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Why is the Labour Force Participation of Women Declining in India?

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Summary. — This paper explores the recent fall in female labour force participation and its socio-economic determinants in India. The major contribution of this paper is: to explore both micro- and macro-level factors which determine female labour force participation rate (LFPR); to examine the "U shape" female LFPR, by examining the likely income and substitution effects of the real wage increase, to identify the sub-sectors within manufacturing and service sectors that could create jobs for new female job aspirants and those older women displaced from agriculture in recent years; and thus to understand the conditions under which female LFPR could be raised. Using both macro-level and household survey (NSS) data, we find that the recent fillip in the process of structural transformation has pushed a large number of females out of agriculture. The growing mechanization in agriculture and rising capital intensity in manufacturing sectors together have limited the opportunity for females because of their low education and skill and due to other cultural constraints. We also found that the rise in real wages in rural areas and the consequent improvement in the standard of living has produced a strong negative income effect which outweighs the positive substitution effect and as a result female LFPR has declined substantially. However, with the massive increase in female enrollment in secondary and higher levels of education, it could be expected that the substitution effect of the increase in real wage would become stronger if appropriate measures are taken by the government, which are suggested.

Key words — structural transformation, female employment, instrumental variables (IV) estimation

1. INTRODUCTION

India has experienced a decline in female labor force participation over the last three decades. A sharp decline in the female labor force participation rate (LFPR) during periods of high economic growth for low-income countries is partly natural, but partly a cause of concern that requires special policy attention of the government. While exploring the pattern of female LFPR, studies like Goldin (1994), Mammen and Paxson (2000), Fatima and Sultana (2009), Tam (2011), Gaddis and Klasen (2014), and Chaudhary and Verick (2014) claim that the female labor force participation rate follows a "U shape" i.e., (i) for countries with a relatively low per capita income female LFPR is very high, (ii) for countries with relatively high per capita income it is also quite high, whereas (iii) the countries that belong to the middle-income category (on the basis of per capita GDP on PPP) have a relatively low female LFPR.

This paper focuses on trends in female LFPR for India. The Indian economy is experiencing rapid economic growth, [1] and made a transition from a low-income to a low-middle-income country in 2007. [2] India's per capita Gross National Income (GNI) was about $306.21 (at US$ 2010) in 1960, which increased to $534.85 and to $762.26 during 1990–2000 respectively, but by 2007 it became 1125.34 (at US$ 2010). It is expected that with rising income and increasing structural transformation the female LFPR would begin to rise. The major contribution of this paper is: (i) to explore both micro- and macro-level factors (social and economic) which simultaneously determine female labor force participation in India, which is a more complex phenomenon than it appears; (ii) to carry forward the discussion on "U shape" female LFPR by examining the likely *income* and *substitution effects* of the real wage increase in India, an important aspect which is not discussed in existing empirical studies; (iii) to identify the sub-sectors within manufacturing and service sectors that could create jobs for new female job aspirants as well as for those who lack skill and have been displaced from agriculture in recent years; (iv) and thus to understand the conditions under which female LFPR could be raised, and suggest policy measures accordingly.

The process of structural transformation got a fillip in recent years (after 2004–05) with an absolute fall in agriculture employment and a corresponding rise in construction, manufacturing (particularly in the labor intensive units) and service sector employment. Durig 2004–05 and 2011–12, of a total 37 million decline in agricultural employment (see Mehrotra, Parida, Sinha, & Gandhi, 2014) about 31 million were female workers (see Table 1), or about 84% of the total decline. Although about 9 million female workers joined the non-agricultural sectors (5.5 million in non-manufacturing, [3], 0.3 million in manufacturing and 3 million in service sectors) with diverse levels of skills, a large number of females have withdrawn from the labor force to participate in education and in domestic duties. [4] The sharp decline in poverty (see Chauhan, Mohanty, Subramanian, Parida, & Padhi, 2016) and an improvement in household standard of living in the post 2004–05 period might have caused a behavioral change among women with respect to their participation in the labor force. However, lack of appropriate education and skills among female workers often restricts a large number of females from taking advantage of processes of structural transformation. Furthermore, unavailability of semi-skilled and relatively skilled jobs within the vicinity of female workers (given the cultural constraints on moving on their own, as single women), and lack of appropriate safety measures in the context of rising criminal activities [5] against women might have restricted many new young female entrants from participating in the labor market. Since the Indian economy is expe-

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Table 1. *Female labour force (in million) by socio-economic groups in India, 1983–2012*

Age groups	Size of Female Labour Force (UPSS)in million				
	1993	1999–2000	2004–05	2009–10	2011–12
Age groups					
Less than 15 years	6.1	4.9	4.0	2.0	1.5
15–29 years	44.0	43.2	49.1	37.8	36.3
30–59 years	66.7	72.1	91.1	81.0	84.3
60 years and above	6.2	6.6	8.6	8.5	8.8
15–59 years	110.6	115.3	140.2	118.8	120.7
Level of education					
Illiterate	91.4	88.1	94.4	68.4	66.6
Primary	28.1	33.9	49.7	50.4	51.4
Secondary	1.3	1.8	4.3	4.5	5.5
Graduate and above	2.1	2.9	4.3	6.0	7.5
Marital status					
Un-married	17.2	16.6	20.0	15.2	14.8
Married	91.0	95.8	115.6	96.8	99.6
Widow	0.0	12.5	15.3	15.9	15.1
Divorced/separated	1.4	1.9	1.9	1.4	1.4
Social groups					
ST	17.0	13.8	20.0	17.2	18.0
SC	25.8	21.4	32.4	28.5	27.3
OBC	NA	35.4	65.6	56.1	56.9
Others	80.1	24.3	34.8	27.5	28.8
Economic groups					
MPCE Quinitile 1	37.8	46.1	54.6	34.2	34.6
MPCE Quinitile 2	29.7	29.7	36.7	29.9	29.9
MPCE Quinitile 3	23.7	23.9	26.3	27.1	27.3
MPCE Quinitile 4	17.9	17.1	19.9	22.6	22.6
MPCE Quinitile 5	12.7	10.1	15.2	15.4	16.6
Total	121.8	126.8	152.7	129.2	131.0

Source: Authors' estimates from the NSS Unit-level data, various rounds.

riencing rising per capita income as well as a quickening of the pace of structural transformation, it is important to know whether female LFPR in India would continue to decrease, if so why and for how long? What are the socio-economic factors that restrict females from participating in the labor market, and undertake more household responsibilities by doing more and more domestic duties? Is there any possibility that the female LFPR would start rising given the fact that more young girls are participating in secondary and higher levels of education? And what could be appropriate policy measures that might help female LFPR to start rising? This paper tries to answer these questions by exploring the recent trends and patterns of female employment, and understanding the determinants (both at micro and macro levels) of female labor force participation in India.

The paper is organized in six sections. Section two provides a brief review of the theories and cross-country empirical studies on female labor force participation. Section three provides some stylized facts including recent trends and changing patterns of female employment and labor force participation in India. In section four we explain the methodology for our study based on nationally representative sample surveys. It presents the data and econometric methodology used in the empirical estimation of female labor force participation functions. Section five explores both micro- and macro-level determinants of female labor force participation in India based on probit and IV-probit regression estimates, and also discusses the "U shape" pattern of female LFPR. Section six outlines policy measures for improving female LFPR in India.

2. A BRIEF REVIEW OF LITERATURE

There are mainly two views on what determines female labor force participation. The first strand of literature argues that females participate in the labor market either to maximize their own utility function or to maximize their households' total welfare (see Becker, 1965; Bardhan, 1979; Franz & Kawasaki, 1981; Goldin, 1983a, 1983b; Heckman & McCurdy, 1980; Renaud & Siegers, 1984; Kooreman & Kapteyn, 1984). The second strand of literature explains how structural factors determine the female LFPR at macro level, leading to a "U shape" female labor force participation curve in the course of economic development (see Durand, 1975; Pampel & Tanaka, 1986; Psacharopoulos & Tzannatos, 1989; Schultz, 1990; Schultz, 1991; Kottis, 1990; Goldin, 1994; Horton, 1996; Tansel, 2001; Mammen & Paxson, 2000, 2008; Fatima & Sultana, 2009; Luci, 2009; Tam, 2011; Klasen & Pieters, 2012; Bhalla & Kaur, 2011; Fatima & Sultana 2009; Gaddis & Klasen, 2014; Chaudhary & Verick, 2014).

According to the first view, a set of micro-level factors including individual characteristics (age, level of education and experience), household income, and the expected market

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wage play an important role in determining female labor force participation. Earlier studies conducted in various developed countries have found that both individual- and household-level factors determine female LFPR. These studies include Fuchs (1984), Goldin (1980), Goldin (1983a, Goldin (1983b), Smith and Ward (1985), and Blau and Kahn (2007, 2013) for United States; Nakamura and Nakamura (1981), Nakamura, Nakamura, and Cullen (1979) for USA and Canada; Joshi, and Owen (1984), Joshi and Owen (1985) and Martin and Roberts (1984) for Britain; Boothby (1984), Smith and Stelcner (1985), and Robinson and Tomes (1985) for Canada; Franz and Kawasaki (1981) for Germany; Bourguignon (1985) for France; Hill (1984), Yamada and Yamada (1984, 1985) and Yamada, Yamada, and Chaloupka (1985) for Japan; and Kooreman and Kapteyn (1984), Renaud and Siegers (1984) and van der Veen and Evers (1984) for Netherland. However, the studies conducted in developing countries (see Polachek, 1981; Becker, 1985; Macpherson & Hirsch, 1995; Schultz, 1990; Duflo & Udry, 2004; Heim, 2007; Luke & Munshi, 2011) draw attention to issues like intra-household bargaining, women's self-selection and their occupational choices which together have a significant influence on female LFPR at the micro level.

On the other hand, evidence from cross-country studies like Durand (1975), Mincer (1985), Pampel and Tanaka (1986), Psacharopoulos and Tzannatos (1989), Schultz (1990, 1991), Kottis (1990), Goldin (1994), Horton (1996), Mammen and Paxson (2000), Tansel (2001), Fatima and Sultana (2009), Luci (2009), Tam (2011), Klasen and Pieters, (2012), Bhalla and Kaur (2011), Gaddis and Klasen (2014), Chaudhary and Verick (2014), Lechman and Kaur (2015), Kapsos, Silberman, and Bourmpoula, (2014), Das, Chandra, Kochhar, and Kumar (2015), Klasen and Pieters (2015) and Sorsa *et al.* (2015) suggest that female labor force participation follows a "U-shaped" pattern. Female LFPR is high in low-income countries, relatively low in middle-income countries, but quite high in the high-income or developed economies. Most developing countries (like many South American countries, and a few African and Asian countries including India) undergoing structural transformation from a low-income to middle-income country status, have experienced declining share of output and employment in agriculture and a corresponding rise in the share of output and employment in industry and service sectors (see Kingombe & te Velde, 2013; Briones & Felipe, 2013; Gaddis & Klasen 2014; Mehrotra *et al.*, 2014; Ferreira & da Silva, 2014). During structural transformation as women move out[6] of agriculture because of income and substitution effects (Goldin, 1994), female LFPR starts falling, it reaches a minima and then starts moving upward as women acquire appropriate skills and return to the labor force at an advanced stage of development to participate in non-agricultural jobs.

In India, while explaining employment trends, studies like Sudarshan and Bhattacharya (2009), Himanshu (2011), Rangarajan, Kaul, and Seema (2011), Kannan and Raveendran (2012) and Mehrotra *et al.* (2014), and in examining the "U shape" female LFPR studies like Klasen and Pieters (2012), Klasen and Pieters (2015), Bhalla and Kaur (2011), Chaudhary and Verick (2014), Kapsos *et al.* (2014), Das *et al.* (2015), Klasen and Pieters (2015) and Sorsa *et al.* (2015) find that female LFPR has been declining. And this decline is due to both demand and supply side factors. From the demand side there is shrinking labor demand in agriculture (which is where women have been historically employed) due to growing mechanization and rising incomes, and on the supply side increasing enrollment among young girls in primary and secondary education, which together were responsible for the sharp decline of female LFPR in India (Mehrotra, 2016; Mehrotra & Sinha, 2017). These studies examine these factors in detail, but these studies do not delve deeper into the household-level implications for women's decision to join the labor force or not. Rising incomes and rising enrollment would likely raise a new set of challenges for government and for these young girls too. Therefore we delve into both macro-level and micro-household-level factors determining the female LFPR.

The important question at this point is whether, going forward, they would participate in the labor force in increasing numbers (that would likely push the female LFPR upward) or remain out of the labor force. This is very difficult to answer. For example the improved standard of living particularly in rural areas (see Mehrotra *et al.*, 2014) due to rising real wages (or income) could have both a positive and a negative impact on female LFPR. First, those who have lost their job in agriculture due to mechanization are either likely to search (with their low level of skill endowments) for alternate occupations in non-agriculture or withdraw from the labor force due to the improved household living standard. Second, the improved living standards would enable households to spend more and a large share on higher education (since both primary and secondary education are almost free[7]) including vocational and technical education, which would consequently increase the number of female skilled job seekers in the non-agricultural sectors.

In this milieu, the paper intends to study both macro and micro-level factors that determine female LFPR in India, which are otherwise not explored by existing empirical studies. The paper also intends to carry forward and strengthen the discussion on the "U shaped" female LFPR, considering the likely influence of real wage increase (income and substitution effects) in both rural and urban India, an important issue not yet examined. There is clear evidence that women suffer from lower levels of education, and have fewer opportunities to enhance their skills (Mehrotra, 2014). Hence, we also intend to identify the employment generating subsectors in manufacturing and service that could create jobs for existing low-skilled females leaving agriculture and better skilled new job aspirants. Finally we wish to explore the conditions under which female LFPR could start rising to hasten the process of structural transformation and thus help sustaining economic growth in the long-run. However, we must first spell out trends in female LFPR in India.

3. FEMALE LABOR FORCE PARTICIPATION IN INDIA: SOME STYLIZED FACTS

(a) *Female LFPR trends*

Female labor force participation rate (LFPR) in India has been declining for the last three decades showing a systematic pattern (See Figure 1: Panel A). Consistent with the U-shaped hypothesis, during 1983 and 1993–94 the female LFPR was quite high (about 45% overall and about 63% among working age women[8]). It started falling but remained almost constant (about 29% overall and about 45% among working age women) during the post economic reforms period (1993–94 and 2004–05), and it declined further during the post second generation reforms period (post 2004–05 period) to reach a very low level (about 22% for all females and about 33% among working age women). While the decline of female LFPR among the age group 6–14 years (child workers) from

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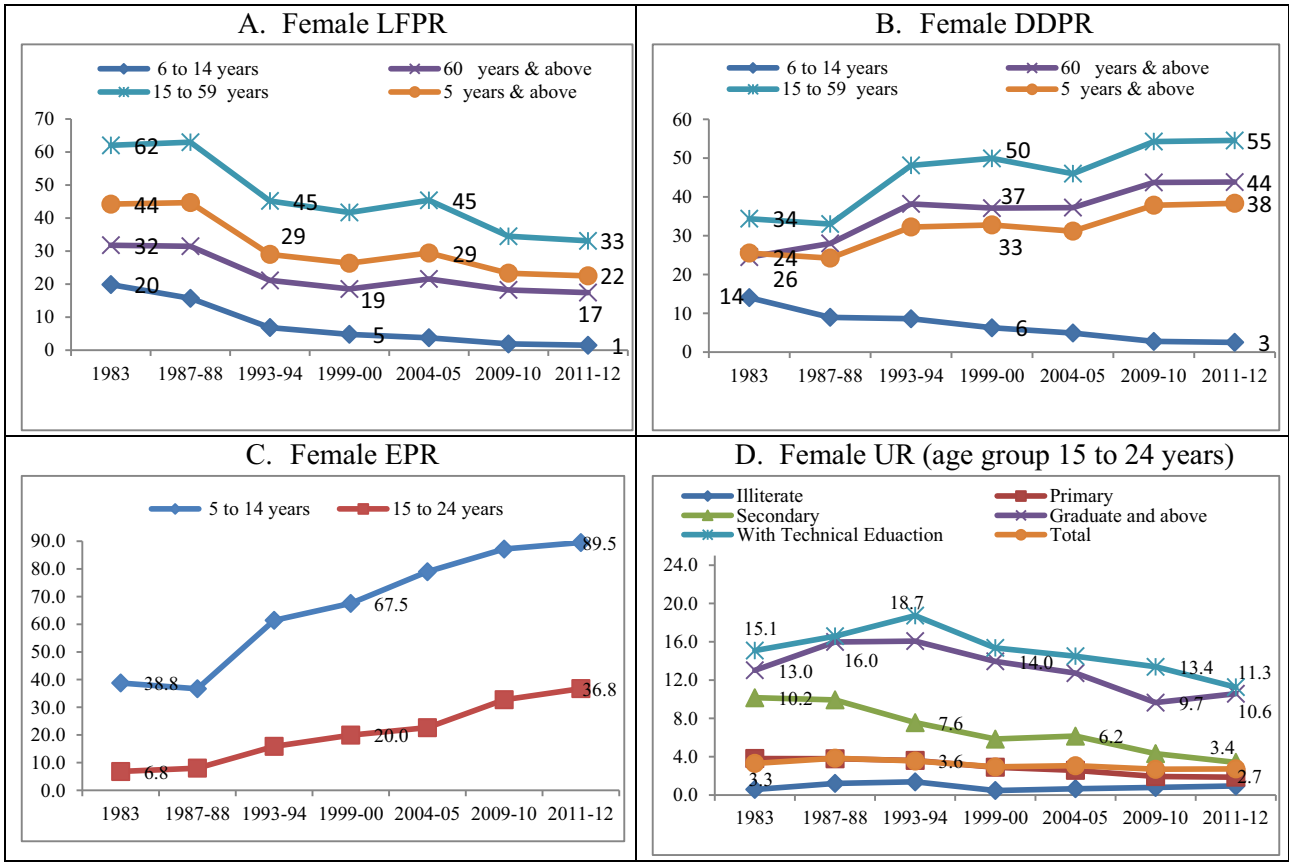

Figure 1. *Female labour force participation rate (LFPR), Domestic Duty Participation Rate (DDPR), Education Participation Rates (EPR) and Unemployment Rates (UR) by Age groups in India, 1983–2012. Note: All the above figures are based principal and subsidiary status (UPSS). Source: Authors' estimates from the NSS Unit-level data, various rounds.*

very high (about 20% during 1983) to a negligible 1% (during 2011–12) is a good sign, the sharp decline of LFPR among working age women (15–59 years) is a cause for concern among both academics and policy makers.

(i) *Why has female LFPR been declining?*

The reasons for declining female LFPR could be classified as structural and behavioral. In the last decade simple technological advancements have been taking place in Indian agriculture, with growing mechanization [9] in agriculture in precisely the activities that women engaged in (e.g., threshing, winnowing), as a result of which women lost work. Secondly, due to increasing demand for skilled labor in the manufacturing/non-manufacturing sectors and modern services women are not able to compete for jobs as their education levels are lower (see Figure 2: Panel A) (also see Mehrotra, 2014). This is clearly reflected in their share in total industrial (manufacturing and non-manufacturing) and service sector employment (See Figure 2: Panel C through E).

The social structure (characterized by a complex caste/religious system) often restricts females from participating in the labor market in India (see Desai & Jain, 1994). Patriarchal norms restrict women to perform specific domestic activities and they are often discouraged from going out of the home alone, especially to take up gainful employment. We have seen (Figure 1: Panel B) that domestic duty participation among working age women is quite high (above 50%) and more importantly, increasing over the years. We also have a relatively high coefficient of correlation showing an inverse relationship between female LFPR and dependency ratio within the household (−0.42). Moreover, as women of socially backward and marginalized groups (including Scheduled Castes and Scheduled Tribes) lost jobs because of mechanization in agriculture, the size of their labor force declined by 7 million during 2004–05 and 2011–12 (see Table 1).

Furthermore, about 27 million women belonging to the lowest two economic quintiles had left the labor force during the same period (see Table 1). Poverty fell in absolute terms in India by 140 million During 2004–5 and 2011–12, as real wages rose, especially but not only rural areas. Behavioral change among women in response to the improved economic condition of their household might have been partly responsible for this (in case of elderly women, see Figure 1: Panel A, second curve from below), but another reason is the lack of required skill in the face of rising capital intensity in industry and services (See Goldar, 2013; Mehrotra *et al.*, 2014; and Kapoor, 2016). Further reasons could be non-availability of job opportunities within their vicinity and mounting security issues due to increasing criminal activities against women. These could also have restricted young girls from moving out of their village or home town for work.

As we have already discussed (see Figure 1: Panel C) and recent studies (like Rangarajan *et al.*, 2011; Kannan & Raveendran, 2012; Hirway, 2012; and Mehrotra *et al.*, 2014) also suggest that young girls' labor force participation has shrunk [10] because of increasing enrollment in education. This is also reflected in the increasing share of female enrollment at secondary and graduate and above level of general education

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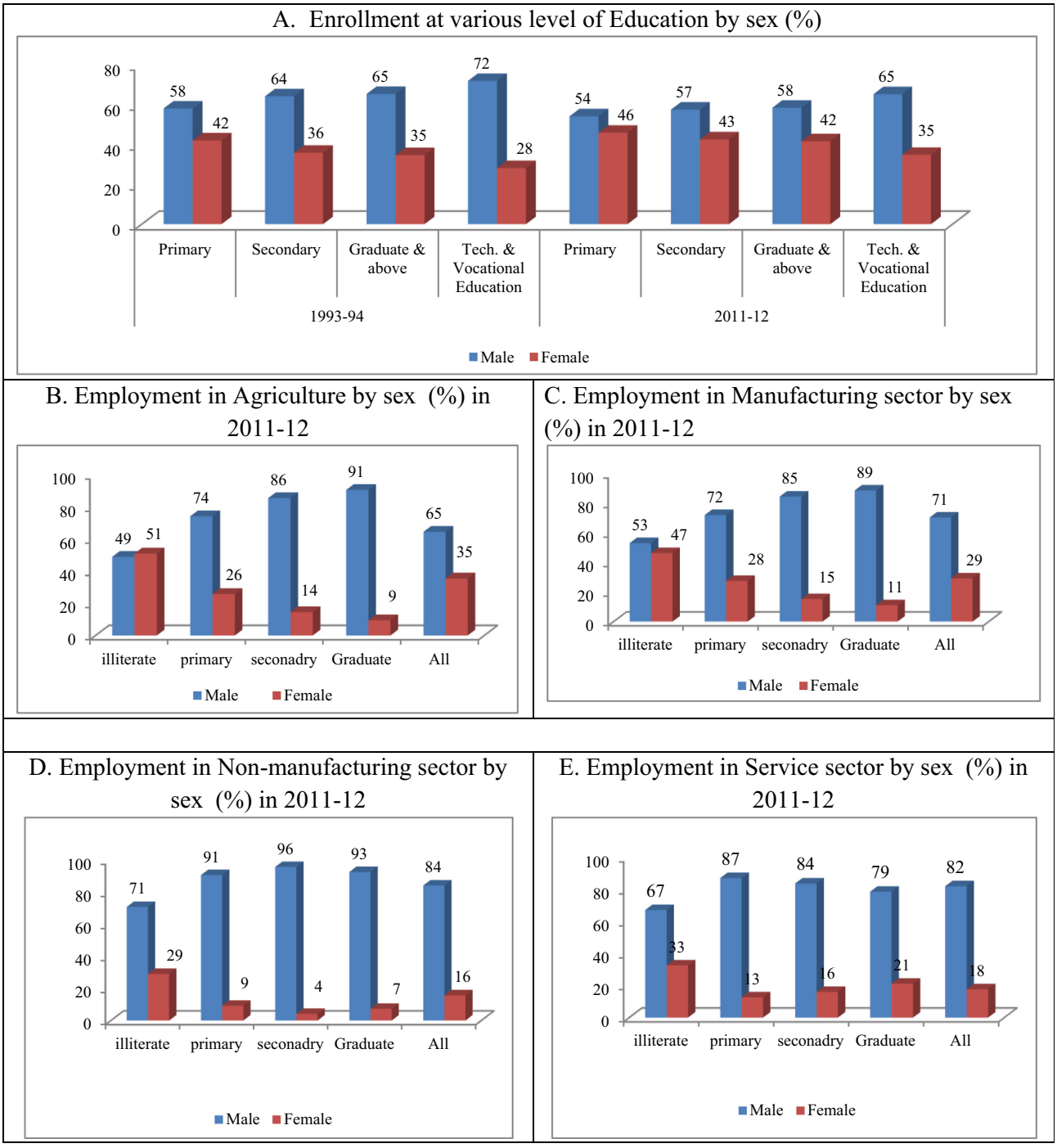

Figure 2. *Enrollment and share of sectoral employment by level of education and sex in India. Source: Authors' estimates from the NSS Unit-level data, various rounds.*

as well as in technical/vocational education in 2011–12 (See Figure 2: Panel A). However, with the improvement in female education levels, the absolute number and share of illiterate (low skilled) women has been declining (from 96 to 66 million and from 74 to 51%, respectively) with a corresponding rise in the number (3.4 million to 13 million) and share (from 3% to 10%) of relatively skilled female workers (see Table 1). Though the structural transformation process has displaced low-skilled women out of the labor force, it has opened new windows of opportunities for young educated girls who are likely to enter the labor market. However, the increased open unemployment rate (based on UPSS) among young and educated girls (see Figure 1: Panel D) indicates that appropriate measures need to be taken by the government for generating female employment in non-agriculture sectors.

(ii) *Sectoral employment pattern of female workers*

Before we discuss how female employment could be generated, it is important to explore how the sectoral female employment pattern has changed over the years in India. Dur-

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ing 1993–94 the size of the female workforce (see Table 1) was 122 million, which increased to 127 million by 1999–2000 (4 million increase or about 1 million per annum), to 153 million by 2004–05 (26 million increase or about 5 million per annum), but fell to 129 million by 2009–10 (a decrease of 24 million or about 4.8 million per annum), just recovering slightly again to 131 million (2 million increase or about 1 million per annum) by 2011–12. The falling trend of total female employment is mainly because of the fall in agricultural employment. However, the recovery is due to the recent increase of female employment in manufacturing, non-manufacturing (mainly construction) and service sectors (modern services). The states that have contributed significantly to this fluctuation in female employment include: Andhra Pradesh (undivided [11]), Maharashtra, Uttar Pradesh, Tamil Nadu, West Bengal, Rajasthan, Karnataka, Gujarat, Odisha, Bihar, Jharkhand, and Chhattisgarh. The relatively backward and agrarian states by and large have contributed more to the decline of female employment during the period 2004–05 and 2011–12. But the relatively advanced and industrialized states contributed to the growth of non-farm employment during the last decade.

The size of female workforce in agriculture was about 96 million in 1993–94. It increased to 113 million in 2004–05, but declined to 82 million in 2011–12 (see Table 2). It is important to note that the rate of decline (about 4.5 million per annum) of female employment in agriculture during 2005–12 is much faster than the rate of increase (about 1.5 million per annum) during 1994–2005. As a result the share of all females working who are employed in agriculture declined from about 78% to 63%. Due to rapid mechanization in agriculture in recent years, both the share and absolute number of female workers is likely to decline further in the coming years. Hence there would be little scope for female employment generation in agriculture. Moreover, an increasing number of females would come out of agriculture who would be searching for alternate jobs in non-agriculture.

In the manufacturing sector female employment shows a cyclical trend. It increased from 11.5 million to 17.2 million during 1994–2005, declined to 14 million during 2009–10 and increased again to 17.5 million during 2011–12 (see Table 2). Share of female employment in this sector increased from 11.5 to 17.5% during 1994–2012. States like West Bengal, Tamil Nadu, Uttar Pradesh, Andhra Pradesh, Maharashtra, Karnataka, and Gujarat have contributed significantly to total female employment in manufacturing sector. All of these states but Andhra Pradesh are responsible for the cyclical trend. Female workers are highly vulnerable to any kind of economic shock because of their low skills (see Figure 2: Panel C). Female employment in the manufacturing sector declined following the period of the global economic crisis [12] of 2008. According to Mehrotra *et al.* (2014) during 2004–05 and 2009–10 total manufacturing employment declined by 3.2 million and this is particularly due to the fall in employment in labor intensive manufacturing units, and mostly in the informal segments. Lacking appropriate skills, female workers in the manufacturing sector are employed as temporary workers and hence they could be hired or fired at any time. Improving skill level of low-skilled female workers along with employment generation measures could therefore sustain the growth of female employment in manufacturing. This would have positive implications for female LFPR in the long-run.

Female employment in the non-manufacturing [13] sectors shows a consistent increase during 1993–94 and 2011–12 (see Table 2). The rate of increase during 2005–12 (about 5.5 million) is much faster than the rate of increase (1.1 million) during 1994–2005. The share of female employment in this sector increased from 1.7% to 6.6% during 1994–2012. States like Tamil Nadu, Rajasthan, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, and Maharashtra contributed significantly to total female employment in the non-manufacturing sectors. Women job seekers with low level of education and skills with few other options are likely to join this sector, partly as it involves hard manual labor. But this sector has a very limited scope for employment generation for young and educated girls who are likely to join the labor force.

The service sector too shows an increasing trend of female employment with stagnation during 2005–10. Total female employment in service sectors increased from 13.7 million to 19.5 million (about 0.5 million per annum) during 1994–2005, remained constant during 2005–10, but increased further to 22.5 million (about 1.5 million per annum) during 2010–12 (see Table 2). The share of female employment in this sector increased from 11.1% to 17.2% during 1994–2012. States like Maharashtra, Andhra Pradesh, Tamil Nadu, West Bengal, Karnataka, Uttar Pradesh, and Kerala have contributed significantly to the growth of total female employment in service sectors. It is important to note that six metropolitan cities of India belong to the above noted states. And in Uttar Pradesh and Kerala there exist a few emerging and fast growing cities, in which the growth of services is relatively high during the last decade. The growth of modern services like IT, telecom, financial intermediation, and modern hospitality including hotel trade together contributed significantly to the growth female employment (Mehrotra *et al.*, 2014) in large and metro cities. These sub-sectors would probably sustain the growth of female employment as the government of India is recently taking initiatives for development of new "Smart Cities" across the states of India.

Growth of female employment is also driven by increased employment in social services including education and private healthcare. Growth of female employment in education could be due to initiatives like Sarva Shiksha Abhiyan (SSA) and Rastriya Madhyamika Shikhya Abhiyan (RMSA) which were taken for the universalization of primary and secondary education. Given this it could be argued that with increasing public spending on healthcare for promotion of medical and nursing education, and construction of advanced hospitals for sophisticated medical procedures (in the face of a rising incidence of non-communicable diseases in India due to changing life styles in cities and towns), female employment could rise in these sectors. Furthermore, increasing public spending on higher education at university level (post-graduation and above level) would also help generate female employment and hence female LFPR could rise.

(iii) *On data and methods*

This paper is based on secondary data. The major sources of secondary data include: National Sample Survey Organization (NSSO), Census of India, Central Statistical Organization (CSO), and Ministry of Agriculture, Government of India. Both household and individual-level characteristics including socio-economic, and demographic variables collected through various quinquennial rounds [14] of NSS covering the periods 1983 and 2012 are used for micro-level analysis. For the macro-level analysis, information from all other sources including NSS are used.

(iv) *Data and methods for micro-level analysis*

To find out the individual- and household-level factors that determine the female labor force participation (LFP) decision, at the micro level, we have estimated a female labor force participation function. Since the dependent variable is dichoto-

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Table 2. *Sectoral Trends of Female Employment in India, 1994–2012*

Name of states	Sectoral female workers (in million) based on UPSS															
	Agriculture				Manufacturing				Non-manufacturing				Service			
	1993–94	2004–05	2009–10	2011–12	1993–94	2004–05	2009–10	2011–12	1993–94	2004–05	2009–10	2011–12	1993–94	2004–05	2009–10	2011–12
Andhra Pradesh	12.1	11.8	10.5	10.7	1.4	1.9	2.0	1.9	0.3	0.4	0.8	1.0	1.8	2.7	2.2	2.6
Arunachal Pradesh	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assam	1.2	2.2	1.8	1.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3
Bihar	5.3	4.2	2.2	1.8	0.3	0.4	0.2	0.2	0.1	0.0	0.0	0.1	0.4	0.3	0.3	0.4
Goa	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Gujarat	5.3	6.7	5.3	4.4	0.4	0.7	0.5	0.9	0.1	0.2	0.2	0.2	0.7	0.9	1.1	1.0
Haryana	1.8	2.5	1.7	1.2	0.1	0.2	0.2	0.1	0.0	0.0	0.1	0.1	0.2	0.3	0.5	0.4
Himachal Pradesh	1.4	1.5	1.3	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Jammu &Kashmir	0.4	0.7	0.9	0.9	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Karnataka	6.5	7.5	5.9	4.6	0.9	1.1	0.9	1.1	0.1	0.1	0.3	0.1	0.9	1.3	1.5	1.6
Kerala	1.8	2.0	1.4	1.3	0.7	0.9	0.8	0.8	0.1	0.1	0.3	0.4	0.7	1.3	1.5	1.5
Madhya Pradesh	10.7	8.2	6.9	5.1	0.6	0.9	0.7	0.5	0.2	0.3	0.5	0.7	0.7	0.8	0.7	0.8
Maharashtra	11.5	13.4	11.5	10.8	0.8	1.3	0.9	1.4	0.3	0.4	0.2	0.5	2.0	2.7	2.9	3.3
Manipur	0.1	0.2	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1
Meghalaya	0.3	0.4	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Mizoram	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nagaland	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Orissa	4.4	4.4	3.4	3.3	0.4	0.9	0.6	0.7	0.1	0.3	0.3	0.4	0.4	0.5	0.4	0.6
Punjab	1.5	2.6	1.8	1.6	0.0	0.2	0.2	0.4	0.0	0.0	0.0	0.0	0.3	0.5	0.5	0.7
Rajasthan	7.4	9.0	7.0	6.9	0.2	0.8	0.4	0.5	0.3	0.4	2.1	1.4	0.5	0.6	0.7	0.9
Sikkim	0.0	0.1	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tamil Nadu	8.4	7.0	6.8	4.5	2.2	2.4	2.0	2.6	0.2	0.3	0.8	2.0	1.8	2.2	1.8	2.3
Tripura	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.1
Uttar Pradesh	11.8	15.5	11.3	11.6	1.0	2.1	1.5	2.1	0.1	0.2	0.3	0.5	1.2	1.6	1.5	1.6
West Bengal	3.1	3.5	2.0	2.7	1.9	2.3	2.2	3.4	0.1	0.1	0.1	0.2	1.2	1.7	1.7	2.2
Delhi	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.3	0.4	0.3	0.6
Chhattisgarh	—	4.5	3.5	3.9	—	0.2	0.1	0.2	—	0.1	0.2	0.3	—	0.3	0.3	0.5
Jharkhand	—	2.9	1.3	1.9	—	0.3	0.2	0.2	—	0.1	0.2	0.1	—	0.2	0.3	0.2
Uttaranchal	—	1.4	1.4	1.1	—	0.0	0.0	0.1	—	0.0	0.0	0.0	—	0.1	0.1	0.1
Other UTs	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1
All India	95.6	112.9	88.8	82.2	11.5	17.2	14.0	17.5	2.1	3.2	7.1	8.7	13.7	19.5	19.4	22.5

Source: Authors' estimates from the NSS Unit-level data, various rounds.

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Table 3. *Determinants of female labour force participation decision in Rural India*

Variables	Simple probit estimates						IV-probit estimates		
	Model 1			Model 2					
	Coeff	*Z*	ME	Coeff	*Z*	ME	Coeff	*Z*	ME
Age	0.08	20.9	0.002	0.08	20.9	0.002	−0.01	−15.8	−0.01
Age Square	−0.001	−19.6	−0.00002	−0.001	−19.6	−0.00002	−0.002	−18.8	−0.2
Log wage (Predicted)	0.12	7.01	0.003	0.12	7.0	0.003	0.12	6.01	0.12
Log husbands earnings	−0.14	−3.5	−0.02	−0.12	−6.2	0.01	−0.12	−8.2	−0.02
Log MPCE	−0.04	−0.99	−0.001	−0.04	−1.0	−0.001	−19.6	−14.2	−19.6
Log MPCE square	0.01	1.76	0.0002	0.01	1.8	0.0002	1.6	14.2	1.6
Years of schooling	−0.06	−54.7	−0.01				−0.1	−15.9	−0.1
Years of schooling square	0.005	49.6	0.001	0.004	47.6	0.001	0.005	45.6	0.001
Primary				−0.19	−53.9	−0.05			
Secondary				−0.19	−31.0	−0.05			
Graduate & above				0.08	5.3	0.02			
With Tech education				−0.52	−1.7	0.13			
Household size	−0.06	−92.4	−0.02	−0.06	−85.6	−0.02	0.01	2.5	0.01
No. of Children (0–5 years)	−0.10	−64.3	−0.03	−0.10	−61.2	−0.03	−0.2	−24.8	−0.2
No. of elderly	−0.09	−54.1	−0.02	−0.09	−51.6	−0.02	−0.1	−18.3	−0.1
No. of Adult females	0.31	277.5	0.08	0.31	223.9	0.08	0.2	59.6	0.2
ST	0.51	107.1	0.13	0.50	106.1	0.13	0.3	25.2	0.3
SC	0.27	66.6	0.07	0.26	66.5	0.07	0.3	32.3	0.3
Hindu	−0.09	−18.0	−0.02	−0.09	−18.1	−0.02	0.1	6.9	0.1
Muslim	−0.19	−27.2	−0.05	−0.19	−26.9	−0.05	0.2	8.6	0.2
Head of family	0.85	108.7	0.22	0.85	108.1	0.21	0.7	29.7	0.7
Spouse of Head	0.40	84.1	0.10	0.39	82.3	0.10	0.3	27.7	0.3
Married	1.01	199.0	0.26	1.01	186.1	0.26	0.9	58.3	0.9
Divorced/separated	0.64	73.0	0.16	0.63	67.5	0.16	0.7	27.6	0.7
Eastern Region	0.02	3.9	0.01	0.02	3.1	0.01	−0.05	−3.2	−0.05
Western Region	0.52	82.0	0.13	0.51	79.6	0.13	0.4	16.3	0.4
Northern Region	0.19	35.2	0.05	0.18	32.3	0.05	−0.1	−4.2	−0.1
Southern Region	0.50	87.4	0.13	0.49	83.4	0.12	0.3	12.6	0.3
Central Region	0.38	55.2	0.10	0.38	53.9	0.10	0.1	3.3	0.1
Period 1994–2000	−0.75	−6.88	−0.02	−0.75	−6.9	−0.02	−3.6	−21.5	−3.6
Period 2005	−0.56	−4.47	−0.01	−0.56	−4.5	−0.01	−4.5	−25.6	−4.5
Period Post-2005	−0.91	−6.56	−0.02	−0.91	−6.6	−0.02	−3.0	−37.0	−3.0
Constant	0.95	8.3		0.95	8.3		54.7	13.9	
Number of observation		1127844			1127844			1127844	
Wald chi-square		437881.77***			284253.99***			96172.52***	
Pseudo R-square		0.3016			0.3026				
Wald test of exogeneity chi-square								1095.31***	

Source: Authors' estimation based NSS unit-level data.

mous (which assumes value 1 for labor force participation and zero otherwise) and we have a very large sample, probit regression is an appropriate choice. Both instrumental variable (IV) probit regressions models are used. While the simple probit is based on the assumption that all explanatory variables are exogenously determined, the IV-probit regression provides robust estimates in the presence of endogenous [15] regressors. In this case, we expect that monthly per capita expenditure (a measure of households' economic status) is likely to be correlated with the error term. As women belonging to lower economic classes are more likely to participate in the labor force to support family income, increasing labor force participation of females is likely to improve household living standards. The improved living standards would enable households to spend a larger share on education and skill development of their children (following Engel's law). The possession of better human capital motivates young girls to participate in the labor force in increasing numbers. The Wald test of exogeneity suggests (see Tables 3 and 4) that monthly per capita expenditure is endogenous, and hence the iv-probit regression is the appropriate functional form that provides unbiased estimated coefficients.

Wage/earnings is another factor determining female labor force participation decisions. However, information on wages of the self-employed (they constitute a sizable portion of the labor force) and those who do not participate in the labor force is not available. To include the wage variable in the model, predicted wage for rural and urban equations are imputed for these groups by running two wage regressions using Heckman (1979) selection correction (See Table 8) under the assumption that women with similar characteristics can get similar salary in the labor market even though they do not work or work as self-employed. The details of the explanatory variables used in the probit and IV probit regression model are given in Table 9. While estimating in Stata, by default iv-probit uses maximum likelihood estimation (MLE) but we have used the two step option, which is based on Newey's (1987) minimum chi-squared method of estimation. Both these methods are used alternatively, but a few do not use MLE to avoid a large number of iterations. The estimated results are given in Tables 3 and 4.

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Table 4. *Determinants of female labour force participation decision in urban India*

Variables	Simple probit						IV-probit		
	Model 1			Model 2			Model 3		
	Coeff	*Z*	ME	Coeff	*Z*	ME	Coeff	*Z*	ME
Age	0.01	5.5	0.001	0.003	1.5	0.0002	0.01	8.4	0.01
Age Square	−0.0002	−8.4	−0.00001	−0.00004	−1.5	−0.000002	−0.0003	−12.9	−0.0003
Log wage (Predicted)	2.67	145.5	0.164	2.43	161.0	0.15	2.7	243.3	2.7
Log husbands earnings	0.25	1.24	0.01	0.14	1.22	0.01	0.18	1.41	0.02
Log MPCE	0.42	11.9	0.026	0.52	13.2	0.03	3.5	11.2	3.5
Log MPCE square	−0.06	−20.8	−0.004	−0.07	−20.8	−0.004	−0.3	−12.4	−0.3
Years of schooling	0.33	84.5	0.020				0.3	85.3	0.3
Years of schooling square	0.03	92.4	0.002				0.03	82.1	0.03
Primary				0.70	1.25	0.04			
Secondary				0.13	1.32	0.01			
Graduate & above				1.51	68.0	0.10			
With Tech education				1.05	23.5	0.07			
Household size	−0.05	−21.7	−0.003	−0.05	−21.7	−0.003	−0.1	−23.3	−0.1
No. of Children (0–5 years)	−0.05	−11.8	−0.003	−0.06	−13.8	−0.004	−0.02	−3.0	−0.02
No. of elderly	0.04	7.4	0.002	0.03	6.7	0.002	0.1	9.8	0.1
No. of Adult females	0.21	70.6	0.013	0.21	74.7	0.01	0.2	59.2	0.2
ST	−0.03	−1.5	−0.002	0.005	0.3	0.0003	−0.003	−0.2	−0.003
SC	−1.41	−88.2	−0.087	−1.28	−88.2	−0.08	−1.4	−103.3	−1.4
Hindu	−0.50	−32.5	−0.031	−0.49	−32.3	−0.03	−0.5	−34.8	−0.5
Muslim	0.43	23.4	0.026	0.34	19.2	0.02	0.4	23.9	0.4
Head of family	0.26	13.3	0.016	0.27	14.2	0.02	0.3	14.2	0.3
Spouse of Head	−0.01	−0.7	−0.001	−0.01	−0.5	−0.0004	0.02	1.6	0.02
Married	−0.33	−18.1	−0.020	−0.31	−16.9	−0.02	−0.4	−22.2	−0.4
Divorced/separated	−0.22	−9.0	−0.014	−0.21	−8.9	−0.01	−0.3	−11.0	−0.3
Eastern Region	−0.20	−10.2	−0.013	−0.24	−12.1	−0.02	−0.2	−10.5	−0.2
Western Region	−0.06	−3.2	−0.004	−0.08	−4.4	−0.005	−0.02	−1.4	−0.02
Northern Region	−0.17	−9.9	−0.010	−0.21	−12.6	−0.01	−0.1	−8.4	−0.1
Southern Region	0.20	12.0	0.012	0.19	11.5	0.01	0.2	14.4	0.2
Central Region	−0.25	−12.3	−0.015	−0.28	−14.4	−0.02	−0.2	−10.8	−0.2
Period 1994–2000	−0.28	−1.8	−0.03	−0.75	−6.9	−0.03	−2.6	−21.5	−2.6
Period 2005	−0.33	−2.6	−0.02	−0.56	−4.5	−0.02	−3.5	−25.6	−3.5
Period Post-2005	0.37	3.4	−0.04	−0.91	−6.6	−0.03	−3.0	−37.0	−3.0
Constant	−0.45	−3.8		−1.05	−8.3		−10.0	−10.3	
Number of observation		582802			582802			582802	
Wald chi-square		39284.04***			45752.47***			74020.23***	
Pseudo R-square		0.7758			0.7659				

Source: Authors' estimation based NSS unit-level data.

(v) *Econometric techniques used for macro-level analysis*

The data on mean years of schooling (for female age group 6–24 years), net enrollment ratio, household monthly per capita expenditure (MPCE), average rural earning/wage, and dependency ratio [16] are computed using NSS unit data. Census population data for years 1981, 1991, 2001 and 2011 are used for interpolation (using monthly exponential growth) of population data (state-wise and all India) for the specific NSS survey years. Census population data are used to adjust the NSS estimates for obtaining the exact number of employed, unemployed, enrolled, and dependent population. The data on Net State Domestic Product (NSDP), per capita NSDP, Net Domestic Product (NDP) and per capita NDP and Gross Fixed Capital Formation in Agriculture (a proxy for agricultural mechanization) are taken from the CSO. And the data on number of tractors and power tillers sold (other proxies for agricultural mechanization) are taken from the Ministry of Agriculture, Government of India.

While estimating the macro-level factors determining female LFPR we have run several regression models. We have estimated regression equations for rural and urban areas separately. In all these equations, the dependent variable is female labor force participation rate (age group 15–59 years) which is available for the above mentioned six [17] periods and across the states of India (total 31 cross sections including 29 states, all UTs and India as two separate cross sections). Given a pseudo panel, we have run OLS fixed effects, OLS random effects and an IV fixed effects regression models for comparison. According to Stock and Watson (2011) a fixed-effects model controls for all time-invariant differences between the cross sections, hence the estimated coefficients of the fixed-effects models cannot be biased due to omitted time-invariant characteristics like culture or religion. On the other hand, if it is believed that differences across the cross-sections have some influence on the dependent variable then we should use a random effects model (see Greene, 2011). And the choice between fixed and random effects models is normally made using the Hausman test (see Hausman, 1978). According to the Hausman test if there is no significant difference between the coefficients of fixed and random effect models, then random effect is the correct specification. Moreover the IV random effect model is used for obtaining unbiased estimates in the presence of endogeneous regressors (per capita NSDP is tested for endogeneity) in the model.

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Table 5. *Determinants of female labour force participation in rural India (at the Macro level)*

Variables	OLS fixed effect models								OLS random effect models								IV regression model	
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4			
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value	Coef.	*Z*-value	Coef.	*Z*-value	Coef.	*Z*-value	Coef.	*Z*-value	Coef.	*Z*-value
Log per capita NSDP	−12.3	−0.5	−24.6	−0.6	−27.5	−0.8	30	0.8	−0.1	0.0	−7.4	−0.2	−11.3	−0.32	62	1.7	−22.7	0.2
Log per capita NSDP square	0.9	0.4	1.3	0.6	1.5	0.7	−1.5	−0.8	0.03	0.01	0.4	0.2	0.5	0.3	−3.3	−1.8	−1.3	−0.2
Average household size	−1.2	−3.4	−1.4	−3.7	−1.2	−3.2	−1.2	−3.4	−1.4	−3.8	−1.2	−3.5	−1.2	−3.7	−1.8	−3.2	−1.2	−3.7
Log of average wages	−3.6	−2.2	−3.2	−1.9	−3.4	−1.9	−6.2	−4.0	−2.7	−1.7	−3.3	−1.8	−3.0	−2.6	−3.4	−2.7	−3.5	−1.9
Enrollment ratio primary	−0.2	−1.8	−0.07	−2.7	−0.1	−1.7	—	—	−0.2	81.8	−0.5	−5.7	−0.4	−3.6	—	—	−0.1	−1.2
Enrollment ratio secondary	−0.3	−2.6	−0.3	−2.1	−0.2	−1.8	—	—	−0.3	−2.9	−0.5	−2.8	−0.2	−1.9	—	—	−0.3	−2.0
Enrollment ratio graduate & more	0.8	3.1	0.5	2.8	0.5	2.8	—	—	0.5	3.2	0.4	2.4	0.3	2.9	—	—	0.5	3.6
Mean years of schooling	—	—	—	—	—	—	−12.4	−15.9	—	—	—	—	—	—	−11.4	−15.5		
Mean years of schooling Square	—	—	—	—	—	—	0.4	1.32	—	—	—	—	—	—	0.5	1.02		
Percentage of child population	−1.0	−1.3	−1.0	−1.3	−0.9	−1.1	−1.0	−1.7	−1.0	−1.6	−1.0	−1.5	−1.0	−0.5	−1.0	−0.8	−1.0	−1.5
Percentage of elderly population	−0.2	−1.3	−0.5	−1.7	−0.3	−0.1	−0.2	−1.1	−0.4	−0.2	−0.4	−1.5	−0.2	−0.8	−0.3	−1.1	−0.3	−1.6
Growth of GFCF in agriculture	−0.05	−2.0	—	—	—	—	−0.02	−1.1	−0.04	−1.7	—	—	—	—	−0.01	−0.5	−0.1	−2.0
Log of Tractors sold			−8.8	−1.1							−7.8	−1.0			—	—	—	—
Log of Power Tillers sold					−6.3	−1.0							−5.3	−1.0	—	—	—	—
Constant	182	0.9	241	1.2	235	1.5	−58	−0.7	89	0.45	152	0.8	125	0.35	−251	−1.5		
Sigma_u	13.03		12.8		12.8		14.4		11.9		11.8		—		10.5		—	
Sigma_e	7.4		7.5		7.5		6.9		7.4		7.4		—		6.9		—	
Rho	0.75		0.75		0.75		0.81		0.72		0.72		—		0.69		—	
Number of observation	205		205		205		205		205		205		205		205		205	
Number of groups	31		31		31		31		31		31		31		31		31	
R square (within)	0.67		0.68		0.68		0.62		0.63		0.67		0.64		0.68		—	
R square (between)	0.02		0.027		0.025		0.053		0.04		0.04		0.03		0.09		—	
R square (overall)	0.27		0.29		0.28		0.29		0.35		0.37		0.39		0.38		—	
Centered R square	—		—		—		—		—		—		—		—		0.6321	
Uncentered R square	—		—		—		—		—		—		—		—		0.6321	
Root MSE	—		—		—		—		—		—		—		—		7.25	
corr(u_i, Xb)	−0.074		−0.05		−0.051		−0.31		—		—		—		—		—	
Wald chi2	—		—		—		—		284.08***		278.66***		278.26***		324.71***		—	
F-statistics	47.15***		85.17***		75.1***		58.9***		—		—		—		—		39.41***	
F test that all u_i = 0	19.8***		18.42***		17***		17.2**		—		—		—		—			
Anderson canon. corr. LM statistic																	15.6 (0.3944)	
Cragg-Donald Wald F statistic)																	0.829	
Sargan statistic																	19.6 (0.1207)	

Note: In the IV-regression model log per capita NSDP and its square are used as endogenous.
Source: Authors' estimates using data from Central Statistical Organisation (CSO), National Sample Survey and Ministry of Agriculture etc.

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Table 6. *Determinants of female labour force participation in urban India (at the Macro level)*

Variables	OLS fixed effect models								OLS random effect models								IV regression model	
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4			
	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value	Coef.	*t*-value	Coef.	*Z*-value	Coef.	*Z*-value	Coef.	*Z*-value	Coef.	*Z*-value	Coef.	*Z*-value
Log per capita NSDP	−17.3	−0.5	−28.6	−0.6	−21.5	−0.7	32	0.8	−0.1	0.0	−8.1	−0.2	−11.3	−0.3	69	1.8	21.7	0.3
Log per capita NSDP square	0.9	0.4	1.3	0.6	1.5	0.7	−1.5	−0.8	0.03	0.01	0.4	0.2	0.5	0.3	−3.3	−1.8	−1.3	−0.2
Average household size	5.8	3.6	5.6	3.3	5.8	3.8	5.8	3.6	5.6	3.2	5.8	3.5	5.8	3.3	5.2	3.8	5.8	3.3
Log Urban wage	3.6	2.2	3.9	1.9	3.6	1.9	6.2	4.0	2.8	1.9	3.3	1.7	3.0	1.6	3.8	2.7	3.8	1.2
Enrollment ratio primary	−0.1	−1.4	−0.05	−0.7	−0.04	−0.6	—	—	−0.1	−1.4	0.0	−0.7	−0.04	−0.6	—	—	−0.1	−1.2
Enrollment ratio secondary	−0.3	−2.6	−0.3	−2.1	−0.2	−1.8	—	—	−0.3	−2.5	−0.2	−2.1	−0.2	−1.9	—	—	−0.3	−2.0
Enrollment ratio graduate & more	0.9	3.1	0.8	2.8	0.8	2.8	—	—	0.7	3.0	0.9	2.8	0.9	2.8	—	—	0.9	1.6
Mean years of schooling	—	—	—	—	—	—	−14.4	−5.9	—	—	—	—	—	—	−13.4	−5.5		
Mean years of schooling Square	—	—	—	—	—	—	0.4	1.3	—	—	—	—	—	—	0.5	1.7		
Percentage of child population	−1.5	−1.3	−1.2	−1.3	−0.7	−1.1	−1.2	−0.7	−1.2	−0.8	−1.5	−0.5	−1.2	−1.5	−1.4	−0.8	−1.2	−0.8
Percentage of elderly population	3.5	0.7	3.8	1.1	4.3	1.2	3.8	0.6	3.8	0.9	3.5	1.4	3.8	1.1	3.6	0.7	3.8	0.7
Growth of Regular salaried jobs	2.5	1.7	2.8	2.1	3.3	2.2	2.8	1.6	2.8	0.9	2.5	1.4	2.8	1.1	2.6	3.7	2.8	7.7
Percent of worker-population ratio	1.5	0.7	1.8	1.1	2.3	1.2	1.8	0.6	−1.8	−0.1	−1.5	−0.4	−1.8	−0.1	−1.6	−2.7	1.8	6.7
Growth of urban population	−0.6	−1.4	−0.3	−7.4	0.2	−6.2	−0.3	−6.8	−0.3	−5.9	−0.6	−5.6	−0.3	−7.6	−0.5	−5.9	−0.3	−4.9
Constant	186	0.8	254	1.2	250	1.1	−54	−0.3	87	0.4	155	0.7	151	0.7	−257	−1.3		
Sigma_u	12.03		11.8		12.8		14.4		11.2		11.8		—		12.5		—	
Sigma_e	8.4		7.2		7.2		6.2		6.7		7.4		—		6.9		—	
Rho	0.72		0.73		0.74		0.79		0.73		0.75		—		0.68		—	
Number of observation	205		205		205		205		205		205		205		205		205	
Number of groups	31		31		31		31		31		31		31		31		31	
R square (within)	0.61		0.63		0.62		0.61		0.63		0.62		0.62		0.67		—	
R square (between)	0.026		0.0270		0.02		0.053		0.041		0.044		0.043		0.09		—	
R square (overall)	0.24		0.20		0.28		0.24		0.30		0.30		0.39		0.31		—	
Centered R square	—		—		—		—		—		—		—		—		0.6321	
Uncentered R square	—		—		—		—		—		—		—		—		0.6321	
Root MSE	—		—		—		—		—		—		—		—		7.25	
corr(u_i, Xb)	−0.074		−0.025		−0.02		−0.36		—		—		—		—		—	
Wald chi2	—		—		—		—		284.08****		278.66***		278.26***		324.71***		—	
F-statistics	32.05***		34.15***		35.1***		50.9***		—		—		—		—		35.78***	
F test that all u_i = 0	15.3***		14.2***		15.38***		15.23***		—		—		—		—			
Anderson canon. corr. LM statistic																	18.6 (0.3944)	
Cragg-Donald Wald F statistic)																	0.824	
Sargan statistic																	17.5 (0.19)	

Note: In the IV-regression model log per capita NSDP and its square are used as endogenous.
Source: Authors' estimates using data from Central Statistical Organisation (CSO), National Sample Survey and Ministry of Agriculture etc.

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The details of the explanatory variables used in the macro-level regression models are given in Table 10 and the estimated results are given in Tables 5 and 6 respectively. We discuss the findings of the macro-level analysis in a later section.

4. FACTORS DETERMINING FEMALE LFPR IN INDIA

(a) *Results of micro-level estimates*

While exploring the determinants of female labor force participation decision we have estimated simple probit and iv-probit (to address the endogeneity issue) regression models for rural and urban areas separately. The estimated results are shown in Tables 3 and 4. The Wald chi-square test statistics in both rural and urban estimates suggest that log monthly per capita consumption expenditure (MPCE) and its square term are not completely exogenously determined, hence simple probit regressions are likely to suffer from an endogeneity problem and provide biased estimates. We therefore used household-level characteristics including household size, land holdings, number of children, number of elderly, number of females, occupation of household head, caste and religion etc. as instruments in the household expenditure function and run the iv-probit regressions.

We found that the individual characteristics like age, education and marital status, significantly influence the female labor force participation decision in both rural and urban India. Age as a proxy for job market experience has a positive influence on female LFP. But negative coefficients for the years of schooling in rural areas substantiates the argument that a rise in secondary school enrollment has a negative influence on female LFPR. This is also revealed from the negative coefficients of primary, secondary and technical education dummies. However, in urban areas on the other hand, these education dummies (graduation and above and technical education) have a positive influence on female LFP. Hence, it could be argued that policy measures focusing on urban development would likely help increase the female LFPR in India.

Other things being constant, marital status of females and their relation to the household head have positive implications on their LFP. For example in rural India, unmarried girls are less likely to participate in the labor market due to various social issues and security reasons as compared to married and separated (divorced) women. In urban areas, unmarried girls are more likely participate than either married and separated women.

When women are either the head of the family or the spouse of the head, they normally take either partial or whole responsibility of the family, and hence they participate in the labor market to support family earnings. Married women's labor force participation is often restricted due to the responsibilities of child care and care of the elderly. This is clearly reflected in the negative coefficients for the number of children (up to five years) and the number of elderly (65 years and above) in rural areas. The number of adult females (15–65 years) has a positive influence on female LFP in rural areas, as they could take care of the children. The number of children in the family also has a negative influence on female LFP in urban areas, but there is positive coefficient for the number of elderly in urban areas. In urban areas, the presence of elderly and adult females in the family could be an added advantage for working mothers who would, by looking after children, be supportive of family earnings.

Furthermore, all else being constant, the husband's earnings have a negative influence on female labor market participation in rural areas but no significant influence in urban India. As the husband's earnings normally reflects the economic status of the family, the greater the husband's earnings, the lower the probability of the wife's labor market participation and vice versa. A negative significant sign for the coefficient for log MPCE (consumption expenditure) furthermore supports the theoretical argument that with increasing standard of living (due to an increase in real wages) female LFPR declines due to an income effect. But this effect is normal in case of those women who were working in agriculture (mostly belonging to poor or relatively low-income families) but now prefer not to work. On the other hand, a positive significant sign of the log MPCE square term indicates that after a threshold women are likely to participate in the labor force. This might be due to the fact that relatively well-off households are able to spend more on their children's (female) education and hence the latter are likely to join the labor force. A statistically significant positive coefficient of the square of years of schooling substantiates this argument. This implies that after a certain number of years of schooling girls are likely to enter the labor market, and as young educated girls begin to search for jobs the female LFPR would start rising in India.

Exploring the determinants of female employment in rural India is a bit more complex than in urban India. This is mainly because of the interplay of social-economic, cultural, and regional factors which are quite complicated in the Indian case. For example, we have found positive and significant coefficients for ST and SC dummies in rural areas (probably because these women are more than likely to be engaged in the family farm, implying ease of entry into such work), whereas we got significant and negative coefficients for these dummies in urban India. But in case of religion dummies we got uniform signs across rural and urban India. The coefficient of religion dummies implies that women belonging to Hindu or Muslim families are less likely to participate in the labor market as compared to other religions (mostly Christian and Sikh).

Those women who belong to other castes (higher castes including *Brahmin*, *Kayastha*, and *Kshatriya* etc.) are less likely to enter the labor force in rural areas but they are more likely to participate in the labor market in urban India. This is mainly because of the nature of jobs that women do, which are quite different and they have different socio-economic implications in rural and urban areas respectively. Women belonging to socially and economically marginalized groups including poor and Scheduled Tribes (ST) and Scheduled Castes (SC), normally work in either agriculture, construction or in labor intensive manufacturing units as low-paid workers. However, not working is a matter of prestige for the economically better-off households and in case of forward castes like *Brahmin, Kayastha*, and *Kshatriya.* However, the nature of jobs that most urban women do is quite different from that rural areas (mostly in better skilled service sectors or low-skilled manufacturing).

More importantly the restrictive social norms common to rural India are not so pervasive in urban India and allow women to go out of the home and work in paid jobs. The probability of labor force participation of rural women in western, southern and central region states are much higher as compared to the women in the far north-eastern states of India (reference category). The reason for this relatively high female LFPR is that most states of the north-eastern region are agrarian states. However in urban areas, the probability of LFP of north-east women is higher than women of all other regions but southern, other things remaining constant. This is partly because of the socio-cultural set up in these states where

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women are allowed to take up gainful employment (their higher levels of education and the fact that Christianity predominates in the north-eastern states are factors). The southern region states are relatively urbanized states, in which women enjoy relatively more freedom with respect to their labor force participation.

To sum up we can say the interplay of individual characteristics, household characteristics and the social-cultural set up in which women live, together influence their labor force participation behavior. Though social constraints affect female LFP negatively, it is the household's economic status and its demographic composition along with the level of education they possess that play an important role in determining female LFP in both rural and urban India. Since social constraints are a bit less in urban areas, focusing on urban development mainly targeting small towns and suburban areas with appropriate security measures for women, along with greater availability of jobs for women in these towns is likely to improve the female LFPR in India. With recent improvements in the level of education, this urbanization would help Indian women to begin to break the barriers of the socio-cultural complexities and hence participate in the labor force in increasing numbers.

(b) *Results of macro-level estimates*

At the macro level we have tried to explore what role the process of structural transformation plays in determining female LFPR in India. On the one hand, the job opportunities for females in rural areas are shrinking due to mechanization in agriculture; on the other the rising real wages and consequent improvement in the household's standard of living has implications for female LFP. We have estimated a female LFPR function for rural and urban areas separately (see Tables 5 and 6). Here too we have run a few regressions like fixed effects and random effects models along with instrumental variable (iv), assuming in the latter case the possible endogeneity between per capita NSDP and female LFPR.

In rural areas, we found that the coefficients for enrollment at primary and secondary education have a negative sign. But the coefficient of enrollment at graduate and above level has a positive sign, indicating that with an improved level of education the female LFPR would increase in India. We also found similar estimated coefficients of enrollment in urban equations, but a relatively high estimated value for the graduate-and-above level education coefficient. This reflects the fact that with better education, the LFPR for urban females is higher than that for their rural counterparts. This indicates that though increased government spending on primary and secondary [18] education has adverse impact on female LFPR during the short-run, it is expected that it will have positive implications in the long-run. Hence, an increased government spending on higher education including technical and vocational education is necessary for sustaining the growth of female LFPR in the long-run.

Furthermore, the variables measuring technological advancement in agriculture (the proxies are gross fixed capital formation in agriculture, log of number of tractors sold and log of number of tractors sold [19]) also have a negative sign, suggesting that female labor force participation is negatively affected by the growing mechanization. This provides substantive evidence for our argument in section one in which we explain the sectoral female employment in India. The recent increased government subsidies (both central and state governments) on agricultural equipment might be partly responsible for this. Furthermore, rising nominal wages (partly because of MGNREGA linkages (for example see Mehrotra, 2008; and Parida, 2016)) in rural areas has also a negative influence on female LFPR. This is reflected in a negative coefficient of log wage in rural areas. As job opportunities for women are shrinking in agriculture, alternate job opportunities should be created in rural areas to keep these women within the labor force particularly, those who lacks skills.

Though we have tried to estimate the influence of number of children in the household and elderly population as regressors, we do not get statistically significant results. However other things remaining constant, the growth of regular salaried jobs in urban areas has a positive influence on female LFRP. This implies if more regular jobs in non-agriculture are created it is likely to boost the growth of female LFPR in India. The coefficient of the log per capita net state domestic product (a measure of income at the state level) is negative while its square term has a positive sign in both rural and urban equations. This reflects the fact that in relatively low-income states female LFPR is high (in India low-income states are mostly agrarian states) and as we move up on the per capita income-scale female LFPR declines. However, after a threshold income level, female LFPR would start rising as the square term shows a positive sign. This suggests that over the long-run the female LFPR curve would produce a U shape curve like that of other countries of the world. But the earlier we move on the rising part of the U curve, the greater would be its impact on growth of output, and over all structural transformation.

(c) *Discussion on the U-shape pattern of female LFPR*

The econometric results suggest that female LFPR would start increasing over the long-run, most probably, as the Indian economy grows. We show a scatter plot per capita of NDSP and female LFPR. The scatter diagram with polynomial fitted line (see Figure 3: Panel A) does not reflect the "U shape" pattern. To explore further how female LFPR behaves with respect to per capita income, we plot the scatter diagram for three [20] different categories of Indian states separately. In the case of both least and less developed states (see Figure 3: Panels B and C), we have observed flat and slightly decreasing but a relatively high female LFPR, while in the case of relatively developed states (see Figure 3: Panel D) we find a downward sloping (first half of the U shape curve) female LFPR curve. These figures clearly show that we are at the bottom of the trough of the U shape, and for these states the female LFPR is likely to increase soon.

To substantiate this argument, we further scatter plot households' monthly per capita expenditure and female LFPR (see Figure 4: Panel A through D); and mean years of schooling and female LFPR (See Figure 5: Panel A through D) for all states and for the above three different categories separately. The scatter plots in Figure 4 also suggest that female LFPR is negatively correlated with the average household monthly per capita expenditure. As we move from low to high per capita expenditure female LFPR is showing declining trends with a relative plateau or slight increase in the upward direction. More interestingly in Figure 4 (See Panels A and C) and in Figure 5 (See Panels B and C) we observe the U shape curve, which provides an indication that female LFPR would start increasing shortly. Because large number of young girls, those who are currently attending various levels of education (See Table 7) would definitely not look for unskilled or low skilled or manual jobs in agriculture (we have already noticed a 6.5 million increase in female non-agricultural workers during 2009–10 and 2011–12). They would rather search for relatively

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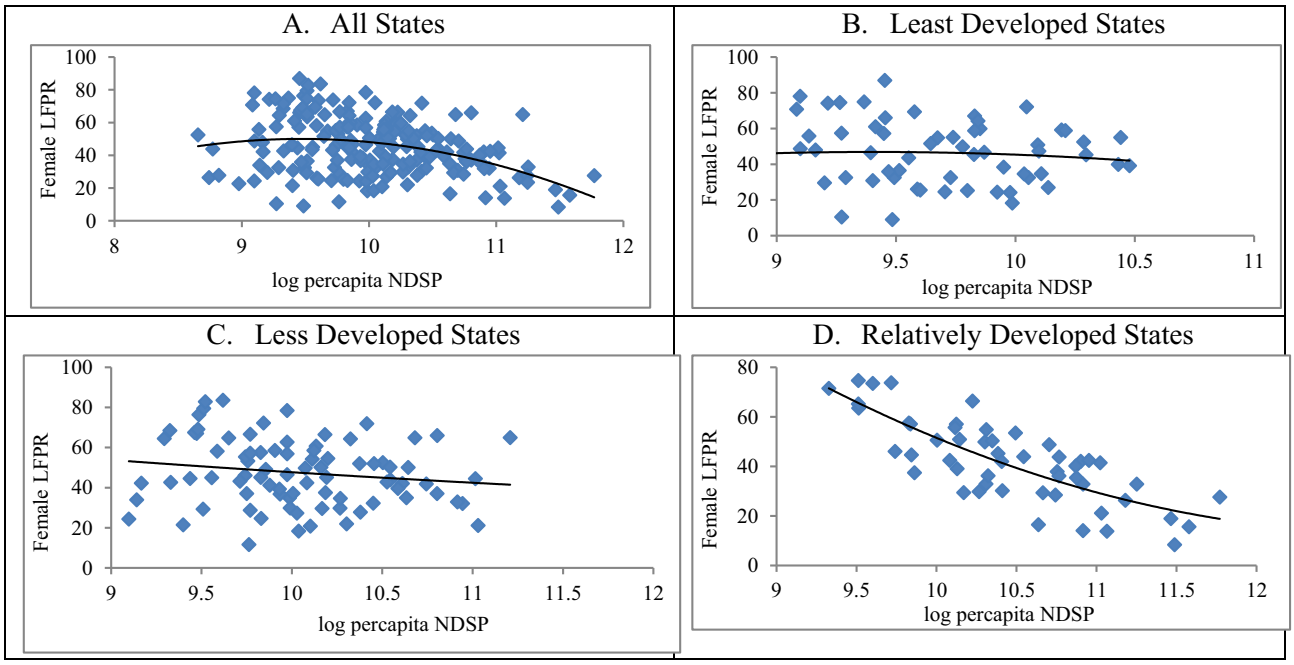

Figure 3. *Scatter diagram of female labour force participation rate (LFPR), and Per capita NSDP in India, 1983–2012. Source: Authors' estimates from the NSS Unit-level data, various rounds.*

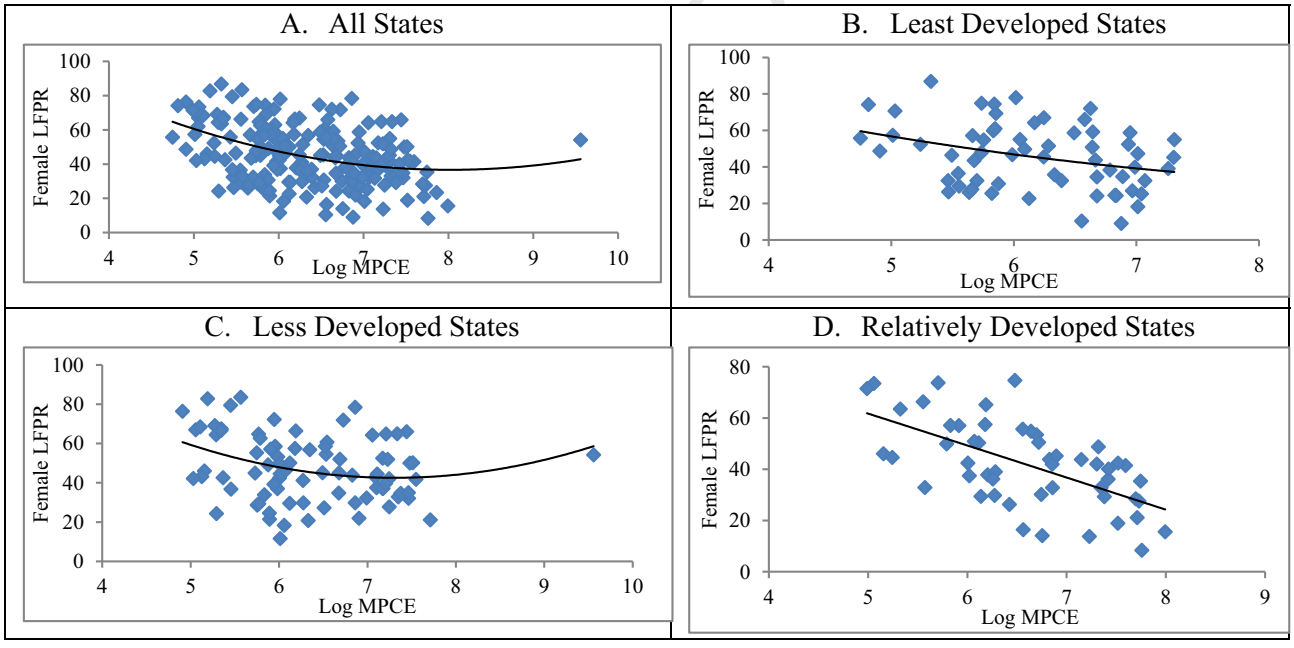

Figure 4. *Scatter diagram of female labour force participation rate (LFPR), and Monthly Per capita Expenditure (MPCE) in India, 1983–2012. Source: Authors' estimates from the NSS Unit-level data, various rounds.*

skilled jobs in either manufacturing or service sectors as their number and share in labor force is rising (see Table 7). In this context of increasing female enrollment in secondary and higher education, it is important for the government to initiate some positive measures for generating female employment in non-agriculture along with the recent skill development measures, which would not only improve female LFPR but also boost economic growth further.

5. CONCLUDING REMARKS

This paper aims to explore how the process of structural transformation affects female employment patterns in India. It also explores the individual-, household-, and macro-level factors (using both micro and macro-level data) that influencing female labor force participation in both rural and urban areas, identifies the prospective sectors that could generate

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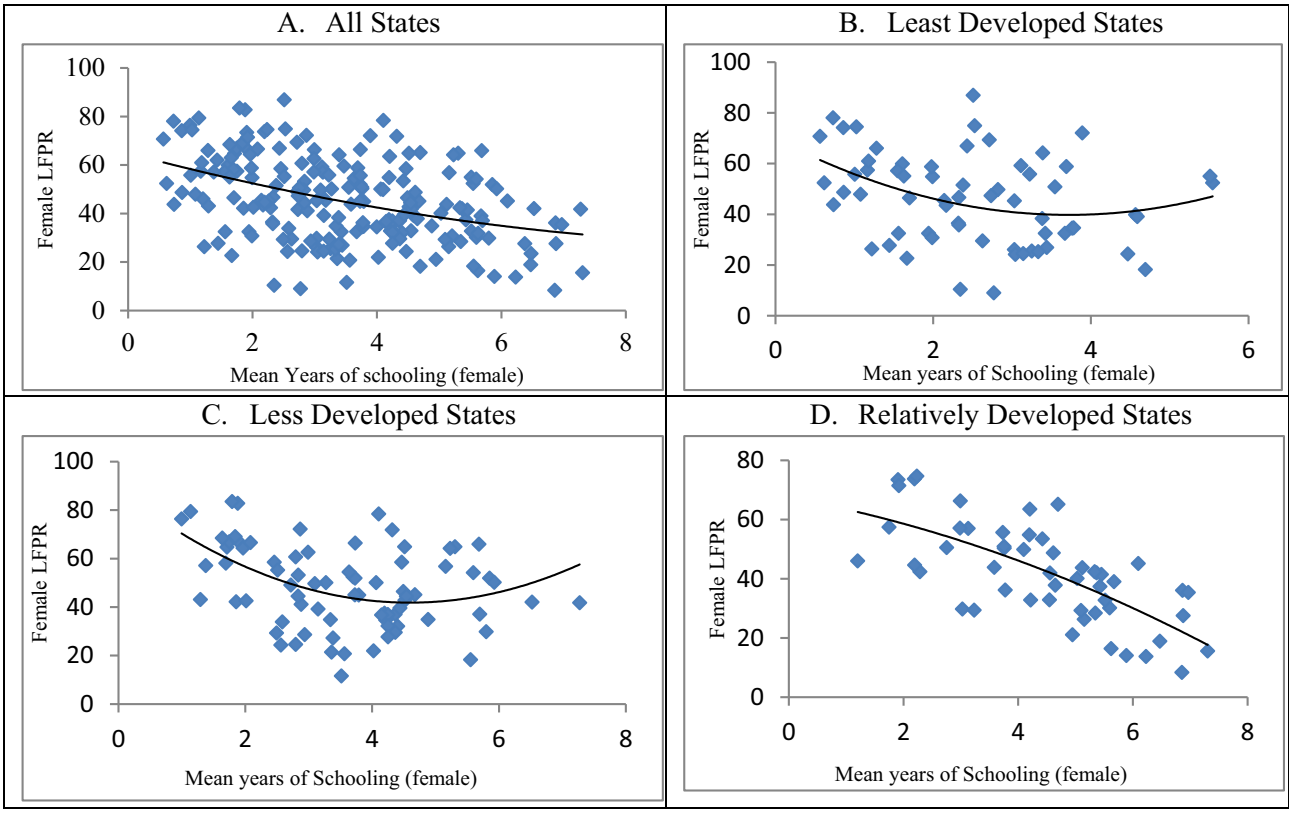

Figure 5. *Scatter diagram of Female labour force participation rate (LFPR), and Female Mean years of Schooling in India, 1983–2012. Source: Authors' estimates from the NSS Unit-level data, various rounds.*

Table 7. *Labour force, LFPR and enrollments of young girls by level of education in India*

Level of education	Young girls belong to age 15–29 years				
	1993	1999–2000	2004–05	2009–10	2011–12
Size of female labour force (million)					
Illiterate	29.0	25.3	22.3	12.1	10.6
Primary	14.0	16.4	24.1	21.7	20.6
Secondary	0.8	1.0	2.2	2.6	2.9
Graduate and above	1.0	1.3	2.0	2.7	3.2
Technical/Voc. Education	0.8	0.9	1.6	1.2	1.7
Total	45.6	45.0	52.2	40.3	38.9
Female labour force participation rate (%)					
Illiterate	51.0	48.5	50.3	36.8	36.7
Primary	27.9	26.1	31.4	24.0	21.8
Secondary	19.3	15.6	24.8	16.2	14.6
Graduate and above	37.1	31.5	37.4	31.5	33.4
Technical/Voc. Education	56.6	47.9	53.9	43.9	45.6
Total	39.2	34.9	37.4	26.6	24.9
Enrollment size (million)					
Not Attending	60.0	68.9	69.0	82.4	83.9
Primary	2.2	3.3	3.2	2.7	2.8
Secondary	7.4	10.2	13.5	20.1	24.0
Graduate and above	2.4	3.6	4.5	8.0	9.5
Technical/Voc. Education	1.3	0.7	1.4	2.2	3.1
Total	73.2	86.8	91.6	115.4	123.2

employment for young female job aspirants, and suggests policy measures for raising the growth of female employment.

We found that while female employment in agriculture has been falling, their employment in manufacturing and construction and services sectors have been rising. First, in manufacturing sector women are very vulnerable (because of their low level of skill) to economic downturns, which was reflected in the cyclical fluctuation of female employment (mostly engaged as temporary or casual workers in labor intensive and informal sectors) during last three decades. Hence, improving the skill level of low-skilled female workers along with employment generation measures could therefore enable them to secure regular employment in manufacturing sector. Secondly, we found that jobs in construction had grown rapidly, and women had sought/obtained employment in this sector since the turn of this century. But such women jobseekers are those with low level of education and skills with few other options. For these low-skilled women, development of rural non-farm sectors focusing on the growth of labor intensive units is likely to absorb many job aspirants, both the younger and older women. Third, the growth of modern services like IT, telecom, financial intermediation and modern hospitality including hotel trade together contributed significantly to the growth female employment in large and metro cities. These sub-sectors would probably sustain the growth of female employment, as will health and education where young girls are getting employment.

We examined determinants of female LFPR at household level, and noted rural–urban distinctions. Since social constraints for women are a bit less in urban areas, focusing on urban development mainly targeting small towns and suburban areas with appropriate security measures for women, along with greater availability of jobs for women in these towns is likely to improve the female LFPR. With recent improvements in the level of girls' education, this urbanization would help Indian women to begin to break the social barriers and join the labor force. Furthermore to counter the negative income effect which outweighed the positive substitution effect of the increase in real wage, relatively better skilled jobs need to be created for the young educated female job aspirants. An increase in the number of regular jobs, requiring better skills, with an improved wage rate is likely to make the substitution effect stronger. That also means bringing vocational skilling closer to the home of young women getting education in rural areas.

We found a clear relationship between rising educational levels and a falling female LFPR. Though increased government spending on primary and secondary education has an adverse impact on female LFPR in the short-run, it is expected that it will have positive implications in the long-run. Hence, increased government spending on higher education including technical and vocational education is necessary for sustaining the growth of female LFPR in the long-run, as the economy diversifies and demand for a more skilled workforce increases. Since Indian economy is currently passing through a phase of demographic dividend, unless these measures are taken, India may not be able to reap the dividend resulting from workforce participation of almost half the population. Improving female LFPR would not only hasten the process of structural transformation but would also help sustain the growth of output and hence overall socio-economic development in the long-run.

6. UNCITED REFERENCES

Goldin (1984), Goldin (1986), Klein and Vella (2006), Madheswaran and Attwell (2007) and Mincer (1962).

NOTES

1. The average annual growth rate of GDP in India was quite low during 1951–1980 (about 3.6% during 1951–1970, and about 2.7% during 1971–80), which increased to about 5.5% during 1981–90 and furthermore, to 5.9% during 1991–2000 and about 7.5% during 2001–10.

2. As per World Bank Analytical Classifications of countries based on *GNI per capita in US$ (2010). According to this classification, countries with $1,025 or less GNI per capita are called Low-income economies; with GNI per capita between $1,026 and $4,035 are lower middle-income economies; with GNI per capita between $4,036 and $12,475 are upper middle-income economies; and high-income economies are those with a GNI per capita of $12,476 or more.*

3. Non-manufacturing sector includes construction, mining and quarrying, electricity, gas, water supply etc. but in employment growth the construction sector contributes the maximum share (more than 95 percentage).

4. For which they normally do not receive any kinds of direct payments or wages from their households. These activities include: free collection of firewood, cow-dung, cattle feed, etc.; work in household poultry, dairy, etc.; husking of paddy for household consumption; grinding of food grains for household consumption; maintenance of kitchen gardens, orchards etc.; free collection of fish, wild fruits, vegetables, etc. for household consumption; making baskets and mats for household use; preparation of cow-dung cake for use as fuel in the household; sewing, tailoring, weaving, etc. for household use; child care and tutoring of own children or other children free of charge; bringing water from outside the household premises; and many more.

5. The National Crime Records Bureau (NCRB) in its "Crime in India 2012" report reveals the sorry state of affairs regarding crime trends and the criminal justice system of India. According to this report, the single crime of rape is the fastest growing crime in India and has increased by 902% over 1971–2012.

6. Women are active participants in the labor force through their roles as contributing family workers on family farms for which they do not get any monetary remuneration.

7. Sarva Shiksha Abhiyan (for elementary education or classes 1–8) and Rastriya Madhyamika Shikhya Abhiyan (for secondary education) are programmes of the central government pursuant to the Right to Education Act 2009, both of which have improved infrastructure as well as the pupil-teacher ratio, thus increasing enrollment. The universalization of school meals first at primary level and then at upper primary level, and financial incentives to girls who continue after completing class 8 into secondary school are also responsible for this rising enrollment.

8. Though in a few subsectors of services the retirement age is 65 years in India, for international comparison working age is normally considered as the age group 15–59 years.

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9. Data on the number of tractors and power tillers sold and gross fixed capital formation in agriculture are used as proxies for agricultural mechanization. We have found a negative correlation between female LFPR and tractors sold (−0.45), female LFPR and power tillers sold (−0.47), and female LFPR and growth of GFCF in agriculture (−0.13).

10. Both the size (from 6 million to only 1.5 million) and percentage share (from 5% to 1% of the total female labor force) of child female labor declined during 1993–94 and 2011–12. And the size and percentage share of younger girls (age group 15–29 years) in the labor force also declined (from 44 million to 36 million and from 36% to about 28% respectively) during the same period (See Table 2).

11. The state of Andhra Pradesh was bifurcated into Telangana and the residuary Andhra Pradesh, based on the Andhra Pradesh Reorganisation Act, 2014 of the Indian Parliament.

12. Also see Kucera, Roncolato, and Von Uexkull (2012) to know how the global economic slowdown affected Indian trade and employment.

13. It includes sectors like Construction, Mining and Quarrying, and Electricity, Water supply and Gas etc.

14. NSS unit-level data are for the years 1983 (38th round), 1987–88 (43rd round), 1993–93 (50th round), 1990–2000 (55th round), 2004–05 (61st round), 2009–10 (66th round) and 2011–12 (68th round).

15. When one or more of the regressors are correlated with the error term simple probit provides biased estimates. The sources of bias could be either due to omitted variable, errors-in-variable, or due to simultaneous causality in the model.

16. Percentage of population not participating in the labor force and belong to the age group less than 15 years and greater than equal to 60 years respectively.

17. For the year 1983, 1987–88, 1993–94, 1999–2000, 2004–05, 2009–10 and 2011–12.

18. The provision of free books, school dresses and bicycles for girl students (in some states) might have increased female enrollments at secondary level. Most of the state governments are spending following RMSA norms following Right to Education Act, 2009.

19. We have run three different regression models using these variables as regressors (See Tables 5 and 6).

20. This categorization is based on a Composite Development Index suggested by the Raghuram Rajan Committee in a report submitted (on 26th Sep, 2013) to the Ministry of Finance, Government of India. Accordingly, the states are categorized into: Least developed including Odisha, Bihar, Madhya Pradesh, Chhattisgarh, Jharkhand, Arunachal Pradesh, Assam, Meghalaya, Uttar Pradesh, and Rajasthan), Less Developed (including Manipur, West Bengal, Nagaland, Andhra Pradesh, Jammu and Kashmir, Mizoram, Gujarat, Tripura, Karnataka, Sikkim, and Himachal Pradesh) and Relatively Developed states (including Haryana, Uttarakhand, Maharashtra, Punjab, Tamil Nadu, Kerala, and Goa).

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APPENDIX A

Table 8. *Earning function estimates*

Variables	Estimates in rural area				Estimates in urban area			
	State-I equation		State-II equation		State-I equation		State-II equation	
	Coeff	*Z*-value	Coeff	*Z*-value	Coeff	*Z*-value	Coeff	*Z*-value
Age	0.2	263.1	0.03	7.9	0.1	215.5	0.1	11.3
Age Square	−0.002	−242.1	0.0004	7.6	−0.002	−195.5	−0.001	−11.7
Household Size	−0.1	−70.9			−0.02	−28.4		
Primary	−0.4	−80.5	0.1	6.6	−0.3	−53.8	−0.5	−15.1
Secondary	−0.3	−38.3	0.5	20.2	−0.4	−51.6	−0.4	−9.7
Graduate & above	0.4	20.8	0.8	22.5	0.2	19.6	0.8	19.9
With Tech education	0.9	37.7	1.2	28.2	0.9	59.4	1.1	18.2
ST	0.4	59.8	−0.02	−1.1	0.3	27.9	0.2	4.2
SC	0.2	43.3	0.2	16.7	0.2	26.5	0.6	23.3
Hindu	0.1	13.6	−0.2	−7.5	0.05	4.2	0.3	6.8
Muslim	−0.3	−26.7	0.1	2.5	−0.1	−8.6	−0.2	−3.2
Christian	0.2	14.6	−0.04	−1.4	0.4	29.7	0.4	6.4
log MPCE	0.1	12.1			−0.01	−0.5		
log MPCE square	0.0	−30.7			−0.02	−17.2		
Professionals			−1.5	−44.1			4.3	96.4
Clerks			−1.3	−26.3			5.5	103.3
Sales and service			−1.9	−60.5			1.6	39.7
Agricultural labour			−1.1	−87.1			1.0	25.1
Production labour			−1.4	−57.4			1.4	34.1
Other Elementary			−1.2	−45.0			3.4	72.7
Manufacturing			0.2	10.4			0.1	3.3
Non-manufacturing			0.8	35.8			2.0	34.7
Services			0.9	37.0			1.1	27.6
Year 1988	0.3	24.7	−1.3	−61.9	0.2	15.6	0.2	2.8
Year 1994	−0.5	−37.1	4.9	189.8	0.3	20.3	0.2	3.9
Year 2000	−0.2	−12.4	5.5	234.5	0.5	33.2	−0.2	−4.0
Year 2005	−0.2	−17.9	5.7	232.1	0.6	41.5	0.6	9.8
Year 2010	−0.2	−16.1	6.3	200.0	0.5	31.6	−0.4	−6.5
Year 2012	−0.2	−11.0	6.6	209.6	0.6	37.8	0.7	11.6
Constant	−2.6	−76.0	3.4	32.2	−2.4	−56.5	−3.4	−11.7
Lambda	−0.4	−13.1			0.9	9.8		
Rho	−0.3				0.3			
Sigma	1.4				2.8			
Number of observation	850406				582802			
Censored observation	740049				478622			
Uncensored observation	110357				104180			
Wald Chi-Square	509930.4				53868.5			

Source: Authors' estimation based NSS unit-level data.

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Table 9. *Summary of variables used in micro-level estimations*

Variable	Used in rural estimation					Used in urban estimation				
	Observations	Mean	Std. Dev.	Min	Max	Observations	Mean	Std. Dev.	Min	Max
Labour force participation	1127844	0.34	0.47	0	1	582802	0.18	0.38	0	1
log MPCE	1127844	6.00	0.93	0	13.7	582802	6.38	1.00	0	17.7
log MPCE square	1127844	36.92	10.83	0	188.6	582802	41.71	12.50	0	314.3
Log wage (Predicted)	1127844	9.19	3.69	0.18	23.37	582802	−0.33	1.52	−4.2	9.3
Age	1127844	26.86	18.72	15	65	582802	27.43	18.72	15	65
Age Square	1127844	1071.6	1291.8	0	10816	582802	1102.5	1317.3	0	10201
Years of schooling	1127844	2.67	3.75	0	19	582802	4.88	4.83	0	19
Years of schooling square	1127844	21.19	41.59	0	361	582802	47.18	66.51	0	361
Household size	1127844	6.68	3.36	1	46	582802	6.12	2.94	1	40
No. of Children (0–5 years)	1127844	1.01	1.19	0	14	582802	0.80	1.08	0	12
No. of Adult females	1127844	2.63	1.73	0	25	582802	2.30	1.51	0	21
No. of children (0–14 yeas)	1127844	2.60	2.10	0	29	582802	2.18	1.93	0	25
No. of elderly	1127844	0.58	0.96	0	11	582802	0.48	0.84	0	10
Education Dummies (Reference category: Illiterate)										
Illiterate	1127844	0.54	0.50	0	1	582802	0.33	0.47	0	1
Primary	1127844	0.37	0.48	0	1	582802	0.44	0.50	0	1
Secondary	1127844	0.07	0.26	0	1	582802	0.16	0.37	0	1
Graduate & above	1127844	0.01	0.09	0	1	582802	0.05	0.21	0	1
With Tech education	1127844	0.00	0.06	0	1	582802	0.01	0.12	0	1
Marriage Dummies (Reference category: Un-married)										
Un-married	1127844	0.41	0.49	0	1	582802	0.44	0.50	0	1
Married	1127844	0.51	0.50	0	1	582802	0.47	0.50	0	1
Divorced/separated	1127844	0.07	0.26	0	1	582802	0.09	0.28	0	1
Relation to Head Dummies (Reference category: Other Members)										
Head of family	1127844	0.04	0.19	0	1	582802	0.05	0.22	0	1
Spouse of Head	1127844	0.36	0.48	0	1	582802	0.36	0.48	0	1
Other Members of Family	1127844	0.60	0.49	0	1	582802	0.59	0.49	0	1
Caste Dummies (Reference category: Others)										
ST	1127844	0.15	0.35	0	1	582802	0.07	0.25	0	1
SC	1127844	0.17	0.37	0	1	582802	0.13	0.34	0	1
Others	1127844	0.69	0.46	0	1	582802	0.80	0.40	0	1
Religion Dummies (Reference category: Others)										
Hindu	1127844	0.78	0.42	0	1	582802	0.73	0.45	0	1
Muslim	1127844	0.11	0.32	0	1	582802	0.17	0.38	0	1
Others	1127844	0.06	0.23	0	1	582802	0.06	0.24	0	1
Religion Dummies (Reference category: North-East region)										
Eastern Region	1127844	0.12	0.32	0	1	582802	0.10	0.30	0	1
Western Region	1127844	0.10	0.30	0	1	582802	0.17	0.38	0	1
Northern Region	1127844	0.38	0.49	0	1	582802	0.31	0.46	0	1
Southern Region	1127844	0.18	0.39	0	1	582802	0.25	0.43	0	1
Central Region	1127844	0.08	0.27	0	1	582802	0.07	0.26	0	1
North-East Region	1127844	0.13	0.34	0	1	582802	0.10	0.30	0	1
Year Dummies (Reference category: Period 1983–88)										
Period 1983–88	1127844	0.22	0.41	0	1	582802	0.21	0.41	0	1
Period 1994–2000	1127844	0.33	0.47	0	1	582802	0.33	0.47	0	1
Period 2005	1127844	0.19	0.39	0	1	582802	0.17	0.38	0	1
Period Post-2005	1127844	0.26	0.44	0	1	582802	0.29	0.46	0	1

Source: Authors' estimation based NSS unit-level data.

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Table 10. *Summary of variables used in the macro-level estimations.*

Variables	Used in rural estimation					Used in urban estimation				
	Obs.	Mean	Std. Dev.	Min.	Max.	Obs.	Mean	Std. Dev.	Min.	Max.
LFPR (Dependent variable)	205	36.78	12.19	6.13	56.98	205	18.59	5.63	7.86	33.84
Log per capita NSDP	205	10.03	0.59	8.66	11.77	205	10.03	0.59	8.66	11.77
Log per capita NSDP square	205	100.97	11.93	74.92	138.5	205	100.97	11.93	74.92	138.5
Average HH Size	205	6.68	3.36	1	46	205	6.12	2.94	1	40
Log wage female	205	0.5	1.84	0	14.08	205	7.09	0.97	0	15.36
Enrollment ratio primary female	205	69.95	22.91	13.18	95.26	205	88.25	22.91	52.18	99.26
Enrollment ratio secondary female	205	18.14	16.89	0.10	32.94	205	35.14	16.89	15.4	62.94
Enrollment ratio graduate & above female	205	2.41	8.73	0.01	22.45	205	15.41	17.3	4.2	42.75
Mean years of schooling female	205	2.55	3.62	0	19	205	5.34	5.05	0	19
Mean years of schooling Square female	205	19.57	39.17	0	361	205	53.96	72.65	0	361
Percentage of child population	205	14.03	15.53	0	91.67	205	11.96	15.35	0	88.89
Percentage of elderly population	205	8.77	17.50	0	100	205	7.97	16.09	0	100
Growth of GFCF in agriculture	205	26.17	25.70	1.80	87.73	—	—	—	—	—
Log of Tractors sold	205	5.31	0.31	4.80	5.73	—	—	—	—	—
Log of Power Tillers sold	205	4.11	0.49	3.35	4.78	—	—	—	—	—
Growth of Regular jobs	—	—	—	—	—	205	1.41	2.07	0.02	3.89
Female worker-population Ratio	205	36.14	12.41	6.13	56.53	205	17.21	5.43	7.35	32.82
Growth of Urban population	—	—	—	—	—	205	29.35	22.35	12.47	45.21

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