appropriate because it determines the association of behavior based on these variables that exist at the individual level.

The logit is the most fitting model for this data set in comparison to other statistical methods for multiple reasons. A Linear Probability Model (hereafter, LPM) estimates models with binary dependent, Y variables, through an Ordinary Least Squares (hereafter, OLS) method. This would not be appropriate because it assumes that the probability of the dependent variable happening increases linearly with the X, explanatory variables (Gujarati & Porter, 2010; 397). As most of the independent predictor variables are either dummy or categorical, an LPM is erroneous. Additionally, the LPM does not consider estimated probability values that are negative, or greater in value than 1. Because some independent predictor variables have negative effects on the decision to participate in the labour or not, this model is not suitable.

The logit is the most appropriate for this study because it has been used in previous research surrounding labour force participation in India. It is used by the International Monetary Fund (Das et al, 2015) to compare the results of the past five NSSO surveys conducted. Their study measures and compares the likelihoods for both men and women alike participating in the labour force. Likewise, the International Labour Organization (Chaudhary & Verick, 2014) use a five-level dependent variable multinomial logit to capture the determinants of women's type of employment status. For the World Bank, Das and Desai (2003) use the logit to determine the probability of being in the labour force for data from the 50th NSSO round, between 1993-1994. Therefore, estimating the probability of participating in the labour force is most appropriately performed by the use of the logit, and this is made clear by previous research.

Therefore, this study encompasses a set of models which measure and compare the factors associated between the predictor variables and the dependent variable. By using a number of models, the results of the variables are compared, such as the magnitude that education has in rural areas versus its magnitude in urban areas, as well as by age cohort. Because the LFPR differs for women in rural and urban areas, the regressions are separated for urban and rural to focus on the differentiating aspects to the determinants of female labour force participation. In this way, the degree to which these variables are associated with labour force participation, and how this is reflected differently in different contexts, is examined.

4.1.1 The Models

Model 1: Women aged 15-59 in Rural Areas:

$$\Pr\{L_i=1\} = \alpha + \beta_1 Age_i + \beta_2 Age^2_i + \beta_3 GeneralEducation_i + \beta_4 CurrentlyMarried_i + \beta_5 LowerCaste_i + \beta_6 Muslim_i + \beta_7 HouseholdSize_i + \beta_8 Children5UnderPresent_i + \beta_9 ParentsInLawPresent_i + \beta_{10} FemaleHead_i + \beta_{11} HouseholdHeadPrimaryActivity_i + \beta_{12} Caste * GeneralEducation_i + \varepsilon_i$$

Model 2: Women aged 15-59 in Urban Areas:

$$\Pr\{L_i=1\} = \alpha + \beta_1Age_i + \beta_2Age^2_i + \beta_3GeneralEducation_i + \beta_4CurrentlyMarried_i + \beta_5LowerCaste_i + \beta_6Muslim_i + \beta_7HouseholdSize_i + \beta_8Children5UnderPresent_i + \beta_9ParentsInLawPresent_i + \beta_{10}FemaleHead_i + \beta_{11}HouseholdHeadPrimaryActivity_i + \beta_{12}Caste*GeneralEducation_i + \varepsilon_i$$

Model 3: Women by Age Cohort; 15-19, 20-24, 25-29, 30-39, 40-49, 50-59:

$$\Pr\{L_i=1\} = \alpha + \beta_1Age_i + \beta_2Age^2_i + \beta_3RuralOrUrban_i + \beta_4GeneralEducation_i + \beta_5CurrentlyMarried_i + \beta_6LowerCaste_i + \beta_7Muslim_i + \beta_8HouseholdSize_i + \beta_9Children5UnderPresent_i + \beta_{10}ParentsInLawPresent_i + \beta_{11}FemaleHead_i + \beta_{12}HouseholdHeadPrimaryActivity_i + \varepsilon_i$$

4.2 Variables

4.2.1 Transforming the Data

The data used in this study is manipulated in a number of ways to uncover the determinants associated with female labour force participation. Information provided in the data is used to create new variables. Transformations of categories are required so as to remove categories with too few observations and combine them with others so as to improve robustness and statistical significance.

This main focus of this study is to uncover determinant factors associated with either participating or not participating in the labour force based on the working age population. That being the case, an age bracket of 15-59 inclusive is used. Firstly, this age bracket is used because the NSSO (2013) survey itself considers this section of the population to be economically active. Secondly, the lower bracket for working age is set at 15 as defined by the OECD (2019). Any age less than 15 is inappropriate to this study too due to rapidly rising educational enrollment for children in India (Mehrotra & Parida, 2017). It is clear that those individuals under 15 years of age provide an obvious determinant to why there is less participation in the labour force at this age, and thus these particular observations are superfluous to this study as including them would bias the results. For those aged 60 and above, there are too few observations within the data set to create accurate and statistically significant results; there are only 126 women aged 60 and above in the microdata set. Additionally, the age variable determines the new variable, age squared.

This study has used the data set to create new variables for use in regressions. As discussed in the previous chapter, the usual principal activity status variable determines the new variable participating in labour force which is used as the dependent variable for the logit. Likewise, the individual marital status variable formed the new variable, currently married. The categorical variables of caste and religion form the new dummy variables of caste; belonging to a scheduled caste or scheduled tribe, and Muslim or not Muslim. As the survey takes the information of all individual members of a household, other new variables include; both the

presence of children aged five and under and the of parents in law, as well as female household head and the head of household's principal activity status, which subsequently produces the dummy variable of head of household in labour force.

In order to improve statistical significance and robustness, some categorical variables, such as general education and head of households principle activity status, are transformed. For example, all four forms of informal literacy are merged together to form literate, no schooling. Higher levels of education contain too few observations, as such diploma, graduate and postgraduate form one category instead of three. Likewise head of household's principal activity status contains seven categories instead of thirteen. Firstly, no household heads appear to be an unpaid family worker, so this variable is redundant, whereas those who work in casual labour in public or other works, are combined into one. Because of there being too few observations for rentiers, disabled, or other, these three are also combined to form one. Despite there being so few household heads falling into the category of seeking or available for work, there are no other appropriate categories for this to be merged with by definition of the variable itself, so this has remained the same.

Missing variables are found for marital status, and general education. As such, a new category within the martial status is created for these missing variables. The missing values of general education disappear when the age range is introduced, indicating unknown educational attainment for observations younger than 15 or older than 59.

4.2.2 Dependent Variable

Binary: Participating in Labour Force, or Not Participating in Labour Force

The dependent variable in use for the logit model is binary, as it takes a value of 0 or 1. In this case, participating in the labour force takes a value of 1, whereas not participating takes the value 0. This study creates this binary variable by taking the Usual Principal Activity Status, which is the activity status of a person based on major time criterion for the 365 days prior to the day the survey was carried out and is 'the activity situation in which a person was found during the reference period with regard to the person's participation in economic and non-economic activities' (NSSO, 2013).

From this activity status, the binary dependent variable is calculated. Observations for participating in labour force include; self-employed, regular salaried or wage employee, casual wage labour, and unemployed workers i.e. seeking or available for work. For those who are withdrawn from the labour force, this includes; unpaid family worker, attended domestic duties only and/or collection of free goods, attended educational institution, pensioners, and the disabled.

It is important to note that despite individuals not being in work but are seeking or available for work, they are still classed as participating in the labour force. This is because the individual in this case is available and making efforts to find work, and so is associated with the labour force. The dependent variable includes all individuals and is accounted for by their usual principal activity statuses observed in the data.

4.2.3 Independent Variables

Human Capital Variables

Age, Age²

Continuous Variable: 15-59, 225-3,481

The variables Age and Age Squared capture the likelihood of participating in the labour force with every incremental increase, and how the marginal increase in likelihood with an increase in age changes in magnitude. In this way, the age and age squared variables act as a proxy to years of experience. Age squared is included because the study does not expect to find a linear relationship between age with regard to labour force participation, but a diminishing marginal return.

General Education

Categorical variable: General Education: Illiterate, Literate: Below Primary, Literate: Primary, Literate: Middle, Literate: Secondary, Literate: Higher Secondary, Literate: Diploma/Certificate Course, Graduate, Postgraduate and Above.

The level of education of women tests the effect education has on likelihood to participate in the labour force. Positive selection into education by women indicates increasing enrolment at primary and secondary levels of schooling showing a willingness for women to seek work, and a presence of essential characteristics deemed good by both the education system and employers. Those who have the highest level of education, graduate level, self-select themselves into work, and therefore do not reduce labour force participation. The preference of highly educated women into white-collar of work reduces the desire to participate in basic and labour intensive work. This means that those with a higher level of education only join the labour force if there is suitable white-collar employment available. Whereas women who have a lower level of education work, but only in agricultural or manufacturing labour. As such, testing for education indicates that for different levels of education, the likelihood to join the labour market is correspondingly different, where the U-Shaped relationship acts as a framing device.

4.2.4 Social and Cultural Factor Variables

Marital Status

Dummy Variable: Currently Married, Not Currently Married.

According to Klasen and Pieters (2013), marriage is a highly important institution in India, especially for women and their parents because women typically move out of their family home and move in with their in-laws after marriage. A marriage variable measures the difference between married and unmarried women, with the theory that women who are single are more likely to work. It captures the income effect for those who are married, in that they are less likely to participate in work if there is a household income already.

Specialisation between partners is accounted for with this variable, as women specialise in home production and men in formal employment. According to Klasen and Pieters (2013) women find it challenging to combine specialisation in the household with work in non-agricultural settings, as well as face social stigmas which oppose married women working.

Presence of In-Laws

Dummy Variable: In-Laws present, no In-Laws present.

Following on from the marriage variable, the presence of in laws in the household effects the likelihood of the individual female household members to work because of the stigmas associated with married women working and her reduced decision-making power. The assumption of a woman as a caregiver for the household, and thus a carer for older family members, increase female specialisation in care giving roles, reducing the likelihood of a women being able to join the labour market. As such, presence of in-laws effects female labour force participation because of their influence and expectation that the female has the care giving role assisting the older generation.

Caste

Dummy Variable: In Scheduled Caste or Scheduled Tribe, Not Scheduled Caste or Scheduled Tribe

The role of caste, and significantly which caste, is important when discussing female labour in India. Belonging to a caste creates social stigmas surrounding women and those who participate in work and employment, and those who do not. The impact of belonging to a certain caste negates the effect education has on participating in labour, because even with high levels of education, women at the higher levels of caste will not enter the labour force because of the expectations over what is appropriate for them. Conversely, social restrictions on women in a lower caste, or scheduled or tribal caste, are not as apparent because of the overriding significance of poverty and the need to support the family income. For women from a lower caste, there is no affordability of withdrawing from the labour force.

Religion

Dummy Variable: Muslim, non-Muslim

Similarly to caste, religion is associated with female labour force participation. The type of religion impacts this result. According to Sorsa *et al* (2015) Muslim woman are significantly less likely to work than women of the Hindu faith or other religions. As such, the regressions include this variable to account for the woman as belonging to the Muslim religion, or not.

4.2.5 Control Variables

Household Size

Continuous variable; 1-18

A household size variable captures the impact other relations have on women's participation in the labour force, and that household duties are of more importance to a larger household. Likewise, in a smaller household, a woman is more likely to participate in the labour force because of the lesser need to pool labour resources and specialise within the household.

Presence of Children 5 and Under

Dummy Variable; Children Under Five Present, No Children Under Five Present

The presence of children limits the capacity for formal employment on a woman, particularly a mother, to participate in the labour force. Having young children in the household reduces the likelihood of women seeing work outside the home because of the welfare gain to the family of her specialisation in home production and care of young children. Therefore, a better investment of time is to specialise in domestic duties.

Female Household Head

Dummy Variable: House Head is Female, Household Head is not Female.

As an individual's head of household is female, it implies a woman is taking responsibility for the family. That being the case, if a woman is female and also the head of the household, she participates in the labour force because of the requirement to support the family income. Controlling for a female head of household indicates that other women in the household are more likely to participate in the labour force in order to support the family income.

Head of Household in Labour Force

Categorical Variable: Self Employed, Employer, Regular Wage or Salary Worker, Casual Wage Worker in Public or Other, Seeking or Available for Work, Attended Domestic Duties and/or Collection of Free Goods, Rentiers/Pensioners/Other

Dummy Variable: Household is Participating in Labour Force, Head of Household is Not Participating in Labour Force

The individuals head of household's principal activity status and if the head of household is participating in the labour force or not, are also variables. Similar to calculating the individuals labour force participation, the household's head's participation is calculated using the principal activity status codes. Doing so measures an impact on household income, and thus the likelihood of a woman participating in the labour force. This variable acts, to a degree, as a proxy for the income effect, whereby the household head's income reflect the family's economic status (Mehrotra & Parida, 2017). Thus, a head of household participating in the labour force and generating household income, reduces the necessity for women in the family to participate in the labour force.

Interaction of Caste and General Education

Categorical Variable: In Scheduled Caste or Scheduled Tribe and: Illiterate, Literate: Below Primary, Literate: Primary, Literate: Middle, Literate: Secondary, Literate: Higher Secondary, Literate: Diploma/Certificate Course, Graduate, Postgraduate and Above

As the models measures the degree to which educational attainment plays a role in its association with determining labour force participation, interacting education with individuals from lower caste or tribes reflects the different impact educational attainment has in different contexts. Educational attainment and its association with labour force participation functions differently to those from lower castes or tribes compared to social groups higher in socio-economic spectrum. As mentioned, educational attainment of women is a symbol of status for those families in higher social groupings and part of the marriage market, where participating in labour is not the purpose of attaining higher levels of education. However, because of the necessity to participate in the labour force out of poverty for those from lower castes, increased educational attainment functions differently compared to those from higher social groups. Women from lower castes or tribes who attain higher levels of education, continue to participate in the labour force because the social expectations placed on women from higher social groups, are not present in the same way for women from lower social groups. Therefore, the interaction and association of lower caste or tribe against educational attainment is crucial in understanding how labour force participation is affected differently in different contexts.

5 Results and Analysis

5.1 Interpreting the Results

Through the use of STATA the logit tests the predictor variables to uncover their association as a function of either participating in the labour force or not participating in the labour force.

Interpreting the results of the logit requires understanding of the terms odds, log of odds, and odds ratios. The results of logistic regressions are given in two forms; coefficients and odds ratios, where this study only provides the odds ratio. Before analysing the results of the regressions, an explanation of how to interpret them is essential.

Unlike the coefficient results found in an OLS model, which assumes that an increase in probability, P_i , is linearly related to the predictor variables, X_i showing the rate of change in probability for a one unit change in the regressor variable, the binary logit instead indicates that the log of the odds ratio is linearly related to X_i . (Gujarati & Porter, 2010; 389, 394). Where P_i takes a value between 0 and 1, the log of the odds, the coefficient, takes a value of L_i , from $-\infty$ to $+\infty$.

The coefficient for a predictor variable indicates the relationship between the log of the odds ratio and the dependent variable. A positive coefficient, or L_i value, indicates that when an X variable, or the predictor variable, increases in value, the odds that the dependent variable, $Y = 1$, increase (Gujarati & Porter, 2010; 389). For a continuous variable such as Age, an increase by one unit increases the log of the odds in favour of being in the labour force. However, if the coefficient is negative in value, the odds that the dependent variable will equals $Y = 1$; participating in the labour force, decreases as the X value increases.

The Logit, L_i , or log of the odds ratio, is expressed as;

$$L_i = \ln\left(\frac{P_i}{1 - P_i}\right)$$

Figure 5.1: The Logit, L_i (Gujarati & Porter, 2010; 389)

The odds ratio, therefore, is the ratio of probability that an individual will participate in the labour force to the probability that they will not participate in the labour force. The odds ratio is the second set of results produced when regressing the logit and is this is what is presented for results in this study.

The odds ratio is expressed as;

$$\frac{P_i}{1 - P_i} = \frac{P_a(\text{Participating in the Labour Force})}{P_b(\text{Not Participating in the Labour Force})} = 0^\infty$$

Figure 5.2: The Odds Ratio (Gujarati & Porter, 2010; 395)

The odds ratio in itself does not indicate probability, but instead measures the change in probability of one event occurring over the probability of another event occurring. The odds ratio indicates a change in the predicted odds for every one unit increase in the predictor variable, with the assumption that these events are mutually exclusive. As such, there are no negative values. Where an odds ratio value is between 1 and ∞ , this indicates a top-heavy ratio where the probability of participating in the labour force is greater than the probability of not participating in the labour force, based on this predictor variable. As such, if the independent predictor variable increases by one unit, the odds ratio indicates a change in the odds for every unit. In this case, an increase in one unit multiplies the odds ratio by the amount indicated in the regression table. Therefore, with an increase in one unit for an odds ratio with a value higher than 1, the likelihood of falling into the dependent variable group $Y=1$, participating in the labour force, increases. The odds ratio is not a measure of probability, but a measure of how probability changes.

If the odds ratio value for an independent predictor variable is between 0 and 1, this indicates a bottom-heavy ratio where the probability of participating in the labour force is smaller than the probability of participating in the labour force. For every one unit change in the predictor variable, the odds ratio indicates the odds of participating in the labour force is lower, compared to the odds of participating without the unit increase in the dependent variable.

5.2 Results

The odds ratio provides not only a quantity with which the odds can be multiplied by for every unit increase in a dependent variable, but so too indicates the magnitude a dependent variable has, the odds ratios will be the main source of analysis in the results section. The decimal places for the odds ratios discussed in text have been adjusted for ease of understanding, where full results with 3 decimal places are found in tables 5.1, 5.2, and 5.3.

5.2.1 Rural Women Aged 15-59

As seen in the results for table 5.1, the logit for rural women ages 15-59 is used across seven tests where additional variables are added each time, test 7 includes the interaction variable of general education and caste. The results show that the goodness of fit increases as testing

takes place, where correct classification goes from 66.1% on test 1 to 70.77% by test 7. See table 5.1 for all odds ratio results of logit for rural women ages 15-59.

For rural women aged 15-59, a one unit increase in age increases the odds of participating in the labour force by 1.28. The odds ratio for age squared show there is a non-linear relationship so that whilst an increase in age increases likelihood to participate in the labour force, the age squared indicates there are diminishing marginal returns. Both age and age squared are statistically significant at the 1% level and the odds ratios results are consistent across testing.

The effect of education for rural women on the likelihood to participate in the labour force falls and rises as attainment increases. Relative to being illiterate, being literate with no schooling increases the likelihood to participate in the labour force, although the magnitude of this changes across testing. Tests 1 to 6 for secondary level education relative to being illiterate, receives the lowest odds ratio at around 0.26, indicating that with this level of education, there is less likelihood to participate in the labour force. The results for general education remain consistent between tests 1 and 6 and are relative to being at illiterate. The results are mostly statistically significant at the 1% level.

Rural women belonging to a scheduled caste or tribe are more likely to participate in the labour force compared to those who are not. Odds ratios for test 1-6 are above 2, and for test 7, 1.75, all at the 1% statically significant level. General education and caste are interacted in test 7. For women who belong to a scheduled caste or tribe, relative to being illiterate, being literate with no schooling has an odds ratio of 10.8. this figure drops to below 1 for primary, middle, and secondary level education and rises to 2.5 and 4.7 for higher secondary and diploma, graduate, and above respectively. Statistical significance at the 1% and 5% level is only found for literate no schooling and diploma and above.

Rural women who belong to the Islamic faith are more likely to participate in the labour force as results from all test give odds ratios higher than 1. All tests results show odds ratios around 2.5, but most results are statistically insignificant.

The results for the likelihood of currently married women in rural areas to participate in the labour force indicates that in test 1 to 3, they are less likely to participate in the labour force as the odds ratios are 0.86, 0.73 and, 0.69 where tests 2 and 3 are statistically significant. However, tests 4 to 7 show the opposite, where currently married women are more likely to participate in the labour force as the odds ratios are higher than 1, but are however, statistically insignificant.

Likewise, household size indicates that with every increment the likelihood of joining the labour force is lower, as the odds ratios between tests hover at 0.95 with tests 4 onwards having statistical significance at the 10% level. Yet, the presence of children aged 5 and under in the household consistently show across all tests that rural women are more likely to participate in the labour force as the odds ratios are around 1.5. They are statistically significant at the 1% level in every test. The presence of parents in law in the household also increase the likelihood of participation as results show an odds ratio around 2. The results are also statistically significant at the 1% level.

With regard to the head of the woman's household, if they are female, which also means if they themselves are the head of the house, they are more likely to participate in the labour force. The odds ratios from tests 4 to 7 range from 3.3 to 3.8 and are all statistically significant at the 1% level. Having a household head that is participating in the labour force increases the odds of participating in the labour force. Furthermore, the woman's head of household's primary activity status relative to being self-employed, indicates that they are more likely to participate in the labour force if the head is an employer; the odds ratio is 2 but is not statistically significant. If the head of household's primary activity is domestic duties than a woman is less likely to participate in the labour force as the odds ratio is 0.07 relative to them being self-employed, and statistically significant at 1% level.

Table 5.1: Odds Ratios For Rural Women. (Note: Assume a value of 1 for the base line variable).

VARIABLES	1	2	3	4	5	6	7
Age	1.276*** (0.0458)	1.287*** (0.0468)	1.311*** (0.0485)	1.267*** (0.0479)	1.278*** (0.0498)	1.278*** (0.0501)	1.276*** (0.0506)
Age Squared	0.997*** (0.000494)	0.997*** (0.000499)	0.997*** (0.000508)	0.997*** (0.000516)	0.997*** (0.000533)	0.997*** (0.000537)	0.997*** (0.000542)
<i>General Education</i> (Illiterate as Base)							
Literate, no Schooling	1.191 (0.258)	1.225 (0.266)	1.108 (0.244)	1.094 (0.242)	1.047 (0.236)	1.024 (0.231)	0.149*** (0.0988)
Primary	0.400*** (0.0700)	0.411*** (0.0721)	0.396*** (0.0700)	0.403*** (0.0714)	0.438*** (0.0801)	0.451*** (0.0834)	0.501* (0.200)
Middle	0.474*** (0.0787)	0.495*** (0.0826)	0.470*** (0.0793)	0.480*** (0.0814)	0.492*** (0.0859)	0.527*** (0.0933)	0.793 (0.329)
Secondary	0.250*** (0.0504)	0.274*** (0.0558)	0.257*** (0.0532)	0.248*** (0.0521)	0.255*** (0.0547)	0.278*** (0.0610)	0.287*** (0.138)
Higher Secondary	0.407*** (0.0918)	0.446*** (0.102)	0.426*** (0.0977)	0.445*** (0.104)	0.440*** (0.105)	0.518*** (0.128)	0.238** (0.169)
Diploma, Graduate +	0.593** (0.156)	0.638* (0.169)	0.618* (0.165)	0.688 (0.187)	0.722 (0.201)	0.969 (0.284)	0.306* (0.195)
Currently Married	0.857 (0.138)	0.729* (0.123)	0.690** (0.118)	1.046 (0.202)	1.083 (0.214)	1.117 (0.222)	1.148 (0.231)
Caste	2.231*** (0.337)	2.166*** (0.329)	2.164*** (0.329)	2.074*** (0.318)	2.221*** (0.344)	2.233*** (0.357)	1.752** (0.446)
Muslim	2.545 (1.556)	2.512 (1.550)	2.846* (1.748)	2.657 (1.629)	2.520 (1.550)	2.485 (1.550)	2.823 (1.856)
Household Size	0.998 (0.0237)	0.974 (0.0242)	0.918*** (0.0257)	0.949* (0.0274)	0.952* (0.0283)	0.945* (0.0284)	0.947* (0.0287)
Children 5 & Under		1.562*** (0.200)	1.516*** (0.196)	1.461*** (0.189)	1.523*** (0.203)	1.516*** (0.204)	1.575*** (0.214)
Parents & In-laws			1.987*** (0.291)	1.839*** (0.271)	2.090*** (0.321)	2.099*** (0.324)	1.998*** (0.312)
Female Household Head				3.281*** (0.797)	3.784*** (0.961)	3.631*** (0.926)	3.661*** (0.942)
Household Head in LF					11.96*** (4.251)		
<i>Head of Households Primary Activity (Self-Employed as Base)</i>							
Employer						1.837 (0.824)	1.992 (0.897)
Regular Wage/Salary						0.522*** (0.0821)	0.539*** (0.0856)
Casual Wage/Salary						0.835 (0.208)	0.835 (0.212)
Domestic Duties						0.0717*** (0.0268)	0.0708*** (0.0266)
Others						0.0992** (0.109)	0.101** (0.111)
<i>Interaction</i>							
Caste*Literate, no Schooling							10.79*** (7.687)
Caste*Primary							0.888 (0.394)
Caste*Middle							0.639 (0.287)
Caste*Secondary							0.979

							(0.520)
Caste*Higher Secondary							2.491
							(1.864)
Caste*Diploma, Graduate+							4.691**
							(3.342)
Constant	0.0110***	0.00948***	0.00925***	0.0106***	0.000713***	0.00928***	0.0109***
	(0.00651)	(0.00571)	(0.00563)	(0.00654)	(0.000527)	(0.00594)	(0.00725)
Observations	1,591	1,591	1,591	1,591	1,591	1,591	1,591
Correctly Classified	66.06%	66.25%	66.25%	67.63%	69.14%	70.40%	70.77%
LR Chi2	256.21	268.41	290.71	315.45	391.84	412.97	438.02
Pseudo R Squared	0.1174	0.123	0.1332	0.1445	0.1795	0.1892	0.2006
Hosmer-Lemeshow Chi2	21.22	16.32	23.07	16.33	7.75	6.64	3.73

Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

5.2.2 Urban Women Aged 15-59

As seen in the results in table 5.2, the logit for urban women ages 15-59 is used across seven tests where additional variables are added each time, test 7 includes the interaction variable of general education and caste. The results show that the goodness of fit increases as testing takes place, where correct classification goes from 82.6% on test 1 to 85.54% by test 7. See table 5.1 for all odds ratio results of the logit for urban women ages 15-59.

For urban women, an incremental increase in age by one unit increases the likelihood of participating in the labour force by about 1.3. These results are consistent across test 1 to 7 and for most tests is statistically significant at the 1% level. Likewise, the age squared odds ratio which is constantly less than 1 indicates diminishing marginal returns to age indicating a non-linear relationship between age and likelihood of participating in the labour force. Age squared for tests 1 to 3 are statistically significant at 1%, but by test 7 the odds ratio for age squared is statistically significant at 10%.

For general education relative to secondary level, being illiterate increases likelihood of participation. The odds ratio results for illiterate women relative to secondary level educated women, across tests 1 to 6 go from 2.4 to 1.7, where statistical significance is between 1% and 10% significance. Yet results for test 7 show the odds of illiterate women participating in the labour force are 4 times as great, at 5% significance level. On the whole, relative to having secondary level education, being literate with no schooling, middle level, or higher secondary level education have the lowest odds ratio results, but all are statistically insignificant. However, at diploma, graduate and above, relative to secondary education, the odds of urban women participating in the labour force are 7.7 times greater.

Urban women belonging to a scheduled or tribal caste are more likely to participate in the labour force. All tests produce odds ratios greater than 2, where the results for test 7 is 5.7. All results for this variable are statistically significant at the 1%. When caste is interacted with education, relative to secondary level education shows that being literate with no schooling has the highest odds ratio result at 3.6. all other levels of education relative to secondary level are lower than 1, indicating that these levels of educational attainment reduce the likelihood of participating in the labour force. However, results are statistically significant.

For urban women who are Muslim, all tests results indicate belonging to the Islamic faith reduces the likelihood of participating in the labour force. The odds ratios hover between 0.77 to 0.92 from tests 1 to 7, but all results are statistically insignificant.

For women who are currently married, the results indicate odds ratio values lower and higher than 1 across the tests. The odds ratios from tests 1 to 5 indicate less likelihood to participate in the labour force as the values are between 0.29 and 0.9, where 1 to 3 are statistically significant at the 1% level. Whereas tests 6 and 7 are statistically insignificant and show that being currently married increases the odds of participation by 1.1.

Household size reduces the likelihood of participation in the labour force as where the odds ratio results between all tests are around 0.8. all results are either statistically significant at the 1% or 5% level. The presence of children aged 5 and under increase the likelihood of participating in the labour force where the odds ratio hovers at 2 across tests 1 to 7. The results are mostly statistically significant at the 1% level. Likewise, the presence of parents in law in the household also increases the odds of participating, but the results are statistically insignificant.

The characteristics of a household's head indicate that if the head of household is female, and therefore if a woman is simultaneously a head of household, they are more likely to participate in the labour force. A female head of household produces an odds ratio going from 11.41 to 16.5 from tests 4 to 7, and all results are statistically significant at the 1% level. Additionally, the odds of an urban women participating in the labour force increases if the household head also participates. Furthermore, the odds ratio results show that the highest odds ratio is for head of household's primary activity. Relative to regular wage or salary employee, the results indicate that a household head who is an employer increases the odds of participation by 9.5, where this is statistically significant at the 1% level.

Table 5.2: Odds Ratios For Urban Women. (Note: Assume a value of 1 for the base line variable).

VARIABLES	1	2	3	4	5	6	7
Age	1.308*** (0.102)	1.342*** (0.106)	1.354*** (0.108)	1.272*** (0.107)	1.266*** (0.108)	1.276*** (0.111)	1.247** (0.110)
Age Squared	0.997*** (0.00109)	0.997*** (0.00110)	0.997*** (0.00111)	0.997** (0.00118)	0.997** (0.00120)	0.997** (0.00121)	0.998* (0.00124)
<i>General Education (Secondary as Base)</i>							
Illiterate	2.371*** (0.787)	2.136** (0.717)	2.122** (0.715)	1.856* (0.642)	1.856* (0.642)	1.735 (0.623)	4.029** (2.735)
Literate, no Schooling	2.707** (1.196)	2.258* (1.014)	2.175* (0.981)	1.992 (0.932)	2.000 (0.934)	2.080 (1.002)	1.328 (1.242)
Primary	1.114 (0.444)	1.001 (0.403)	0.966 (0.390)	0.736 (0.312)	0.739 (0.313)	0.640 (0.275)	1.514 (1.147)
Middle	1.112 (0.398)	1.066 (0.384)	1.075 (0.389)	1.052 (0.391)	1.050 (0.390)	0.933 (0.361)	1.619 (1.329)
Higher Secondary	1.144 (0.379)	1.160 (0.388)	1.184 (0.397)	1.161 (0.406)	1.160 (0.405)	1.255 (0.452)	3.559* (2.577)
Diploma, Graduate +	1.848* (0.644)	1.823* (0.640)	1.858* (0.654)	1.746 (0.666)	1.746 (0.665)	2.055* (0.806)	7.728*** (5.993)
Currently Married	0.377*** (0.123)	0.285*** (0.0970)	0.295*** (0.100)	0.903 (0.372)	0.910 (0.376)	1.094 (0.462)	1.140 (0.491)
Caste	2.123*** (0.471)	2.235*** (0.503)	2.386*** (0.550)	2.173*** (0.528)	2.168*** (0.527)	2.302*** (0.584)	5.676*** (3.590)
Muslim	0.760 (0.520)	0.791 (0.548)	0.830 (0.572)	0.845 (0.616)	0.841 (0.613)	0.775 (0.575)	0.923 (0.732)
Household Size	0.814*** (0.0479)	0.776*** (0.0482)	0.753*** (0.0490)	0.861** (0.0577)	0.860** (0.0579)	0.841** (0.0587)	0.852** (0.0601)
Children 5 & Under		2.266*** (0.576)	2.075*** (0.543)	1.986** (0.532)	1.985** (0.533)	2.024*** (0.553)	2.129*** (0.599)
Parents & In-laws			1.924 (0.799)	1.471 (0.624)	1.484 (0.630)	1.468 (0.650)	1.524 (0.683)
Female Household Head				11.41*** (4.267)	11.57*** (4.351)	15.53*** (6.151)	16.50*** (6.641)
Household Head in LF					1.298 (1.013)		
<i>Head of Households Primary Activity (Regular Wage/Salary as Base)</i>							
Self-Employed						2.432*** (0.598)	2.524*** (0.634)
Employer						9.466*** (7.322)	9.521*** (7.536)
Casual Wage/Salary						1.765 (0.801)	1.965 (0.948)
Others						1.716 (1.391)	1.550 (1.254)
<i>Interaction</i>							
Caste*Illiterate							0.285 (0.228)
Caste*Literate, no Schooling							3.578 (4.126)
Caste*Primary							0.280 (0.263)
Caste*Middle							0.475 (0.445)

Caste*Higher Secondary							0.245*
							(0.206)
Caste*Diploma, Graduate +							0.167**
							(0.150)
Constant	0.00274***	0.00182***	0.00172***	0.00119***	0.00101***	0.000707***	0.000466***
	(0.00340)	(0.00232)	(0.00221)	(0.00161)	(0.00146)	(0.00100)	(0.000703)
Observations	742	742	742	742	742	740	740
Correctly Classified	82.61%	82.75%	83.02%	85.04%	85.04%	85.81%	85.54%
LR Chi2	79.97	90.12	92.5	138.36	138.47	160.08	171.67
Pseudo R Squared	0.1104	0.1244	0.1277	0.191	0.1911	0.2221	0.2382
Hosmer-Lemeshow Chi2	20.58	19.22	11.56	13.79	14.74	11.24	10.21

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.2.3 Women by Age Cohort

Table 5.3 provides the odds ratio results of logit across age cohorts. The variables used are the same as those found for test 6 used for rural and urban women aged 15-59, with the addition of a variable of urban or rural. The results show the goodness of fit, where the variables in question produce the highest goodness of fit for age cohort 15-19, at 90.82%, and the lowest goodness of fit for cohort 25-29 at 70.34%. See table 5.3 for all the odds ratio results of the logit for all women by cohort.

For women aged 20-24, relative to having a diploma, degree or above, indicates that being illiterate, literate with no schooling, or primary level education increases the odds of participating in the labour force as the odds ratios are greater than one. Likewise, levels of educational attainment such as that of middle, secondary, and higher secondary reduce the likelihood of participating as the results are lower than one in value. For the cohort 50-59, relative to being illiterate, middle, secondary, and higher secondary also produce odds ratio results lower than 1. Only the result for secondary level education is statistically significant at the 1% level. However, if a woman is aged 50-59 the odds of her participating in the labour force increase, as the results for higher secondary, and diploma, graduate, or above, give odds ratios of 10.3 and 3.3 respectively. However, most results are statistically insignificant.

A woman belonging to scheduled caste or tribe indicates an increase in the odds of participating in the labour force, for all age cohorts other than 15-19. The highest odds ratio is for those aged 25-29 at 3.8, where all cohorts other than 15-19 are statistically significant. For Muslim women, the results vary where for those aged 20-24, the odds of participating in the labour force increase by 31, yet for those aged 40-49 this figure stands at 0.35. All cohorts indicate that this variable is statistically insignificant, except for cohort 20-24.

The effect of being currently married changes across age cohorts, where for those aged 15-19 the odds ratio is 13.5, 0.58 for 30-39, and 4.3 for 40-49, although statistical significance varies.

Table 5.3: Odds Ratios for Women Per Cohort. (Note: Missing observations occur because there are too few observations or variable is a base: Assume a value of 1 for the base line variable).

VARIABLES	15-19	20-24	25-29	30-39	40-49	50-59
Age	13.38 (57.28)	0.352 (1.383)	0.970 (5.040)	0.302 (0.268)	0.173 (0.242)	0.0595 (0.225)
Age Squared	0.939 (0.118)	1.028 (0.0921)	1.002 (0.0972)	1.019 (0.0132)	1.020 (0.0162)	1.028 (0.0363)
Rural or Urban	0.287* (0.193)	0.330*** (0.142)	0.452** (0.162)	0.254*** (0.0616)	0.372*** (0.108)	0.285* (0.201)
<i>General Education</i>						
Illiterate	13.52*** (10.63)	2.270 (1.414)	1.991 (0.902)	-	-	-
Literate, no Schooling	18.99*** (15.69)	3.864* (2.863)	1.763 (1.104)	0.613 (0.260)	1.119 (0.457)	0.885 (0.847)
Primary	10.03*** (7.653)	2.719 (1.784)	1.003 (0.462)	0.313*** (0.0918)	0.375** (0.145)	0.514 (0.486)
Middle	4.873** (3.509)	0.946 (0.554)	-	0.791 (0.232)	0.338*** (0.129)	0.203 (0.238)
Secondary	-	0.139*** (0.0945)	1.990 (0.969)	0.326*** (0.114)	0.732 (0.299)	3.404 (3.429)
Higher Secondary	3.558 (2.969)	0.777 (0.415)	0.339* (0.194)	0.887 (0.356)	0.381* (0.197)	10.32* (13.23)
Diploma, Graduate +	-	-	1.132 (0.639)	1.229 (0.585)	0.908 (0.553)	3.308 (3.790)
Currently Married	13.46*** (10.12)	0.764 (0.333)	0.956 (0.415)	0.583 (0.303)	4.248* (3.447)	2.305 (1.567)
Caste	0.963 (0.524)	3.255*** (1.295)	3.787*** (1.521)	2.865*** (0.704)	1.997** (0.626)	2.761* (1.595)
Muslim	-	31.21* (63.02)	1.709 (2.094)	1.855 (1.481)	0.349 (0.388)	-
Household Size	1.057 (0.0999)	0.828** (0.0668)	0.992 (0.0786)	0.870** (0.0495)	0.939 (0.0628)	0.932 (0.0944)
Children 5 & Under	1.604 (0.787)	1.035 (0.402)	0.791 (0.259)	1.649** (0.370)	3.328*** (1.222)	1.661 (0.954)
Parents & In-laws	0.641 (0.374)	2.791** (1.154)	3.961*** (1.645)	2.551*** (0.812)	1.142 (0.380)	0.778 (0.399)
Female Household Head	0.774 (0.520)	1.231 (0.757)	7.631*** (5.353)	31.03*** (22.39)	232.9*** (245.9)	11.47** (11.52)
<i>Head of Households Primary Activity (Self-Employed as Base)</i>						
Employer	-	1.903 (2.556)	2.458 (2.925)	1.038 (0.769)	7.033** (6.879)	-
Regular Wage/Salary	0.488 (0.284)	0.363*** (0.141)	1.060 (0.357)	0.360*** (0.0908)	0.394*** (0.115)	0.449 (0.251)
Casual Wage/Salary	0.892 (0.702)	0.363* (0.199)	0.688 (0.463)	0.792 (0.335)	1.088 (0.506)	8.509* (10.82)
Domestic Duties	0.615 (0.687)	0.130** (0.117)	0.0664** (0.0740)	0.0460*** (0.0324)	0.0468*** (0.0429)	-
Others	-	-	1.499 (1.370)	-	-	0.219 (0.323)
Constant	0 (0)	11,306 (484,011)	0.0896 (6.223)	2.097e+08 (3.155e+09)	8.393e+15 (2.553e+17)	1.888e+30 (1.913e+32)
Observations	414	298	290	672	489	133
Correctly Classified	90.82%	74.83%	70.34%	76.04%	74.23%	74.44%
LR Chi2	84.47	102.69	75.84	258.12	197.29	43.17
Pseudo R Squared	0.3012	0.2624	0.1956	0.2826	0.2925	0.2341

Hosmer-Lemeshow Chi2	10.27	11.2	10.05	13.3	7.97	9.34
Standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

5.3 Analysis

The aim of this study is to establish the effect that educational attainment has with regard to labour force participation, and how these effects function differently at different levels of attainment. The study considers educational attainment in different contexts, for urban and rural women, and for women across age cohorts. The results for educational attainment indicate a non-linear relationship with female labour force participation. Fig 5.3 graphically illustrates the odds ratios for educational attainment and its effect on labour force participation from test 6 for both rural and urban women. Likewise, fig 5.4 illustrates the odds ratios results for test 7 for urban and rural women. The results show that in different contexts, that of the rural and urban, educational attainment functions differently with respect to labour force participation.

Furthermore, different levels of education change the odds ratios in a non-linear fashion. Fig 5.3 shows that at low levels of attainment, the odds of participating in the labour force relative to being illiterate for rural women, and having secondary education for urban women, increases the likelihood of participating in the labour force. Primary, middle and secondary levels of education have lower odds ratio results, while higher secondary and diploma graduate and above indicate an increase once more in the odds of participation. This agrees with the theory that lower levels of education which are indicative of poverty, suggest a needs-based requirement to work in order to survive. Likewise, low odds ratio results for middle level education agree with the theory of an income effect, and, or, a preference for white-collar work which observes the reservation wage. But, the magnitudes of the results differ between urban and rural settings. For urban women in fig 5.4, the magnitude of the odds ratio reaches nearly 8 for women with diploma, graduate, and above educational attainment.

Figure 5.3: Odds Ratios from Test 6; General Education of Women (Note a value of 1 for base)

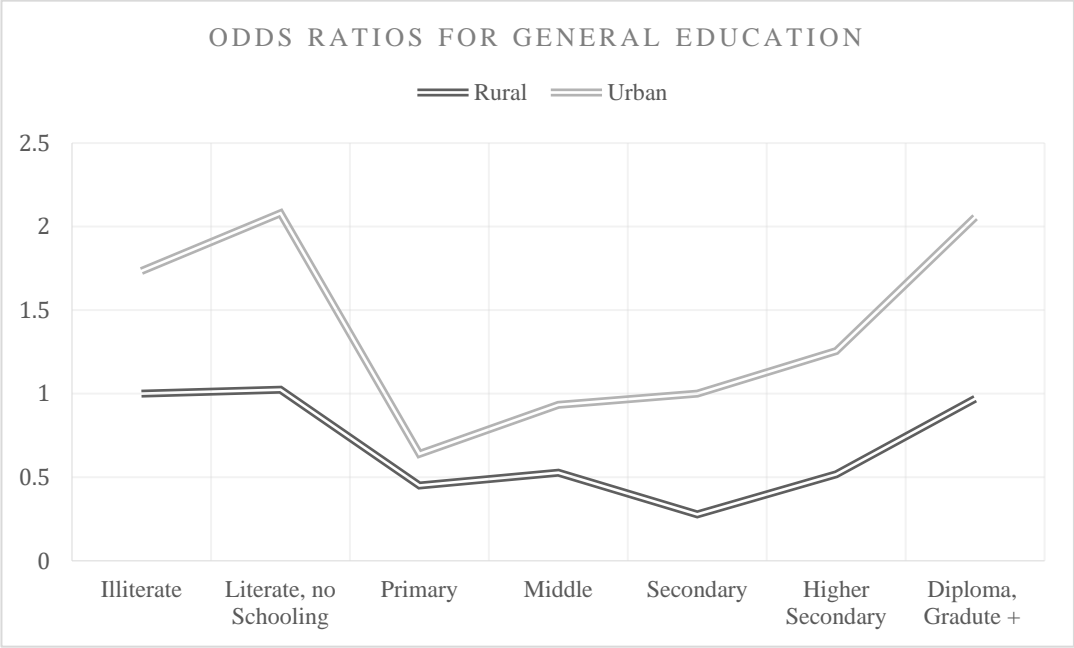
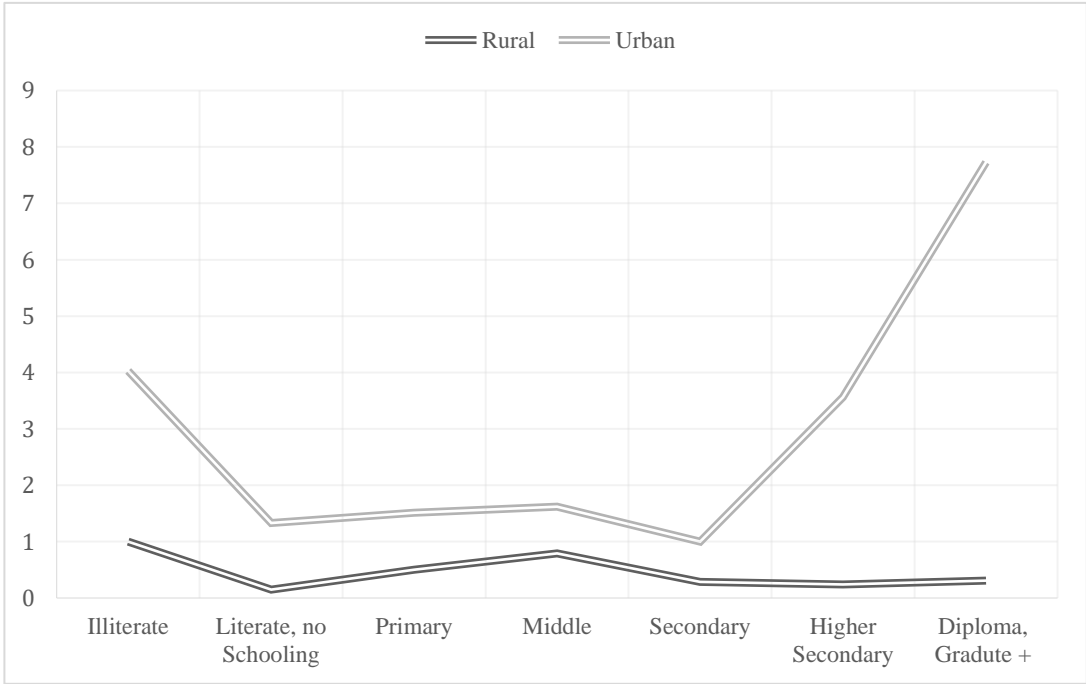
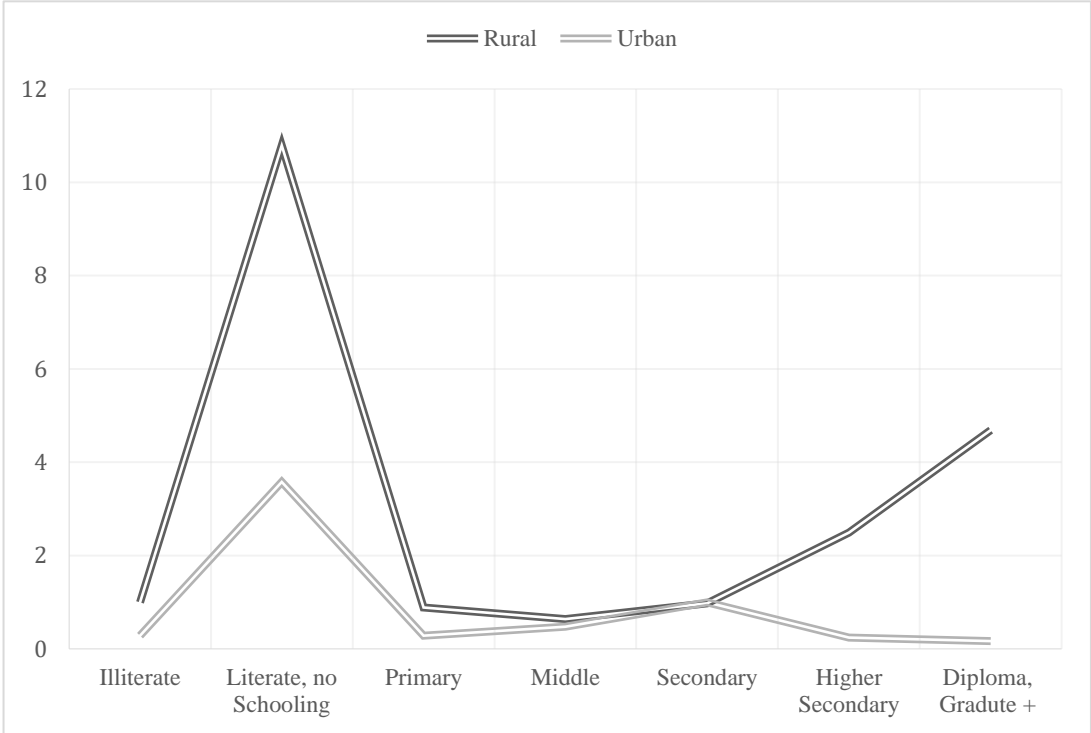


Figure 5.4: Odds Ratios from Test 7; General Education of Women (Note a value of 1 for Base)



There is a non-linear relationship when caste is interacted with education. Fig 5.5 illustrates the results from the interaction variable from test 7, comparing results for rural and urban women. Relative to being illiterate for rural women and having secondary level education for urban women, the highest odds ratio is found for literate with no schooling. Again, the magnitude differs between the rural and urban context. Therefore, the results of this study to a degree agree with the theory that the degrees of educational attainment, as well as belonging to a caste, change the likelihood of a woman participating in the labour force. As rural women from scheduled or tribal castes have few restrictions placed on them especially with regard to their work, the results indicate that when higher levels of educational attainment are achieved, the odds of participating increases agreeing with the self-selection theory. However, for women belonging to a caste and who have middling levels of education, scheduled castes imitate the restrictions placed on women in other higher castes as the results indicate odds ratios below 1. Indeed, for both rural and urban women in fig 5.3, urban women in fig 5.4, and rural women in 5.5, a U-Shaped curve exists between educational attainment and increased odds of participating in the labour force.

Figure 5.5: Odds Ratios from Test 7; Interaction of Caste and General Education for Women (Note value of 1 for Base)



When considering education per cohort, it is clear that many young women are not participating in the labour force because they are pursuing education. At younger ages, labour force participation or lack of participation, is due to pursuing education, where the modeling for group 15-19 has the best result of all the models for a goodness of fit, of 91%, see table 5.3 results.

Although the study cannot consider the effect of belonging to a higher caste on the likelihood to participate in the labour force, it does include women from the lowest social groups; scheduled castes or tribes. The results indicate that for urban and rural women, as well as for most age cohorts, belonging to a lower caste increases the odds of participating in the labour force.

Other social influences such as that of being currently married indicate differing effects on rural and urban women across testing. Earlier testing indicates being married does reduce likelihood of participating in the labour force, suggesting an income effect is taking place for these women. Yet, the results which indicate a result higher than 1 contradict theory. Further testing which considers husbands principle activity status might uncover that wives support husbands who are agriculturally based in farm work, thus accounting for this figure. Likewise, further testing or investigation into other marital statuses such as divorced, or previously married and their effect on labour force participation is an area for further study. Being married is also correlated with age, as more older women are married than younger women. Using the cohort groups, it is clear that older women, between 30 and 59, are married, hovering between 79% to 94% of the observed individuals. It is therefore not surprising that an odds ratio greater than one for this variable is produced because apart from cohort 15-19 and 20-24, the number of women currently married is always a high proportion of total number of women observed above 65%.

The presence of children aged five and under, and of parents in law in a household, contradict theory that woman assume care based responsibilities, and that the presence of parents in law may impose certain expectations on women which prevent her from pursuing paid work. Instead, young children may be expensive to provide for, especially if educational enrolment is increasing in India and child labour is falling. Parents must work to support the family income and child's education. Poorer families may have high aspirations for their children and so they work because they want their children to go to school. Likewise, for parents in law, it may not be affordable to sacrifice wages in order to provide care for relatives.

When testing to see if Muslim women differ in their participation in the labour force, tables 5.1 and 5.2 show two different results. For rural women, the theory that Muslim women are less likely to participate in the labour force is contradicted by the results which show consistently across testing that the odds ratio is double times the odds if a woman is Muslim. That being the case for these observations, poverty and the necessity to support a family income negates any expectations placed on women to remain in the domestic sphere. Yet, urban Muslim women are less likely to participate in the labour force as the odds ratio is below 1. Due to there being too few observations; only 12 and 19 Muslim women in the rural and urban areas, these results are entirely statistically insignificant nor robust and so further studies with more observations may want to investigate this further.

There are limitations with data with regards to correlation and collinearity, especially between age, age squared, and marital status, see tables B.1 and B.2 in the Appendix. Limited sample sizes, especially when testing by age cohort or for Muslim women, also reduces statistical significance of the results where some results are missing because there are too few observations.

5.4 Further Discussion

The tests for goodness of fit of the models range from 60% to 80% indicating that the variables included in measuring associations with female labour force participation do not fully account for why some women participate in the labour force and others do not. As such, further discussion includes other contributing factors that also account for the low female LFPR.

If women are not participating in the labour force despite having middle, secondary, and higher secondary level education, but they have a preference for white-collar work, there may be a lack of employment opportunities available to Indian women who would supply their labour if they could (Verick, 2018; Motkuri, 2016; Klasen & Pieters, 2013). It is not only the supply of women to work, but the demand of female labour that has played a role in falling female labour force participation, and as such, a further area to explore is sectoral employment and occupational segregation. Sorsa et al (2015) suggest that sluggish job growth partly explains the low female LFPR, and that the unemployment of many educated women in rural and urban areas indicate that if jobs were to be made available, women would like to work.

Additionally, women would supply their labour more if female-friendly jobs were made available (Dasgupta & Goldar, 2005; Rustagi, 2013). Interventions that allow for facilities for the care of young children during working hours, better modes of payment, and greater training would allow women to move out of the domestic sphere and to improve households' economic conditions (Dasgupta & Goldar, 2005). Likewise, improving access to technology and training which in turn enhances productivity and increases skills of women (Verick, 2018), and improving the safety of female workers in the private sector (Klasen & Pieters, 2013) are other ways of improving the supply of female labour. Therefore, further study could focus on interventions which increase women's supply and productivity of labour.

Other discussion relates to the limitations of this study and the very nature of female work and its casual nature (Kapsos et al, 2014; Hirway, 2012). Confusion over the measurement of female labour force participation and the differentiation between informal and sporadic work, unpaid labour, and the collection or growing of goods for household consumption, should not be recorded as domestic duties or interpreted as not participating in the labour force (Hirway, 2012). As such, the NSSO data is limited in fully capturing the nature of women's work and has not fully accounted for female labour across the years (Hirway, 2012). In addition, measuring labour force participation whilst indicating that some women are employed, fails to recognise quality of employment, especially if working as a woman from a lower caste only allows certain types work, which is of poor quality (Das & Desai, 2003). Further study could therefore find ways of capturing the way women work, intensity of work, and quality of work more accurately to understand the complex nature of female labour force participation better.

6 Conclusion

This study uses individual micro-level data provided by the NSSO from 2011-2012 to investigate factors associated with the female LFPR in India. The data is manipulated to create new variables used in three different logit regressions; rural women, urban women, and by age cohort. The results are given in the form of odds ratio which capture the variables associated with an increase or decrease in the odds of participating in the labour force. In response to the Question 1. *What effect does educational attainment have on women's labour force participation in India?*, this study finds that educational attainment is associated with female labour force participation in India, and that different levels of general education correspond to a change in the likelihood of a woman participating in the labour force. For Question 2. *What effect do other cultural factors such as caste, and its interaction with education, have on women's labour force participation?*, this study finds that educational attainment combined with caste are associated with female labour force participation in India. The different levels of educational attainment combined with belonging to a scheduled caste or tribe, correspond to differing effects on female labour force participation. This study confirms that factors effecting female labour force participation change in magnitude depending on context or rural or urban location, where a U-Shaped association exists for urban and rural women belonging to a lower social group.

Between the urban and rural regions, there are different levels of economic development and educational attainment, and so there are differing outcomes on women and their decision to join the labour market. The results have answered the main aims of this study by uncovering how different levels of development and educational attainment correspond to the likelihood of a woman participating in the labour force.

However, the results of this study have, to a degree, confirmed these assumptions. This is because the results of the study, depending on context, do not confirm a U-Shaped association between the odds of labour force participation, education and scheduled caste or tribe. It does not account for other levels of caste due to the nature of the data and so the effect that higher levels of caste have on female labour force participation are not considered. Likewise, the effect of rising income on lower castes and their increasing aspirations for status, which sees the withdrawal of women from the labour force as a status symbol, could be an aspect for further study. The study finds that other social and cultural contexts which restrict women's participation, such as that of being married or being Muslim, actually increase the odds of participating in the labour force. Further areas of study should explore these factors in greater depth.

The results indicate that the development of India is uneven. The number of illiterate women who must work out of necessity show that further progress must be made to improve the standard of living by reducing the reliance of needs-based work. Women would benefit from furthering their education, and so too would the white-collar industries if they were to employ

them as they become skilled. However, this is based on the assumption that there is enough demand for female labour from the white-collar sectors, which may not always be the case. The results indicate that further research into the demand for female labour and sectoral employment, as well as the improvement of data collection methods, is essential in finding out more about determinants of the low FLPR.

In summary, the study considers the associations related to female labour force participation at the micro-level during the period 2011-2012. It provides insight into the effect of educational attainment and social and cultural norms surrounding women's labour. The study contributes to the discussion with regard to the causes of the falling female LFPR in India, and acts as a precursor to the next round of NSSO data taking place in the coming years.

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Appendix A

Table A.1: Descriptive Statistics for Full Data and Microdata set, at Household and Individual Level for Continuous Variables

Households												
Continuous Variables												
	Full Data Set						Micro Data Set					
	Obs.	Missing	Min	Max	Mean	Std. Dev	Obs.	Missing	Min	Max	Mean	Std. Dev
N	101,724						1,680					
<u>Household Size</u>	101,724	0	1	39	4.5	2.2	1,680	0	1	18	4.52	2.12

Individuals												
Continuous Variables												
	Full Data Set						Micro Data Set					
	Obs.	Missing	Min	Max	Mean	Std. Dev	Obs.	Missing	Min	Max	Mean	Std. Dev
N	456,999						7,600					
<u>Age</u>	456,999	0	0	110	28.7	19.2	7,600	0	0	90	25.4	16.5

Table A.2: Descriptive Statistics for Full Data and Microdata set, at Household Level for Categorical Variables

Households						
Categorical Variables						
	Full Data Set			Micro Data Set		
	Obs.	Percent	Missing	Obs.	Percent	Missing
N	101,724			1,680		
<u>Rural or Urban</u>	101,724		0	1,680		0
Rural	59,700	58.70%		1,072	63.80%	
Urban	42,024	41.30%		608	36.20%	
<u>Religion</u>	101,723		1	1,680		1
Hinduism	77,035	75.70%		458	27.30%	
Islam	13,276	13.10%		33	1.90%	
Christianity	6,931	6.80%		368	21.90%	
Sikhism	2,093	2.10%		2	0.10%	
Jainism	305	0.30%		1	0.10%	
Buddhism	1,101	1.10%		217	12.90%	
Zoroastrianism	5	0.00%		1	0.10%	
Others	977	0.90%		600	35.70%	
<u>Caste</u>	101,722		2	1,680		1
Scheduled Tribe	13,406	13.20%		1,141	67.90%	
Scheduled Caste	15,652	15.40%		32	1.90%	
Other Backward Class	39,721	39.00%		29	1.70%	
Others	32,943	32.40%		478	28.50%	

Table A.3: Descriptive Statistics for Full Data and Microdata set, at Individual Level for Categorical Variables

Individuals

Categorical Variables

	Full Data Set			Micro Data Set		
	Obs.	Percent	Missing	Obs.	Percent	Missing
N	456,999			7,600		
<u>Rural or Urban</u>	456,999		0	7,600		0
Rural	280,763	61.40%		5,155	67.80%	
Urban	176,236	38.60%		2,445	32.20%	
<u>Sex</u>	456,999		0	7,600		0
Male	233,804	51.20%		3,934	51.80%	
Female	223,195	48.80%		3,666	48.20%	
<u>General Education</u>	456,362		637	7,587		13
Not literate	117,712	25.80%		1,841	24.30%	
Literate without formal schooling						
EGS/ NFEC/ AEC	1,101	0.20%		55	0.70%	
Literate without formal schooling: TLC	203	0.00%		8	0.10%	
Literate without formal schooling: Others	1,257	0.30%		45	0.60%	
Literate: below primary	75,103	16.50%		1,111	14.60%	
Literate: primary	62,531	13.70%		1,180	15.60%	
Literate: middle	68,770	15.10%		1,220	16.10%	
Literate: secondary	53,116	11.60%		905	11.90%	
Literate: higher secondary	36,346	8.00%		672	8.90%	
Literate: diploma/certificate course	4,795	1.10%		44	0.60%	
Literate: graduate	27,044	5.90%		448	5.90%	
Literate: postgraduate and above	8,384	1.80%		58	0.70%	
<u>Marital Status</u>	456,939		60	7,595		5
Never Married	212,393	46.50%		4,077	53.70%	
Currently Married	221,235	48.40%		3,264	42.90%	
Widowed	21,783	4.80%		211	2.80%	
Divorced/Separated	1,528	0.30%		43	0.60%	
<u>Usual Principle Activity Status</u>	456,999		0	7,600		0
Self Employed (HH Enterprise)	58,515	12.80%		1,613	21.20%	
Employer	2,746	0.60%		28	0.40%	
Unpaid Family Worker (HH Enterprise)	23,670	5.20%		146	1.90%	
Regular Salaried/Wage Worker	39,896	8.70%		691	9.10%	
Casual Wage Labour, Public	1,664	0.40%		97	1.30%	
Casual Wage Labour, Other	31,844	7.00%		110	1.50%	
Seeking/Available for Work	6,285	1.40%		60	0.80%	
Attended Education	130,492	28.50%		2,846	37.50%	
Attended Domestic Duties	57,852	12.60%		686	9.00%	
Domestic Duties and Collection	41,190	9.00%		479	6.30%	

Pensioner/Remittance	7,824	1.70%	8	0.10%
Disabled and Cannot Work	5,523	1.20%	48	0.60%
Begging/Prostitution	13,040	2.90%	276	3.60%
Child 0-4	36,458	8.00%	512	6.70%

Table A.4: Descriptive Statistics for Rural and Urban Women Aged 15-59 for Continuous Variables

Women Aged 15-59

	Continuous Variables									
	Rural Women					Urban Women				
	Obs.	Min	Max	Mean	Std. Dev.	Obs.	Min	Max	Mean	Std. Dev.
N	1,591					742				
<u>Age</u>	1,591	15	59	31.67	11.38	742	15	58	31.06	10.24
<u>Age Squared</u>	1,591	225	3,481	1,131.64	767.19	742	225	3,364	1,069.72	657.39
<u>Household Size</u>	1,591	1	18	5.74	2.36	742	1	14	4.95	2.10

Table A.5: Descriptive Statistics for Rural and Urban Women aged 15-59 for Categorical Variables

Women Aged 15-59

	Categorical Variables			
	Rural Women		Urban Women	
	Obs.	Percent	Obs.	Percent
N	1,591		742	
<u>General Education</u>				
Illiterate	501	31.49%	111	14.96%
Literate: Without Formal Schooling	127	7.98%	40	5.39%
Literate: Primary	237	14.90%	76	10.24%
Literate: Middle	304	19.11%	114	15.36%
Literate: Secondary	221	13.89%	180	24.26%

Literate: Higher Secondary	127	7.98%	128	18.60%
Diploma, Graduate and Postgraduate	74	4.65%	83	11.19%
<u>Marital Status</u>				
Never Married	462	29.04%	198	26.68%
Currently Married	1,046	65.74%	526	70.89%
Widowed	64	4.02%	16	2.16%
Divorced/Separated	16	1.01%	2	0.27%
Missing Value	3	0.19%	0	0.00%
<u>Caste</u>				
Scheduled Tribe	1,280	80.45%	435	58.63%
Scheduled Caste	15	0.94%	18	2.42%
Other Backward Caste	9	0.57%	22	2.96%
Others	287	18.04%	267	35.98%
<u>Religion</u>				
Hinduism	237	14.90%	295	39.76%
Islam	12	0.75%	19	2.56%
Christianity	463	29.10%	119	16.04%
Sikhism	0	0.00%	2	0.27%
Jainism	4	0.25%	0	0.00%
Buddhism	256	16.09%	59	7.95%
Zoroastrianism	1	0.06%	0	0.00%
Others	618	38.84%	248	33.42%
<u>Usual Principal Activity Status</u>				
Self Employed	519	32.62%	51	6.87%
Employer	2	0.13%	0	0.00%
Unpaid Family Worker	88	5.53%	10	1.35%
Worked - Regular Wage / Salary	41	2.58%	56	7.55%
Worked - Casual Wage Labour: Public Works	17	1.07%	5	0.67%
Worked - Casual Wage Labour: Other Types	19	1.19%	7	0.94%
Seeking / Available for Work	15	0.94%	13	1.75%
Attended Educational Institution	291	18.29%	165	22.24%
Attended Domestic Duties Only	232	14.58%	349	47.04%
Attended Domestic Duties and Collection of Free Goods	351	22.06%	69	9.30%
Rentiers / Pensioners / Remittance	1	0.06%	0	0.00%
Disabled and Unable to Work	5	0.31%	1	0.13%
Others - Begging, Prostitution	10	0.63%	16	2.16%
<u>Head of Household's Principle Activity Status</u>				
Self Employed	1,046	65.74%	225	30.32%
Employer	27	1.70%	8	1.08%
Worked - Regular Wage: / Salary	317	19.92%	438	59.03%
Worked in Casual Wage: Labour Public / Other	99	6.22%	52	7.01%
Seeking / Available for Work	0	0.00%	1	0.13%
Attended Domestic Duties / Collection of Free Goods	93	5.85%	1	0.13%
In Education, Pensioner, Disabled or Other	9	0.57%	17	2.29%

Table A.6: Descriptive Statistics for Rural and Urban Women aged 15-59 for Dummy Variables

Women Aged 15-59				
Dummy Variables				
	Rural Women		Urban Women	
	Obs.	Percent	Obs.	Percent
N	1,591		742	
<u>Participating in Labour Force</u>				
No	890	55.94%	600	80.86%
Yes	701	44.06%	142	19.14%
<u>Currently Married</u>				
No	545	34.26%	216	29.11%
Yes	1,046	65.74%	526	70.89%
<u>Lower Caste/Tribe</u>				
No	296	18.60%	289	38.95%
Yes	1,295	81.40%	453	61.05%
<u>Muslim</u>				
No	1,579	99.25%	723	97.44%
Yes	12	0.75%	19	2.56%
<u>Head of Household Participating in Labour Force</u>				
No	102	6.41%	18	2.43%
Yes	1,489	93.59%	724	97.57%
<u>Children 5 and Under Present</u>				
No	1,063	66.81%	558	75.20%
Yes	528	33.19%	184	24.80%
<u>Parents in Law Present</u>				
No	1,177	73.98%	672	90.57%
Yes	414	26.02%	70	9.43%
<u>Female Head of Household</u>				
No	1,463	91.95%	678	91.37%
Yes	128	8.05%	64	8.63%

Appendix B

Table B.1: Testing for Correlation For Rural Women Aged 15-59

	LFP	Age	Age2	General_Ed~n	Currently_~d	Caste	Muslim	Size_H~d	Childr~r	Parent~t	Female~d	Head_O~v
LFP	1.0000											
Age	0.2505	1.0000										
Age2	0.2205	0.9852	1.0000									
General_Ed~n	-0.2492	-0.3774	-0.3766	1.0000								
Currently_~d	0.1791	0.5396	0.4576	-0.2413	1.0000							
Caste	0.1250	-0.0017	0.0021	-0.0184	-0.0796	1.0000						
Muslim	0.0251	0.0589	0.0599	0.0352	0.0476	-0.1263	1.0000					
Size_House~d	-0.0170	-0.0717	-0.0514	0.0026	-0.1469	0.1846	-0.0459	1.0000				
Children_5~r	0.1139	-0.0438	-0.0675	-0.1342	0.2134	0.0831	-0.0152	0.2517	1.0000			
Parents_In~t	0.0969	0.0304	0.0472	-0.0217	-0.0066	0.0995	-0.0517	0.4766	0.1753	1.0000		
Female_Head	0.1424	0.0481	0.0580	-0.0558	-0.3027	0.0761	0.0009	-0.1263	-0.0858	0.0089	1.0000	
Head_Of_Ho~v	-0.2291	-0.0087	-0.0087	0.1303	0.0164	-0.0348	-0.0149	0.0156	0.0004	0.0469	-0.0123	1.0000

Table B.2: Testing for Correlation For Urban Women aged 15-59

	LFP	Age	Age2	General_Ed~n	Currently_~d	Caste	Muslim	Size_H~d	Childr~r	Parent~t	Female~d	Head_O~v
LFP	1.0000											
Age	0.2085	1.0000										
Age2	0.2007	0.9862	1.0000									
General_Ed~n	-0.0744	-0.2031	-0.2100	1.0000								
Currently_~d	0.0553	0.6251	0.5488	-0.2039	1.0000							
Caste	0.0865	-0.0737	-0.0657	0.1010	-0.0920	1.0000						
Muslim	-0.0138	0.0040	-0.0055	-0.1776	0.0475	-0.1680	1.0000					
Size_House~d	-0.1247	-0.1537	-0.1271	-0.0665	-0.1430	0.2271	-0.0406	1.0000				
Children_5~r	0.0300	-0.1120	-0.1329	-0.1852	0.1688	-0.0213	0.0255	0.2191	1.0000			
Parents_In~t	0.0071	0.0119	0.0304	-0.1552	0.0343	-0.1015	0.0061	0.3939	0.2311	1.0000		
Female_Head	0.3509	0.0262	0.0375	-0.0082	-0.2364	0.0387	-0.0194	-0.2069	-0.0875	-0.0006	1.0000	
Head_Of_Ho~v	-0.0566	-0.0323	-0.0177	0.0008	0.0063	-0.0459	0.0032	0.0226	0.0197	0.1326	0.1028	1.0000