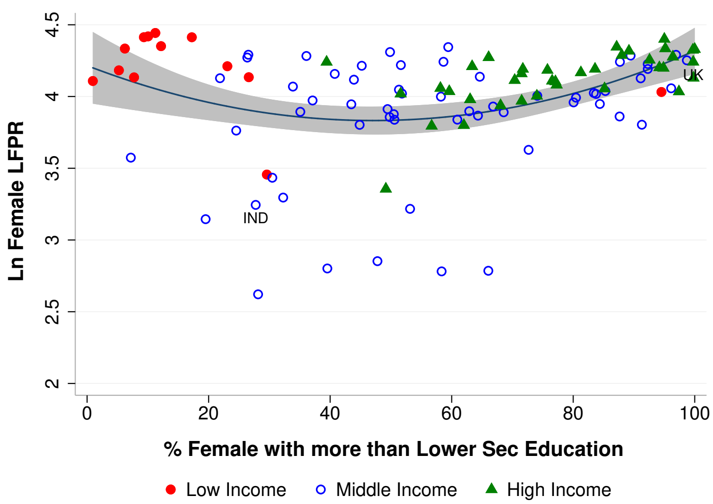
ONLINE APPENDIX

What Determines Women's Labor Supply? The Role of Home Productivity and Social Norms

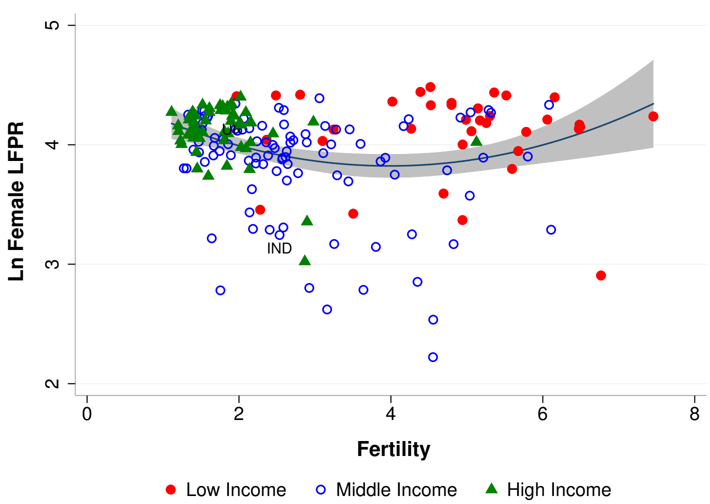
A Additional Analysis

Figure A.1 Cross-country Women's LFPR: Education, Fertility and GDP per capita

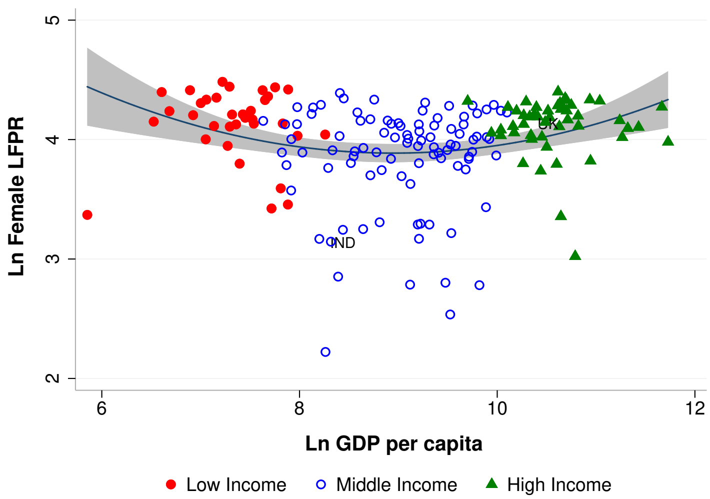
(a) Women's LFPR and women's education



(b) Women's LFPR and fertility



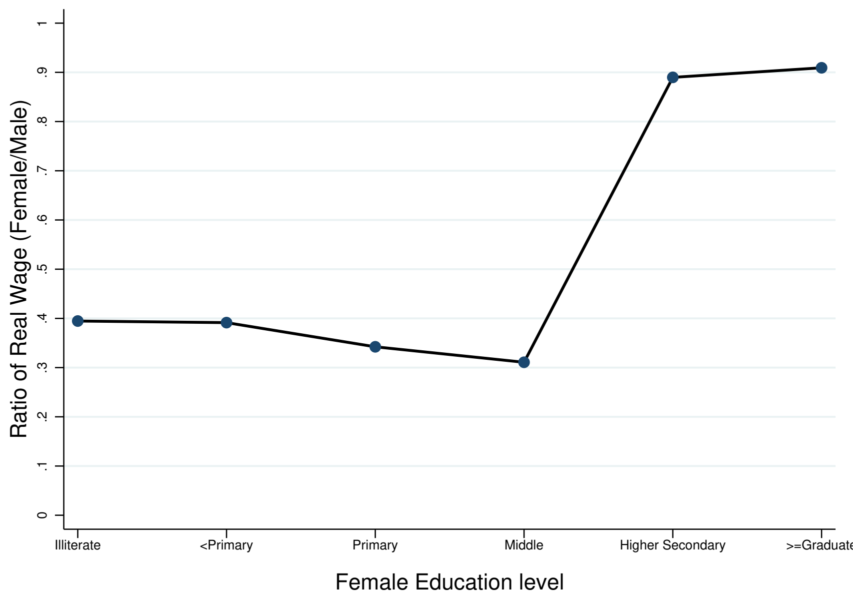
(c) Women's LFPR and per capita income



Source: World Development Indicators

Note: The graphs are plotted for all countries available in the World Bank dataset. Female LFPR refers to proportion of females aged 15-64 who participate in labor force. Education captures proportion of females aged 25 and above, having at least lower secondary (class 10 and above) level of education in 2011 (an average over last 5 years is taken because education details are not available for each country every year). Fertility measures total births per woman till the end of her childbearing age in year 2011. GDP per capita is measured in 2011 and is based on purchasing power parity in constant 2011 international dollars. The classification of countries into low, middle and high income is done according to the World Bank classification as in year 2011. The lower middle income and the upper middle income countries are clubbed together to form the middle income group. In graph (a), Kyrgyz Republic, a low income country but with a high level of secondary schooling completion, is at the right end of the schooling distribution.

Figure A.2 Wage ratio over Female Education using Spousal Data

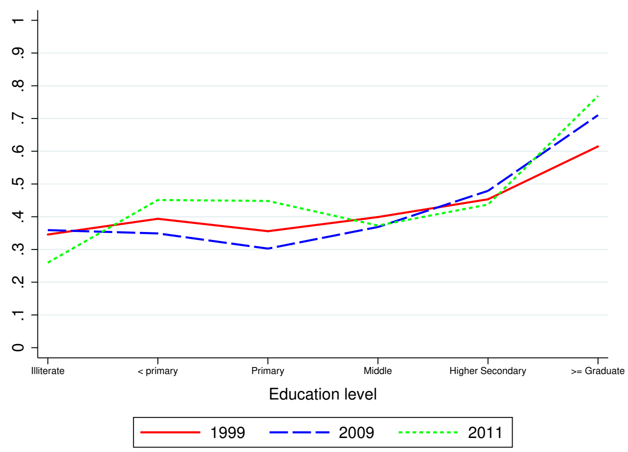


Source: National Sample Survey, Employment and Unemployment Schedules 1999, Time Use Survey 1998 (Authors' own calculations).

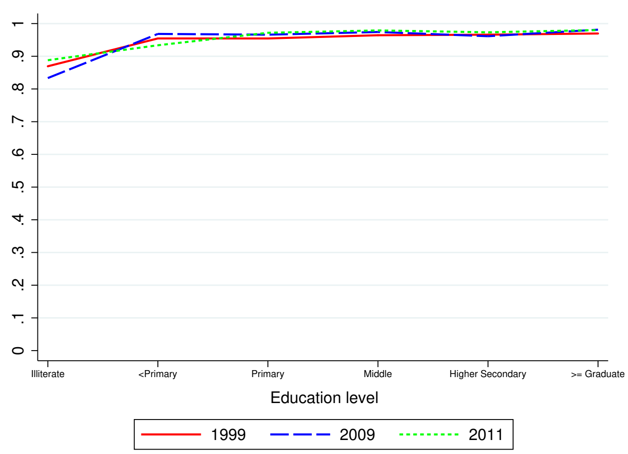
Note: Daily wage calculated from the NSS data 1999 for each education-gender cell and attached to the spousal data from Time Use. Based on this the gender wage ratio is calculated.

Figure A.3: LFPR by education (urban, never married, age 20-45)

(a) Women



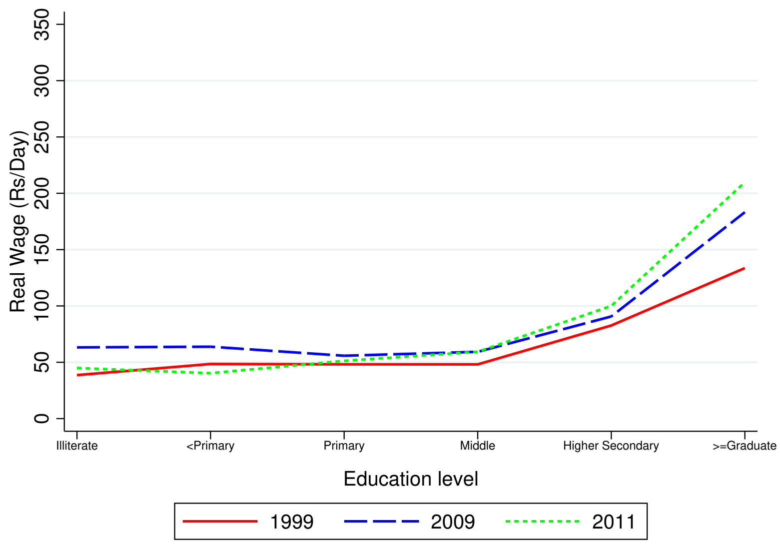
(b) Men



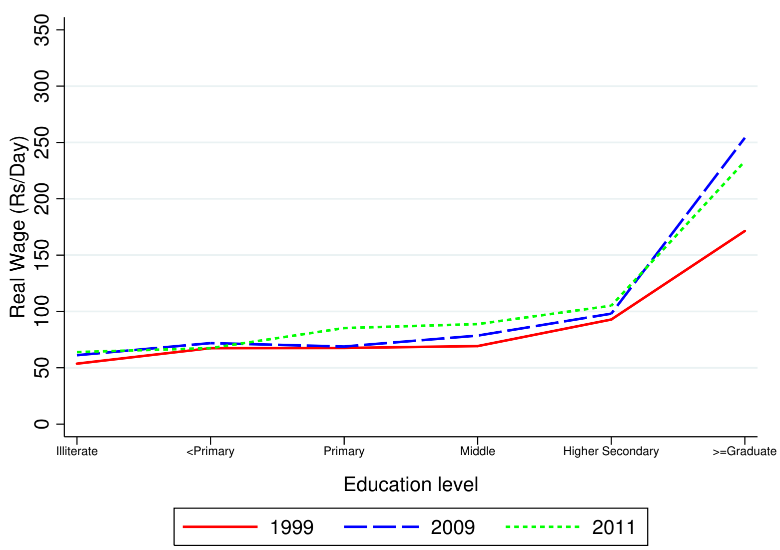
Source: National Sample Survey, Employment and Unemployment Schedules 1999, 2009 and 2011 (Authors' own calculations). *Note*: LFPR is calculated using the usual status definition of employment in the NSS data for those not currently enrolled in education. The sample size is 12,253 (in 1999), 9424 (in 2009) and 8995 (in 2011) for men and 4211 (in 1999), 3621 (in 2009) and 3744 (in 2011) for women. See data appendix for details.

Figure A.4: Returns to education (urban, never married, age 20-45)

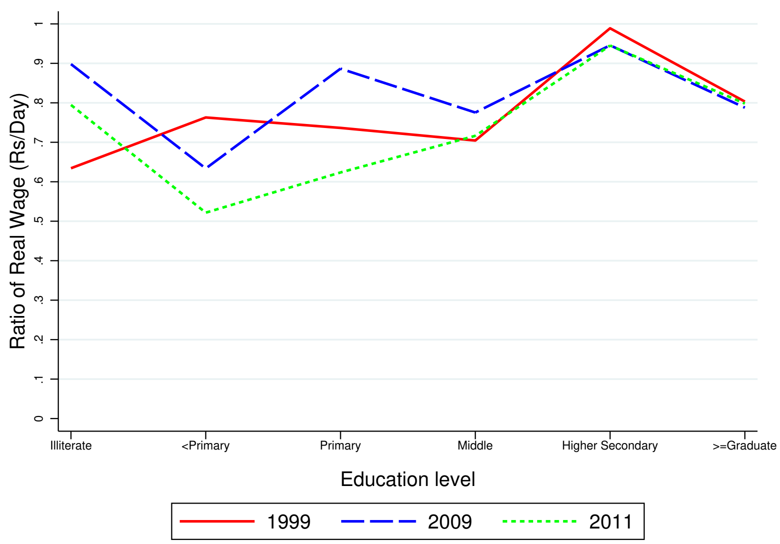
(a) Women



(b) Men



(c) Gender Wage Ratio

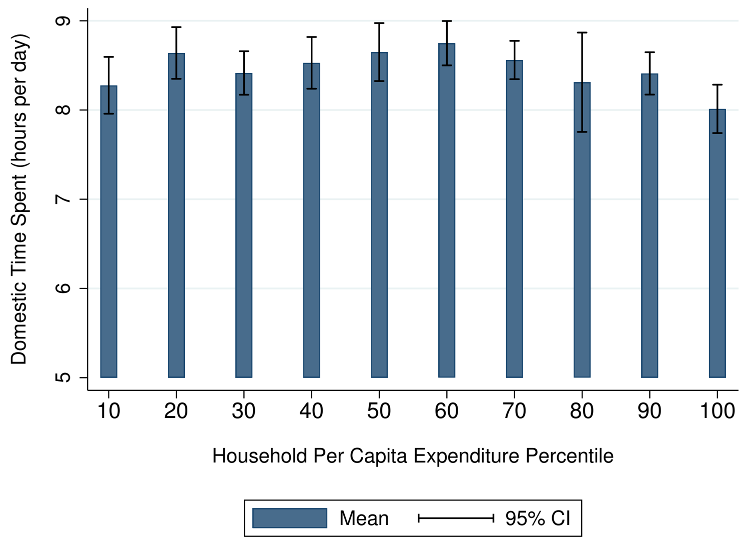


Source: National Sample Survey, Employment and Unemployment Schedules 1999, 2009 and 2011 (Authors' own calculations).

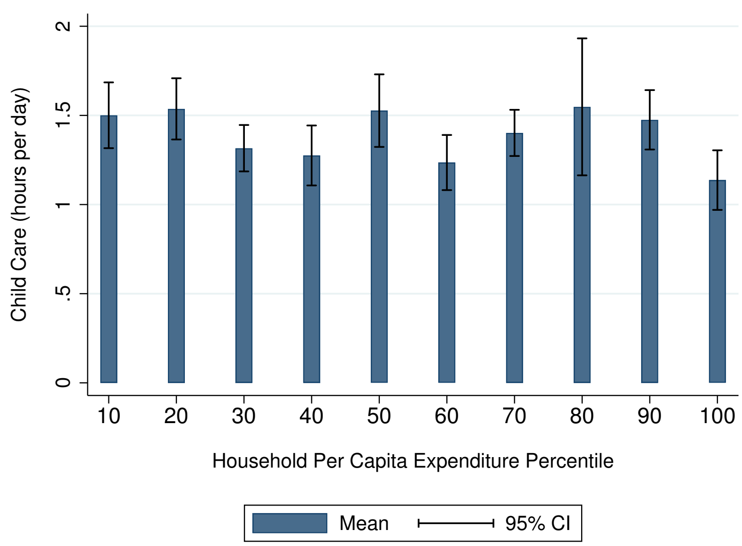
Note: Mean daily wage is calculated from the NSS data for each education-gender cell and deflated at 1999 price levels using the All India Consumer Price Index for Industrial Workers. The sample size is 5271 (in 1999), 4850 (in 2009) and 4607 (in 2011) for men and 985 (in 1999), 914 (in 2009) and 1076 (in 2011) for women.The wage gap was calculated as the ratio of mean female to mean male wage.

Figure A.5: Household Time Allocation (hours per day)

(a) Domestic Work



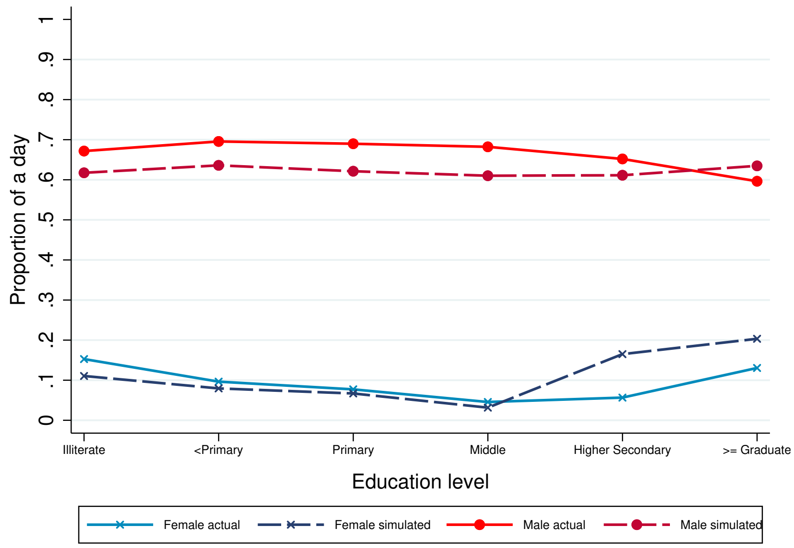
(b) Child Care



Source: Time Use Survey 1998 (Authors' own calculations).
Note: Time spent on domestic work by a household is defined as the sum of husband's and wife's time on all home production activities on the reference day. Time spent on exclusive child care is a sub-category of domestic work. It is the sum of husband's and wife's time on physical care, teaching, supervision and travel directly related to child well-being.

Figure A.6 Simulations for time spent in labor market, home production, leisure (with $\bar{H}$ fixed across education groups) with wealth effects

(a) Labor Supply



(b) Domestic Work

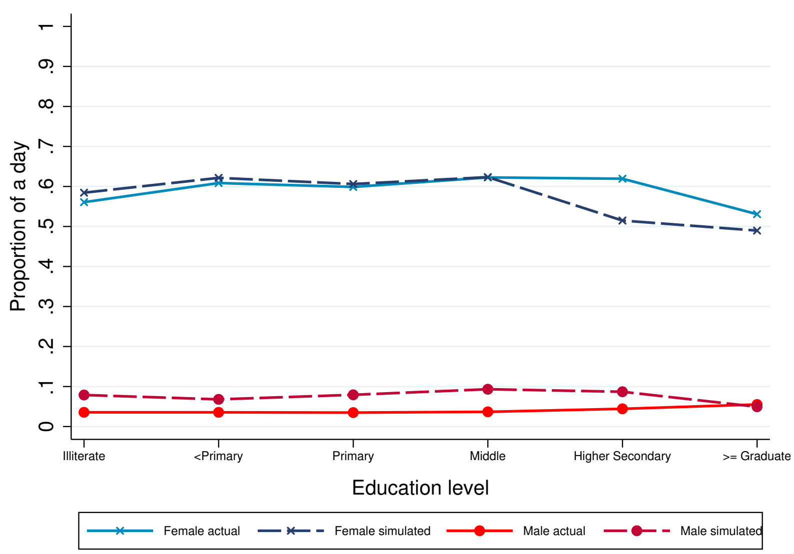
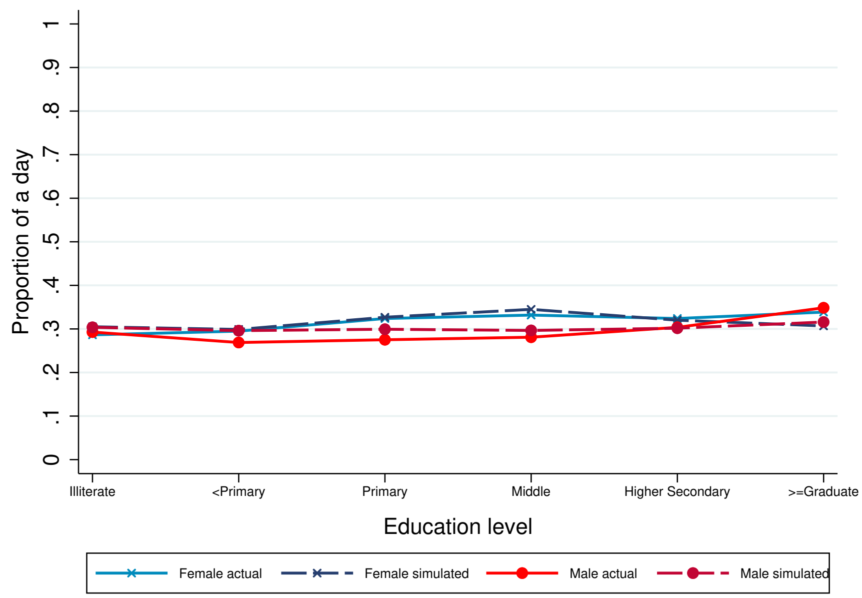


Figure A.6 (contd.)Simulations for time spent in labor market, home production, leisure (with $\bar{H}$ fixed across education groups) with wealth effects

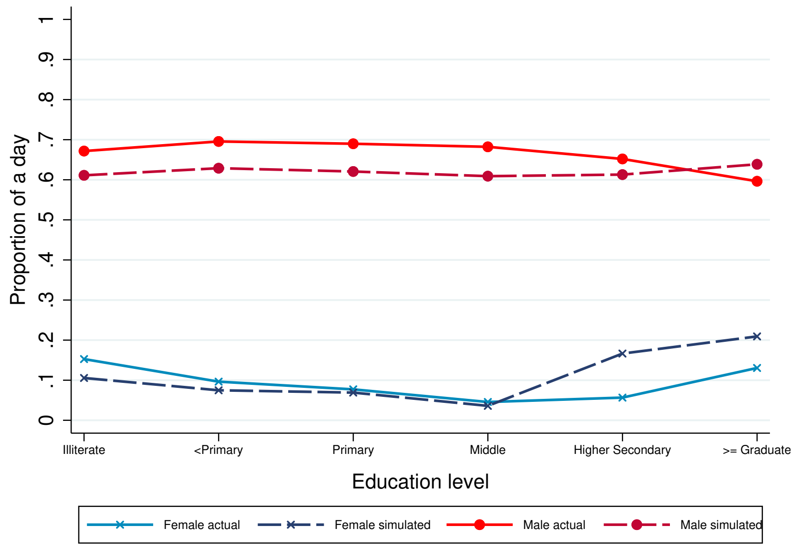
(c) Leisure



Note: Time spent in labor market, home production and leisure is shown as a fraction of the total time endowment of one. See data appendix for details on Time Use data.

Figure A.7 Simulations for time spent in labor market, home production, leisure (with $\bar{H}$ varying across education groups)

(a) Labor Supply



(b) Domestic Work

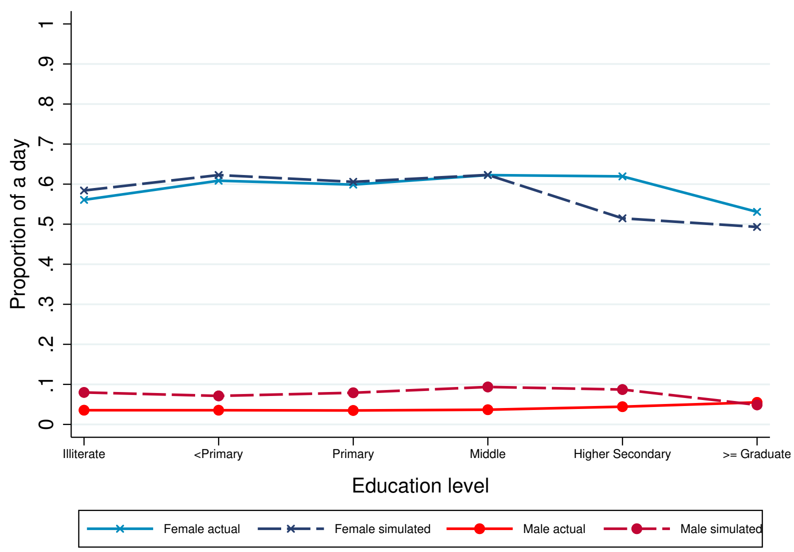
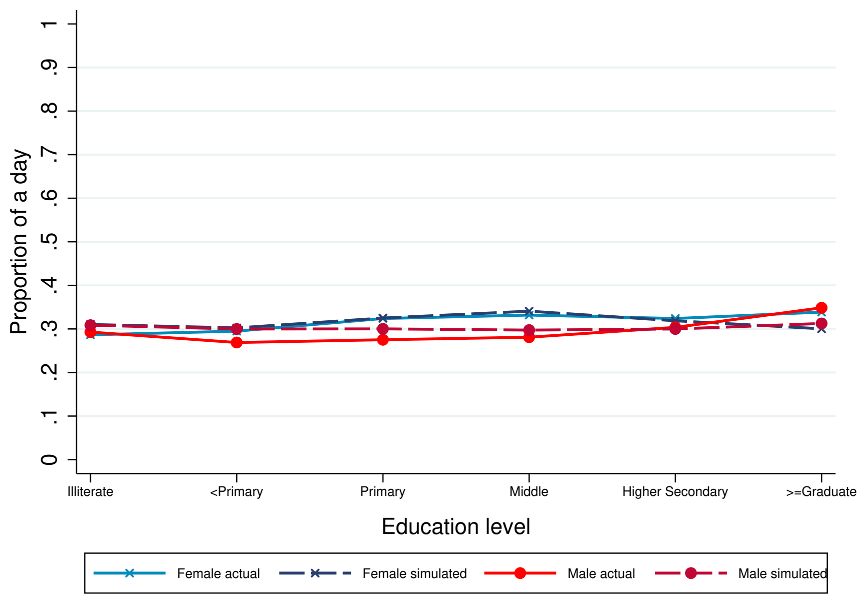


Figure A.7 (contd.)Simulations for time spent in labor market, home production, leisure (with $\bar{H}$ varying across education groups)

(c) Leisure

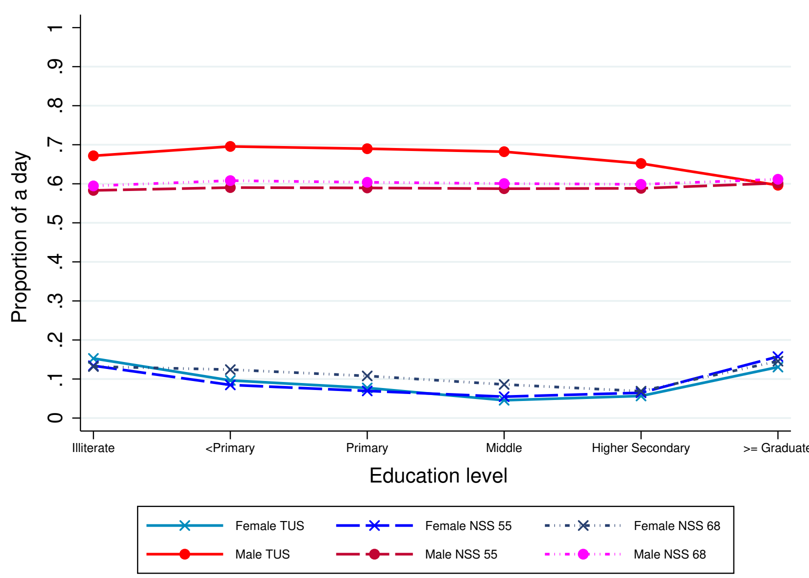


Note: Time spent in labor market, home production and leisure is shown as a fraction of the total time endowment of one. See data appendix for details on Time Use data.

Recent Employment Data

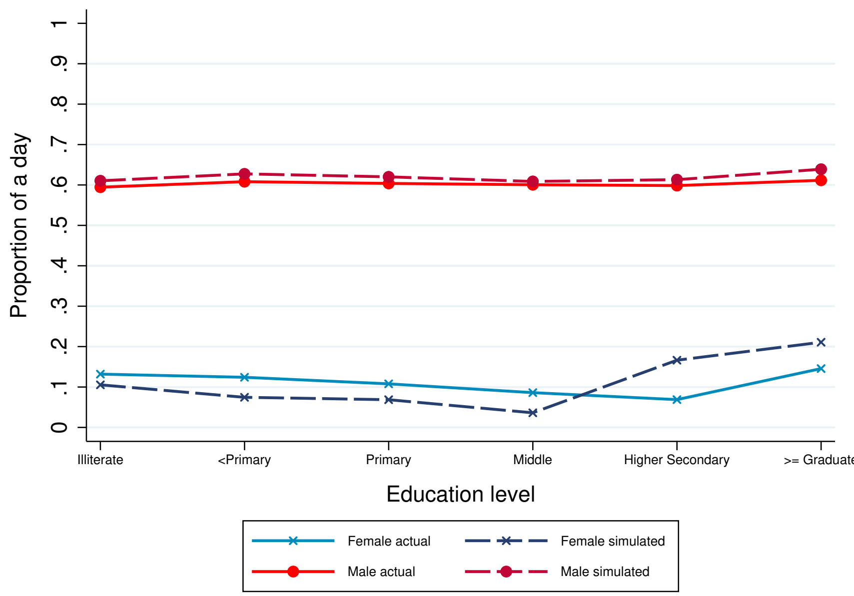
To calculate labor supply using NSS, consistent with the definition used in the TUS, we use the daily status definition of employment which captures the number of days a person was employed in the previous week. These are captured as half (0.5) or full (1) day. Assuming an eight hour work day, the total number of hours spent in employment in the past week are calculated for each individual. We then divide this figure by the average discretionary time per week obtained from the time use survey for each gender-education cell to obtain the proportion of time spent in the labor market in a reference week. Figure A.8 below shows that the TUS 1998 and NSS 1999 labor supply measures are close for women but not men. Thus, measurement error is likely for men in lower education groups when we use the NSS approximation and the simulated paths for men are likely to overpredict men's labor supply. We corroborate this using the TUS data where we find that on an average men who work, spend around 9.3 hours per day in market work. This is higher than our assumed 8 hour work day when approximating NSS for employment. For women, this is not a concern since on an average they report working for 3.5 hours, captured well in half day work in NSS.

Figure A.8 LFPR in urban India (married, age 20-45): comparison across TUS (1998) and NSS (1999, 2011)



Source: National Sample Survey, Employment and Unemployment Schedules 1999 (NSS 55) and 2011 (NSS 68), Time Use Survey 1998 (Authors' own calculations).

Figure A.9 Simulations for time spent in labor market using NSS (2011)



Source: National Sample Survey, Employment and Unemployment Schedules 1999 and 2011, Time Use Survey 1998 (Authors' own calculations).
Note: LFPR is calculated by summing up the days worked in the reference week in NSS data, multiplying it by eight (assuming 8 hour work day) and then dividing by discretionary time obtained for each education-gender cell. See data appendix for details.

Table A.1 Impact of mother's education on child learning outcomes

Dependent variable ⟶	(1) Reading Test Score	(2) Writing Test Score	(3) Math Test Score
Less than Primary	0.245**	0.085**	0.127
	(0.097)	(0.037)	(0.088)
Primary	0.296***	0.047	0.213***
	(0.080)	(0.029)	(0.060)
Middle	0.374***	0.067**	0.217***
	(0.077)	(0.028)	(0.059)
Higher Secondary	0.421***	0.119***	0.262***
	(0.077)	(0.028)	(0.065)
Graduate and Above	0.403***	0.130***	0.328***
	(0.103)	(0.036)	(0.077)
Observations	3,401	3,374	3,381
R-squared	0.300	0.251	0.367
Mean Scores	2.923	.776	1.851
Child's gender	Yes	Yes	Yes
Child's age	Yes	Yes	Yes
Caste	Yes	Yes	Yes
Religion	Yes	Yes	Yes
Household consumption expenditure	Yes	Yes	Yes
Father's education	Yes	Yes	Yes
District FE	Yes	Yes	Yes

Source: Indian Human Development Survey 2004 (Authors' own calculations).
Note: The dependent variable is the score of a child in reading (0 to 4), writing (0 to 1) and math (0 to 3) in a standardized test administered in the nationally representative Indian Human Development Survey (IHDS) 2004. The coefficients represent the marginal effect of mother's education level on these outcomes, with an illiterate mother as the reference group. Other controls include indicator variables for age category and gender of the child, indicator variables for caste, religion and consumption expenditure per capita (quintiles) of the household, father's education and district fixed effects. The sample is restricted to households residing in urban areas and children aged 8-11 (the learning scores are captured only for this age group in the IHDS survey). Robust standard errors reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.2 Calibrated values of α when $\bar{H}$ varies by education group

Paramater	Value	Description	Source
		Ratio of $\bar{H}$ to H : Male	
$\alpha^{i,1}$	0.030	Illiterate	calibrated
$\alpha^{i,2}$	0.027	Less than primary	calibrated
$\alpha^{i,3}$	0.025	Primary	calibrated
$\alpha^{i,4}$	0.024	Middle	calibrated
$\alpha^{i,5}$	0.025	Higher Secondary	calibrated
$\alpha^{i,6}$	0.026	Graduate and above	calibrated
		Ratio of $\bar{H}$ to H : Female	
$\alpha^{1,j}$	0.025	Illiterate	calibrated
$\alpha^{2,j}$	0.024	Less than primary	calibrated
$\alpha^{3,j}$	0.025	Primary	calibrated
$\alpha^{4,j}$	0.023	Middle	calibrated
$\alpha^{5,j}$	0.024	Higher Secondary	calibrated
$\alpha^{6,j}$	0.039	Graduate and above	calibrated

Note: To ease presentation the 36 calibrated α values (for each possible i, j education combination of wife and husband) are averaged over each education group of women and men in this table.

B Data Appendix

We draw on the following datasets in the analysis:

B.1 National Sample Survey (Employment)

The Employment and Unemployment rounds of India's National Sample Surveys (NSS) conducted in 1999-2000, 2009-10 and 2011-2012 (referred to as 1999, 2009 and 2011 in this paper) for urban India are used to calculate women's labor force participation rates over these years. These surveys are repeated cross sections of households (120,578, 100,957 and 101,724 households surveyed in 1999, 2009 and 2011, respectively), selected through stratified random sampling across all states, that are representative of the country's population.

Construction of education categories: NSS reports educations status of all members in the households by recording the highest level of education completed. These categories are collapsed to create six categories of education used in the paper - Illiterate, Less than Primary, Primary, Middle, Higher Secondary (includes secondary and higher secondary levels) and Graduate and above education.

Construction of labour force participation variable: NSS uses three reference periods to capture employment: (i) one year, (ii) one week, and (iii) each day of the previous week. This paper employs the Usual Principal and Subsidiary Status (UPSS) definition in the introductory graphs (Figure 1, Figure A.3) since that is the most frequently used measure for comparing employment figures across years in India. This employment status is derived from two variables - Usual Principal Activity Status (PS) and Subsidiary Activity Status (SS).

The activity status on which a person spent relatively longer time (major time criterion) during the 365 days, preceding the date of survey, is considered the PS of the person. After determining the principal status, the economic activity on which a person spent 30 days or more during the reference period of 365 days, preceding the date of survey, is recorded as the SS of a person. In our analysis, if a person is defined to be in the labor force in either the principal activity status or the subsidiary activity status then she is defined to be in the labor force according to the UPSS definition.

Construction of real wages: The details about wages are collected in the weekly schedule of the NSS survey where each respondent is asked the number of days worked across various activity categories in each day of the previous week. Total weekly earnings are divided by total days worked in the week for an individual to arrive at the individual daily wage earned.

This is done for each year - 1999, 2009 and 2011 - and the wages for the years 2009 and 2011 are deflated using the Consumer Price Index for Industrial Workers (CPIIW) to make them comparable with 1999.

B.2 Time Use Survey

Time use data were collected from 18,591 households across six states of India in 1998-99 by the same nodal agency that conducts the National Sample Surveys to assess the detailed activity wise time spent by adults in India. The selection of states was purposive so that all regions (North west - Haryana, central - Madhya Pradesh, West - Gujarat, East - Orissa, South - Tamil Nadu and North-east - Meghalaya) of India were adequately represented. While the NSS surveys collect data on aggregate work, the time use survey allows us to break down various activities and classify them into activities that are directed towards labor market, household production and leisure.

The TUS adopted the interview method rather than diary or observation method for collection of data since not all respondents are literate enough to maintain time diaries. A reference period of one week was used for collecting the data. To capture the variation in the activity pattern, data were collected for three types of days - normal, weekly variant and abnormal - with a recall lapse of one day, i.e. a 24 hour recall with actual time spent in minutes recorded for each activity.

Classification of activities: We followed standard classification of time use activities for total market work (labor) and total non-market work (home production) (Aguiar & Hurst (2007)). Classification of activities into leisure is more subjective [42]:

(a) Time spent in labor market: farming, animal husbandry, fishing, food processing, collection of fruits/vegetables/fodder/forest produce, mining, construction, manufacturing, trade, business, services, travel to work and in search of job (paid and self employed labor which includes both formal and informal type of work).

(b) Time spent on home production: Fetching water (for drinking at home), collecting fuelwood (for cooking at home), household maintenance activities like cooking, cleaning,

[42] Different definitions are proposed by Aguiar & Hurst (2007) to construct a measure for leisure. The measure of leisure used in this paper coincides with the narrow definition since discretionary time is excluded from it. In addition, it also includes time spent on social and religious activities. Other minor deviations are - pet care is included both in home production and leisure by Aguiar & Hurst (2007) but we include it only in home production; gardening is not recorded as a separate activity in TUS survey of India and is clubbed under hobbies.

shopping for household supplies, supervising household work, repair of household goods, pet care, travel related to household maintenance, care for - children, the sick, the elderly and the disabled, non-formal education of children.

(c) Time spent on leisure: community services, social and cultural activities, hobbies, smoking and drinking, exercise, talking, resting and relaxing, participation in religious activities.

Activities like sleeping and maintaining basic physical well-being (hygiene and eating) constitute discretionary time and are removed from the 24 hours. The remainder of the time is then divided into the above three activities and normalized to one for the calibrations.

Imputation of wages for each education category: The six education categories are classified in the same manner as for the NSS since both NSS and TUS capture education using the same question. The TUS however do not contain data on wages. The daily wage data are imputed from NSS 1999 since these rounds were conducted closest to the TUS. Median daily wage is calculated for married individuals in each education category, for men and women separately, using the NSS survey. These are then used for imputation of wages for the corresponding education and gender category in the couple's data in the TUS while calibrating the model. We use wage data for all states in the NSS to impute wages in the TUS.

Creating a dataset on couples: The TUS (or the NSS) does not identify spouses formally. To identify couples we make use of the fact that the enumerators who conduct the survey are instructed to use a continuous serial number for recording household members and their corresponding details like relation to head, sex and marital status. The head of the household appears first, followed by head's spouse, the first son, first son's wife and their children, second son, second son's wife and their children and so on, for the sons who stay with the head. After the sons are enumerated, the daughters are listed followed by other relations, dependants, servants, etc. This data structure is used to identify couples in the data. Each couple then constitutes a household. Couples in which age of the women is between 20-45 are then used for analyses. Once women are filtered on their age in the couple's data, the corresponding age categories for their husbands are 21-60 in the data. Thus, while imputing the wages from the NSS, the age categories for women are 20-45 while for men are 21-60.

B.3 National Sample Survey (Consumption expenditure)

The consumption expenditure round of India's National Sample Surveys (NSS) conducted in 1999-2000 for urban India is used to calculate the education expenditure of household per child. Education expenditure in NSS entails the annual expenditure incurred by households on books, journals, newspapers, periodicals, library charges, stationery, tuition and institution fees, private tutoring and coaching fees and other miscellaneous expenses. We first create a couples data and assign education categories to individuals in this dataset following the steps discussed in Appendix B.1. The sample for couples with children in age group 5-18 in the NSS stood at 22,991. We calculate the average education expenditure per child for a couple in a given education category (for each of the 36 education categories of couples) and the first percentile value of the annual education expenditure per child incurred by a couple where both have no education. The latter value is used to benchmark the minimum home good production or the social norm. This benchmarked minimum value of home good is assumed to be constant across all education groups. We then calculate the ratio of benchmark minimum home good to the actual education expenditure per child incurred by a couple belonging to education category (i,j). This gives the calibrated value of $\alpha^{i,j}$.

C Theoretical Model

We provide a detailed solution to the household optimization problem in this section.

The Lagrangian of the household optimization problem is $L = U + \lambda_1(\sum_g w_g^e n_g^e - \sum_g c_g^e - q)$, where $U = \theta^{i,j} U_m^j + (1-\theta^{i,j}) U_f^i$ and $U_g = \log(c_g^e) + \phi_L \log(1 - n_g^e - h_g^e) + \phi_H \log(H_g^e - \bar{H})$, $g \in \{m, f\}$. Further, as mentioned above, we have assumed that $H_g^e = H$, $\forall g = f, m$ with the specification $H = q^\delta [z_m (a_m^j h_m^{i,j})^{1-\rho} + z_f (a_f^i h_f^{i,j})^{1-\rho}]^{(1-\delta)/(1-\rho)}$. First order conditions with respect to the choice variables are as follows:

$$c_m^{i,j} \ : \frac{\theta^{i,j}}{c_m^{i,j}} = \lambda_1, \tag{C.1}$$

$$c_f^{i,j} \ : \frac{1-\theta^{i,j}}{c_f^{i,j}} = \lambda_1, \tag{C.2}$$

$$q \ : \frac{\delta \phi_H}{q} \Big[\frac{1}{1 - \frac{\bar{H}}{H_g}} \Big] = \lambda_1,$$

and given $\frac{\bar{H}}{H_g} = \alpha^{i,j}$, we have

$$q \ : \frac{\delta \phi_H}{q} \Big[\frac{1}{1 - \alpha^{i,j}} \Big] = \lambda_1, \tag{C.3}$$

$$n_m^{i,j} \ : \frac{\theta^{i,j} \phi_L}{1 - n_m^{i,j} - h_m^{i,j}} = \lambda_1 w_m^j, \tag{C.4}$$

$$n_f^{i,j} \ : \frac{(1-\theta^{i,j}) \phi_L}{1 - n_f^{i,j} - h_f^{i,j}} = \lambda_1 w_f^i, \tag{C.5}$$

$$h_m^{i,j} : \frac{\theta^{i,j} \phi_L}{1 - n_m^{i,j} - h_m^{i,j}} = \frac{\phi_H}{H_g - \bar{H}} \left(\frac{q^\delta (1-\delta)(z_m (a_m^j h_m^{i,j})^{1-\rho} + z_f (a_f^i h_f^{i,j})^{1-\rho})^{(\frac{1-\delta}{1-\rho} - 1)} z_m (a_m^j h_m^{i,j})^{1-\rho}}{h_m^{i,j}} \right), \tag{C.6}$$

$$h_f^{i,j} : \frac{(1-\theta^{i,j}) \phi_L}{1 - n_f^{i,j} - h_f^{i,j}} = \frac{\phi_H}{H_g - \bar{H}} \left(\frac{q^\delta (1-\delta)(z_m (a_m^j h_m^{i,j})^{1-\rho} + z_f (a_f^i h_f^{i,j})^{1-\rho})^{(\frac{1-\delta}{1-\rho} - 1)} z_f (a_f^i h_f^{i,j})^{1-\rho}}{h_f^{i,j}} \right). \tag{C.7}$$

Using (C.4) in (C.6) and (C.5) in (C.7) we get

$$\lambda_1 w_m^j = \frac{\phi_H}{H_g - \bar{H}} \Big[\frac{q^\delta (1-\delta)(z_m (a_m^j h_m^{i,j})^{1-\rho} + z_f (a_f^i h_f^{i,j})^{1-\rho})^{(\frac{1-\delta}{1-\rho} - 1)} z_m (a_m^j h_m^{i,j})^{1-\rho}}{h_m^{i,j}} \Big], \textit{and} \tag{C.8}$$

$$\lambda_1 w_f^i = \frac{\phi_H}{H_g - \bar{H}} \Big[\frac{q^\delta (1-\delta)(z_m(a_m^j h_m^{i,j})^{1-\rho} + z_f(a_f^i h_f^{i,j})^{1-\rho})^{(\frac{1-\delta}{1-\rho}-1)} z_f(a_f^i h_f^{i,j})^{1-\rho}}{h_f^{i,j}} \Big]. \tag{C.9}$$

Taking a ratio of above expressions, we get

$$\frac{\lambda_1 w_m^j}{\lambda_1 w_f^i} = \frac{z_m(a_m^j h_m^{i,j})^{1-\rho}}{z_f(a_f^i h_f^{i,j})^{1-\rho}} \frac{h_f^{i,j}}{h_m^{i,j}},$$

which implies

$$h_f^{i,j} = \gamma h_m^{i,j},$$

where $\gamma = \left(\frac{w_m^j z_f}{w_f^i z_m}\right)^{\frac{1}{\rho}} \left(\frac{a_f^i}{a_m^j}\right)^{\frac{1-\rho}{\rho}}$. Also using (C.3) in (C.1) and (C.2) we get

$$c_m^{i,j} = \frac{\theta^{i,j} q(1-\alpha^{i,j})}{\delta \phi_H}, \tag{C.10}$$

$$c_f^{i,j} = \frac{(1-\theta^{i,j}) q(1-\alpha^{i,j})}{\delta \phi_H}. \tag{C.11}$$

Using (C.10) and (C.11), we can re-write the budget constraint as:

$$q\left(\frac{1-\alpha^{i,j}}{\delta \phi_H} + 1\right) = w_m^j n_m^{i,j} + w_f^i n_f^{i,j}. \tag{C.12}$$

Adding (C.8) and (C.9) and substituting the value of λ_1 in terms of q from (C.3), we can re-write the budget constraint as:

$$w_m^j h_m^{i,j} + w_f^i h_f^{i,j} = q\left(\frac{1}{\delta} - 1\right). \tag{C.13}$$

Adding (C.12) and (C.13) we get,

$$w_m^j(n_m^{i,j} + h_m^{i,j}) + w_f^i(n_f^{i,j} + h_f^{i,j}) = q\left(\frac{1-\alpha^{i,j}}{\delta \phi_H} + \frac{1}{\delta}\right). \tag{C.14}$$

We can re-write (C.4) and (C.5) after eliminating λ_1 using (C.3) as follows,

$$n_m^{i,j} + h_m^{i,j} = 1 - \frac{\theta^{i,j} \phi_L q(1-\alpha^{i,j})}{\delta \phi_H w_m^j},$$

and

$$n_f^{i,j} + h_f^{i,j} = 1 - \frac{(1-\theta^{i,j})\phi_L q(1-\alpha^{i,j})}{\delta \phi_H w_f^i}.$$

Therefore we can solve for q using the above two equations and equation (C.14), giving us,

$$q = \frac{(w_m^j + w_f^i)\delta\phi_H}{(1+\phi_L)(1-\alpha^{i,j}) + \phi_H}. \tag{C.15}$$

Using $h_f^{i,j} = \gamma h_m^{i,j}$ we can solve for $h_m^{i,j}$ from (C.8), where we replace the LHS using (C.4) and substitute for λ_1 from (C.3) which gives us $h_m^{i,j} = \frac{q}{w_m^j}\left(\frac{1}{\delta} - 1\right)\left[\frac{1}{1+\frac{z_f(a_f^i\gamma)^{1-\rho}}{z_m(a_m^j)^{1-\rho}}}\right]$ or using the value of q from (C.15), rearranging

$$h_m^{i,j} = \frac{\left(1+\frac{w_f^i}{w_m^j}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H}+1\right)(\Psi_m^{i,j}+1)} \tag{C.16}$$

where $\Psi_m^{i,j} = \left(\frac{z_f}{z_m}\right)^{\frac{1}{\rho}}\left(\frac{w_m^j a_f^i}{w_f^i a_m^j}\right)^{\frac{1-\rho}{\rho}}$ and using $h_f^{i,j} = \gamma h_m^{i,j}$ gives us

$$h_f^{i,j} = \frac{\left(1+\frac{w_m^j}{w_f^i}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H}+1\right)(1+\Psi_f^{i,j})} \tag{C.17}$$

where, $\Psi_f^{i,j} = 1/\Psi_m^{i,j}$. Now $n_m^{i,j} = 1 - \frac{\theta^{i,j}\phi_L q(1-\alpha^{i,j})}{\delta\phi_H w_m^j} - h_m^{i,j}$ implies that

$$n_m^{i,j} = 1 - \frac{\left(1+\frac{w_f^i}{w_m^j}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H}+1\right)(\Psi_m^{i,j}+1)} - \frac{\left(1+\frac{w_f^i}{w_m^j}\right)\theta^{i,j}}{\frac{(1+\phi_L)}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i,j})}}. \tag{C.18}$$

Also, $n_f^{i,j} = 1 - \frac{(1-\theta^{i,j})\phi_L q(1-\alpha^{i,j})}{\delta\phi_H w_f^i} - h_f^{i,j}$, and which implies that

$$n_f^{i,j} = 1 - \left(\frac{\left(1+\frac{w_m^j}{w_f^i}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H}+1\right)(1+\Psi_f)}\right) - \left(\frac{\left(1+\frac{w_m^j}{w_f^i}\right)(1-\theta^{i,j})}{\frac{(1+\phi_L)}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i,j})}}\right). \tag{C.19}$$

The expressions for $l_m^{i,j}$ and $l_f^{i,j}$ are obtained by using $l_m^{i,j} = 1 - n_m^{i,j} - h_m^{i,j}$ and $l_f^{i,j} = 1 - n_f^{i,j} - h_f^{i,j}$, which finally result in

$$l_m^{i,j} = \frac{\left(1 + \frac{w_f^i}{w_m^j}\right)\theta^{i,j}}{\frac{(1+\phi_L)}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i,j})}}, \tag{C.20}$$

and

$$l_f^{i,j} = \frac{\left(1 + \frac{w_m^j}{w_f^i}\right)(1-\theta^{i,j})}{\frac{(1+\phi_L)}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i,j})}}. \tag{C.21}$$

Comparisons: Comparisons of labor supply in the market and time spent on home production between two different education groups for both women and men are presented below.

Change in time spent in labor market by women: From the expression derived for female labor supply to the market, we can write the difference in the labor force choice made by women at two consecutive education levels ($i+1$ and i matched to husbands with education levels k and j respectively) as,

$$\begin{aligned} n_f^{i+1,k} - n_f^{i,j} = & \underbrace{\left[\frac{(1-\theta^{i,j})}{\left(\frac{(1+\phi_L)}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i,j})}\right)} - \frac{(1-\theta^{i+1,k})}{\left(\frac{(1+\phi_L)}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i+1,k})}\right)} \right]}_{a} + \\ & \underbrace{\left[\frac{\frac{w_m^j}{w_f^i}(1-\theta^{i,j})}{\left(\frac{1+\phi_L}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i,j})}\right)} - \frac{\frac{w_m^k}{w_f^{i+1}}(1-\theta^{i+1,k})}{\left(\frac{1+\phi_L}{\phi_L} + \frac{\phi_H}{\phi_L(1-\alpha^{i+1,k})}\right)} \right]}_{b} + \\ (1-\delta) & \underbrace{\left[\frac{\left(1 + \frac{w_m^j}{w_f^i}\right)}{(1+\Psi_f^{i,j})\left(\frac{(1+\phi_L)(1-\alpha_{i,j})}{\phi_H} + 1\right)} - \frac{\left(1 + \frac{w_m^k}{w_f^{i+1}}\right)}{(1+\Psi_f^{i+1,k})\left(\frac{(1+\phi_L)(1-\alpha_{i+1,k})}{\phi_H} + 1\right)} \right]}_{c} \end{aligned} \tag{C.22}$$

where $\Psi_f^{i,j} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^i a_m^j}{w_m^j a_f^i})^{\frac{1-\rho}{\rho}}$, $\Psi_f^{i+1,k} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^{i+1} a_m^k}{w_m^k a_f^{i+1}})^{\frac{1-\rho}{\rho}}$.

As discussed earlier in Section 3.1.1, the above expression shows that the base model is capable of generating a non-monotonic relationship of women's labor supply with their education. Note that as a special case, when $k = j$, the relevant wage, home productivity, Pareto weight and social norm ratios that matter in explaining the response of wife's labor supply to her education are shown in Appendix Table C.1. Clearly, as shown in the table, only the relative changes in parameters for the wife matter now and the parameters for the husband do not play any role. Row 1, columns (2)-(4) show the effect on wife's labor supply for each component when these components increase across education levels, i.e. the direction of change in these components is > 1. For instance, as wife's education increases from i to $i+1$, it is likely to result in an increase in the relative wage ratio for wife across education levels, resulting in an increase in her labor supply (denoted by > 0 in column 2, row 1). Similarly, home productivity ratio is likely to increase too, resulting in a decrease in her labor supply (column 3, row 1). The increase in bargaining power of women (column 4, row 2) will also lead to a decline in her labor supply. However, the effect of the social norm on time spent in the labor market would be ambiguous, as discussed in Section 3.1.1.

Change in time spent in home production by women: From the expression derived above for female time spent at home production (Equation C.17), we can write the time at home production chosen by a wife at higher education level $i+1$ who is matched with a husband of education level k, and that chosen by a wife with a lower education level i matched with a husband of education level j as

$$h_f^{i,j} = \frac{\left(1 + \frac{w_m^j}{w_f^i}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H} + 1\right)\left(1 + \Psi_f^{i,j}\right)},$$

$$h_f^{i+1,k} = \frac{\left(1 + \frac{w_m^k}{w_f^{i+1}}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i+1,k})}{\phi_H} + 1\right)\left(1 + \Psi_f^{i+1,k}\right)}.$$

This implies

$$h_f^{i+1,k} - h_f^{i,j} = (1-\delta)\left[\frac{1 + \frac{w_m^k}{w_f^{i+1}}}{\left(\frac{(1+\phi_L)(1-\alpha^{i+1,k})}{\phi_H} + 1\right)\left(1 + \Psi_f^{i+1,k}\right)} - \frac{1 + \frac{w_m^j}{w_f^i}}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H} + 1\right)\left(1 + \Psi_f^{i,j}\right)}.\right] \tag{C.23}$$

where $\Psi_f^{i,j} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^i a_m^j}{w_m^j a_f^i})^{\frac{1-\rho}{\rho}}$, $\Psi_f^{i+1,k} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^{i+1} a_m^k}{w_m^k a_f^{i+1}})^{\frac{1-\rho}{\rho}}$

The above expression shows that the change in time spent in home production by a wife as her education increases depends on relative wage and relative home productivity of the matched spouses. Keeping other things constant, if wife's relative wage increases with her education ($\frac{w_m^k}{w_f^{i+1}} < \frac{w_m^j}{w_f^i}$) then her time spent in home production would fall. However, if there is a simultaneous increase in her relative home productivity ($\frac{a_m^k}{a_f^{i+1}} < \frac{a_m^j}{a_f^i}$), her time in home production would increase. It is also easy to verify that if α decreases with higher education of wife, her time spent in home production decreases. The final direction of change in home production time depends on the magnitude of the movements in relative wage, relative home productivity and relative norm responsiveness as wife's education increases. In a similar manner, we can perform the comparative static analysis for the changes in time spent by men in labor market and home production as their education level increases.

Change in time spent in labor market by men: From the expression derived for male labor supply to the market, we can write the labor force chosen by a husband at higher education level $j+1$ who is matched with a wife of education level k, and that chosen by a husband with a lower education level j matched with a wife of education level i as

$$n_m^{i,j} = 1 - \frac{\left(1+\frac{w_f^i}{w_m^j}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H}+1\right)(\Psi_m^{i,j}+1)} - \frac{\left(1+\frac{w_f^i}{w_m^j}\right)\theta^{i,j}}{\frac{(1+\phi_L)}{\phi_L}+\frac{\phi_H}{\phi_L(1-\alpha^{i,j})}}, \Psi_m^{i,j} = (\frac{z_f}{z_m})^{1/\rho}(\frac{w_m^j a_f^i}{w_f^i a_m^j})^{\frac{1-\rho}{\rho}}$$

$$n_m^{k,j+1} = 1 - \frac{\left(1+\frac{w_f^k}{w_m^{j+1}}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{k,j+1})}{\phi_H}+1\right)(\Psi_m^{k,j+1}+1)} - \frac{\left(1+\frac{w_f^k}{w_m^{j+1}}\right)\theta^{k,j+1}}{\frac{(1+\phi_L)}{\phi_L}+\frac{\phi_H}{\phi_L(1-\alpha^{k,j+1})}}, \Psi_m^{k,j+1} = (\frac{z_f}{z_m})^{1/\rho}(\frac{w_m^{j+1} a_f^k}{w_f^k a_m^{j+1}})^{\frac{1-\rho}{\rho}}$$

$$\begin{aligned} n_m^{k,j+1} - n_m^{i,j} = (1-\delta)&\left[\frac{1+\frac{w_f^i}{w_m^j}}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H}+1\right)(\Psi_m^{i,j}+1)} - \frac{1+\frac{w_f^k}{w_m^{j+1}}}{\left(\frac{(1+\phi_L)(1-\alpha^{k,j+1})}{\phi_H}+1\right)(\Psi_m^{k,j+1}+1)}\right] \\ &+\left[\frac{\left(1+\frac{w_f^i}{w_m^j}\right)\theta^{i,j}}{\frac{(1+\phi_L)}{\phi_L}+\frac{\phi_H}{\phi_L(1-\alpha^{i,j})}} - \frac{\left(1+\frac{w_f^k}{w_m^{j+1}}\right)\theta^{k,j+1}}{\frac{(1+\phi_L)}{\phi_L}+\frac{\phi_H}{\phi_L(1-\alpha^{k,j+1})}}\right] \end{aligned} \quad (C.24)$$

where $\Psi_f^{i,j} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^i a_m^j}{w_m^j a_f^i})^{\frac{1-\rho}{\rho}}$, $\Psi_f^{k,j+1} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^k a_m^{j+1}}{w_m^{j+1} a_f^k})^{\frac{1-\rho}{\rho}}$

The expression shows that the model is also capable of generating a non-monotonic relationship of husband's labor supply with increase in his education. The three factors affecting the change in husband's labor force choice with his education are - change in Pareto weights, change in spousal wage ratio and change in spousal home productivity ratio - as his education increases. Also, similar to the case of female labor supply, the effect of α on the labor supply by the husband is ambiguous. The final effect depends on the direction and the magnitude of each of the four components.

Change in Time spent in home production by men: From the expression derived for male time spent at home production, we can write the time in home production chosen by a husband at higher education level $j+1$ who is matched with a wife of education level k, and that chosen by a husband with a lower education level j matched with a wife of education level i as

$$h_m^{i,j} = \frac{\left(1 + \frac{w_f^i}{w_m^j}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H} + 1\right)(\Psi_m^{i,j} + 1)}, \Psi_m^{i,j} = (\frac{z_f}{z_m})^{1/\rho}(\frac{w_m^j a_f^i}{w_f^i a_m^j})^{\frac{1-\rho}{\rho}}$$

$$h_m^{k,j+1} = \frac{\left(1 + \frac{w_f^k}{w_m^{j+1}}\right)(1-\delta)}{\left(\frac{(1+\phi_L)(1-\alpha^{k,j+1})}{\phi_H} + 1\right)(\Psi_m^{k,j+1} + 1)}, \Psi_m^{k,j+1} = (\frac{z_f}{z_m})^{1/\rho}(\frac{w_m^{j+1} a_f^k}{w_f^k a_m^{j+1}})^{\frac{1-\rho}{\rho}}$$

This implies

$$h_m^{k,j+1} - h_m^{i,j} = (1-\delta)\left[\frac{\left(1 + \frac{w_f^k}{w_m^{j+1}}\right)}{\left(\frac{(1+\phi_L)(1-\alpha^{k,j+1})}{\phi_H} + 1\right)(\Psi_m^{k,j+1} + 1)} - \frac{\left(1 + \frac{w_f^i}{w_m^j}\right)}{\left(\frac{(1+\phi_L)(1-\alpha^{i,j})}{\phi_H} + 1\right)(\Psi_m^{i,j} + 1)}\right] \tag{C.25}$$

where $\Psi_f^{i,j} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^i a_m^j}{w_m^j a_f^i})^{\frac{1-\rho}{\rho}}$, $\Psi_f^{k,j+1} = (\frac{z_m}{z_f})^{1/\rho}(\frac{w_f^k a_m^{j+1}}{w_m^{j+1} a_f^k})^{\frac{1-\rho}{\rho}}$

Again, it is straightforward to see that the husband's time spent in home production reduces as his relative wage improves with education ($\frac{w_f^k}{w_m^{j+1}} < \frac{w_f^i}{w_m^j}$) and increases if his relative home productivity improves with education ($\frac{a_f^k}{a_m^{j+1}} < \frac{a_f^i}{a_m^j}$). Also, if α decreases with higher education of the husband, time spent by him in home production decreases. The final direction of change depends on the direction and the magnitude of these two effects.

Table C.1 Theoretical predictions of effects on wife's labor supply (keeping husband's education constant)

Direction of Change	Δ Relative wage	Δ Relative home productivity	Δ Pareto weight (men)	Δ in Norm responsiveness
	$(\frac{w_f^{i+1}}{w_f^i})$	$(\frac{a_f^{i+1}}{a_f^i})$	$\frac{\theta^{i+1,j}}{\theta^{i,j}}$	$\frac{\alpha^{i+1,j}}{\alpha^{i,j}}$
(1)	(2)	(3)	(4)	(5)
	Effect on wife's labor supply			
> 1	> 0	< 0	> 0	*Ambiguous*
< 1	< 0	> 0	< 0	*Ambiguous*
$= 1$	No change			

Note: Column 1 shows the direction of change in each of these four variables - relative wages (column 2), home productivity (column 3), Pareto weight (column 4) and norm responsiveness (column 5). Each cell in columns 2-5 shows the predicted direction of change in wife's labor supply for a given change in the corresponding variable (column 1) when her education increases. The predictions follow the theoretical decomposition of changes in wife's labor supply derived in Equation 8, when $k = j$.