

## Extended Abstract for PAA 2019

# Resource Dependence and Inter-Generational Transmission Effect

Pallavi Choudhuri<sup>1</sup> and Sonalde Desai<sup>2</sup>

### 1. Introduction

Parental care plays an important role in shaping children's human capital development and psychological well-being, and comprises of a key channel for intergenerational transmission of time (Guryan et al., 2008). Studies show that children's skill formulation is a dynamic process, and time inputs and other parental endowments, especially that of the mother, provides important building blocks for developing children's attributes [(Leibowitz, 1974);(Flavio & James, 2009)] and can be particularly crucial for later life outcomes [(G. Becker, 1981);(Heckman & Carneiro, 2003)]. This study aims to examine intergenerational time transmission, focusing on how maternal time influences children's development outcomes.

The finite nature of time and the varied requirements of day to day activities tends to put constraints on the amount of time parents, especially the mother, can potentially devote towards childcare. Such time constraints are more likely to manifest when the mother's involvement in time intensive unpaid household chores, such as firewood collection or fetching of water, reduces the time available for monitoring children's study time or other skill development and employment generating activities, after meeting responsibilities related to cooking and cleaning, or other care services. This can be especially true for rural areas in India, where households have to take recourse to common pool resources to meet their demand for energy and water for production of household goods and services, affecting household level choices and time-bound activities at the individual level.

Substitution between employment generating activity and household/personal care activity may not be a self-induced decision, and can depend on access to resources or social or cultural norms prevailing within local communities. This is particularly true for households in rural settings with limited access to energy markets or adequate village water supply systems. Such activities are intended to supplement otherwise scarce household resources and improve wellbeing of household members. However, in cases where this disproportionately affects women's discretionary time, it may affect women's choice of engaging in employment generating activities, leisure time, or time to pursue education and skill development. Lack of discretionary time may affect child care activities in two ways - it may directly reduce time available for supervising children and aiding children's cognitive development. Additionally it may induce children to take up household care activities, such as cleaning, washing, or looking after siblings, reducing time available for study.

Interestingly, data from the NSSO show that while there has been a decline in rural women's labour force participation (principal and subsidiary status) between 2004-05 and 2011-12 (from 49.7 per cent to 35.8 per cent), the period also witnessed an increase in the share of women who

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<sup>1</sup> Pallavi Choudhuri: National Council of Applied Economic Research, Email: [pchoudhuri@ncaer.org](mailto:pchoudhuri@ncaer.org)

<sup>2</sup> Sonalde Desai: University of Maryland & National Council of Applied Economic Research

reported household work as their primary activity (from 52 per cent to 60 per cent). This study seeks to reflect upon how such work pattern, paid and unpaid, influences children’s outcome using data from the India Human Development Survey (IHDS) wave II. More specifically, this study examines the following questions:

- a) Does the mother’s share of unpaid activity such as fetching water or collecting firewood have an adverse effect on children’s educational outcome?
- b) In contrast to unpaid activity, does share of maternal time spent on employment related activities improve children’s educational outcome?
- c) What is the role of village infrastructure, in terms of access to energy markets or village water supply systems, in the intergenerational transmission effect?

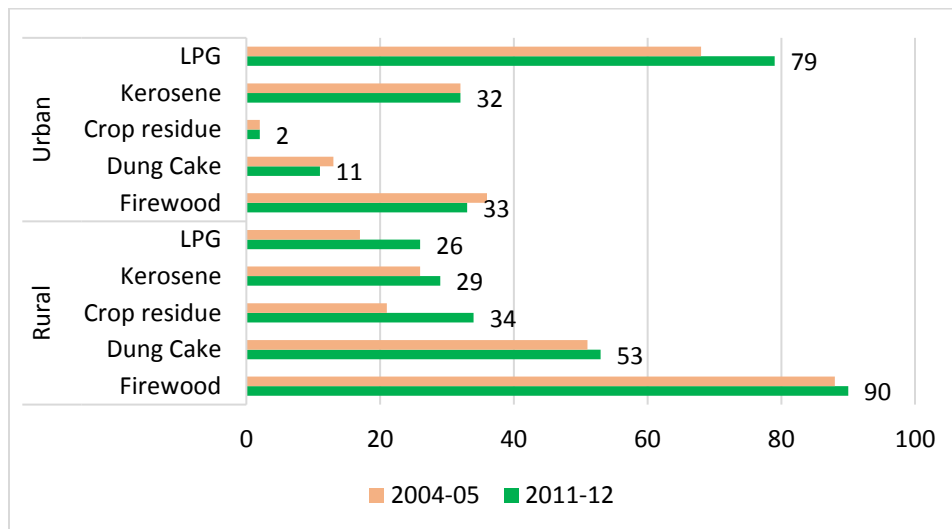
The study uses nationally representative 2011-12 data from the Indian Human Development Survey (IHDS) wave II. In contrast to a regular time use data, the IHDS data not only provides data on gendered differences in time spent in paid versus unpaid work, and children’s study time, it also provides data on cognitive attainment. Additionally, it contains a range of other contextual variables, which enables examination of how this correlates across household demographic characteristics, and village-level infrastructure facilities.

## 2. Resource dependence and time use

Intra-household time allocation for different activities is often dictated by traditional gendered division of labour, with women spending more time in unpaid work, while men tend to engage more in paid work. Such unpaid work tends to involve fetching water, collecting fuel, cooking, child care and elderly care, resulting in undue time poverty, compelling women to reduce time allocated to paid work, self-care and leisure. Often it is the lack of basic infrastructure, such as energy services, water supply, sanitation, and transportation services, that necessitates trade-offs in time allocation and household dependence on common pool resources, influencing such gendered division of labour.

### *Energy usage and time use*

Figure 1: Patterns of Energy Usage by Households



*Note:* Authors’ computation based on IHDS waves I and II. Figures reflect population estimates for household energy demand for cooking and heating.

Household energy usage patterns have remained largely the same between 2004-05 and 2011-12, with high dependence on traditional fuels, such as firewood, dung, crop residue and kerosene, compared to more modern sources of fuel, such as LPG<sup>3</sup> (see Figure 1). Interestingly enough, the data also show that those who use LPG for their energy needs continue to depend on common pool resources, such as firewood.

The continued dependence on firewood as a primary source of energy in rural India places undue time burden especially on women, who are traditionally responsible for collecting biofuel for meeting domestic energy needs. In terms of time use, this approximately translates into an women spending more than two and half times the amount of time on firewood collection (round-trip distance in minutes including search time) compared to men, affecting time available for other activities (see Table 1).

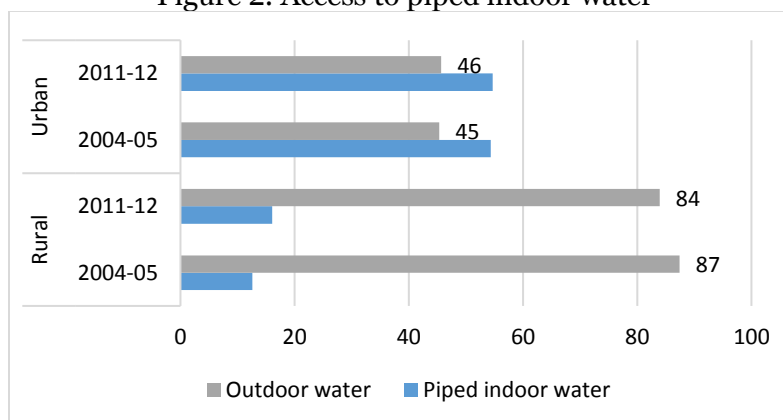
Table 1: Average time (minutes per week) spent on activities by households that fetch water or collect firewood

	Woman	Man
Fetching Water	323 (307)	155 (228)
Collecting Firewood	352 (510)	133 (292)

Note: Source IHDS – II 2011-12, figures in parentheses indicate standard deviations.

### Water and time use

Figure 2: Access to piped indoor water



Note: Authors' computation based on IHDS waves I and II. Figures reflect population estimates of percentage of rural households with access to piped drinking water.

Collection and searching for firewood is not the only activity that results in substantial time burden on women. While approximately 55 percent of urban households reported to have access to piped indoor drinking water, only 16 percent of rural households had such facility (see Figure 2). This translates into households accessing alternate sources of water from common pool resources, with the task of fetching water being borne primarily by women. Data from IHDS 2011-12 show that women typically spend more time than men collecting water (see Table 1).

<sup>3</sup> Energy demand for lighting is met by either kerosene or electricity, and does not induce time burden on households in terms of collection time or search time as in the case of firewood.

This can potentially drain away discretionary time that women may spend on paid economic activity, education, leisure, or other pursuits.

Devoto et al. (2012) noted that acquisition of piped water connection within the house led people in Morocco to spend more time in leisure activities, while Meeks (2017) showed that construction of village water infrastructure and shared water taps in Kyrgyzstan resulted in significant time savings, reducing distance to drinking water and time spent in home production. This leads to our first testable hypotheses:

***Hypothesis H1:*** *A higher proportion of time spent by the mother in unpaid activities, such as firewood collection or fetching water may adversely affect children's outcome if such activities substitutes maternal time away from her time spent in monitoring children's study or aiding their cognitive development.*

### **3. Maternal time to work and children's outcome**

The economic paradigm on household production function typically delves into allocation of time into paid versus unpaid work (G. S. Becker, 1985), with women often “losing” compared to men because of unequal sharing of resources within the household (Findlay & Wright, 1996). Evidence suggests that women's engagement in paid employment activities has the potential to not only increase access to financial resources for the household, it may also enhance women's agency and bargaining power within the household, with greater resources devoted towards children's well-being (Agarwal, 1997).

While workforce participation can have an adverse effect if time spent on employment crowds out time spent with children, previous studies have shown that mothers tend to reduce the impact by cutting back on household work and personal care activities[(Desai & Jain, 1994), (Bianchi, 2000), (Stewart, 2009)]. Bianchi (2000) noted that despite increases in female labour force participation, maternal time with children remained nearly stable, and the effect is true across both developed and developing countries. Further, evidence suggests that when women have greater earning power, they tend to invest more in the health and education of their children, playing a key role in the development of human capital formulation.

On the other hand, when women are more engaged in unpaid work for household production, such as cooking, cleaning, fetching water, and numerous such activities, it takes time away from engaging in income-generating activities, with consequent negative spill-over effects on their children through income-effect. The negative spill-over effect may be further exacerbated through the substitution effect if such engagement in unpaid activity is particularly time intensive, resulting in substituting time away from childcare. Kabeer (2012), for instance, discusses how women in rural areas are subject to intense time poverty, investing several long hours in domestic activity. The current study aims to add to the existing literature by examining the effect of maternal time spent in unpaid work on children's study outcome and cognitive ability. Accordingly, we examine our second testable hypotheses in this paper:

***Hypothesis H2:*** *Higher proportion of time spent by the mother towards income-generating activities will increase children's study time and cognitive achievement through income effect.*

#### 4. Data and methodology

The study uses the nationally representative sample from the India Human Development Survey (IHDS) for 2011-12. The sample comprises of 23,439 children aged between 6 to 14 years from 13,187 rural households across 1452 villages. The sample is spread across 33 states and union territories, barring Andaman and Nicobar islands.

The objective of this paper is to examine how children's study time and cognitive achievement is influenced by mother's time in paid versus unpaid work. The analysis involves maximum likelihood estimation using Heckman control function approach. IHDS captures a range of variables measuring women's work patterns, paid and unpaid, along with other demographic variables. The IHDS data also captures time spent by children in educational activities, along with reading, writing, and arithmetic skills of children aged 8 to 11 years.

The Heckman control function approach considers the underlying model:

$$Y_i = \beta X_i + \gamma Z_i + \varepsilon_i \quad (1)$$

where,  $Y_i$  = alternate measures of children's development outcome captured by

- (i) study time and
- (ii) arithmetic test score

$Z_i$  = household level selectivity for unpaid work,

$X_i$  = vector of explanatory variables for the  $i$ -th household. These include

- a) child-level controls, such as children's sex and standard in school;
- b) school-level controls: type of school (public or private), distance to school (in kilometers),
- c) maternal time: share of maternal time in unpaid work (ratio of time spent by mother on paid work to total time spent on such work by both parents), share of maternal time in paid work (ratio of time spent by mother on unpaid work to total time spent by both parents),
- d) household level characteristics, such as caste/ religious background of the parents, highest level of education obtained by parents in the household, whether the household uses electricity, and
- e) state dummies to capture time-invariant state-level characteristics and type of village (less or more developed)

A reduced form model for household unpaid work self-selection can be of the following type:

$$Z_i = \alpha + \beta W_i + \varepsilon_i \quad (2)$$

where,

$W_j$  indicates the set of instruments and  $\varepsilon_{eij}$  is the unobserved random error term

We use two alternate measures of unpaid work in alternate regressions – (i) amount of time invested in collecting firewood and (ii) amount of time invested in fetching water.

##### *Dependent Variables:*

In terms of time spent on educational activities, we use the total minutes spent by children, aged 6 to 14 years, in school on any given week. To take into account the fact that children also need to spend time at home on assigned school work, we also add the time spent on homework. For the analysis involving study time, we use ordinary least square Heckman control function approach, with robust standard errors.

Our second variable involves arithmetic test scores for children aged 8 to 11 years. The test scores for arithmetic are recorded across four categories: (a) cannot identify numbers above 10, (b) can read numbers between 10 to 99, (c) can subtract two digit number from another, and (d) can divide a number between 100 to 999 by another between 1 and 9. Among those who took the test, nearly 20 percent cannot identify numbers, while another 39 percent could only recognize numbers. Only 15 percent could carry out subtraction and division. The test scores are coded as 1, 2, 3, and 4, with higher scores indicating higher math skill. For this part of the analysis, we use ordered-probit Heckman control function approach, with robust standard errors.

#### *Share of Maternal Time in Paid and Unpaid Work:*

To capture women's time burden from unpaid work, we use the share of time spent by an adult woman at the household level, measured as the ratio of time spent by an adult woman to the total time spent by an adult woman and an adult man in the household on that activity. The ratio thus captures gender based heterogeneity in time endowments at the level of the household in rural areas. As previously discussed, we use two alternate measures of unpaid work (i) time spent in collecting firewood and (ii) time spent in fetching water.

To take into account the effect of time invested in paid employment, we take the ratio of maternal time invested in such work to the total time invested in paid work by both the parents. We use time invested per week in employment generating activities for those who have worked more than 240 days per year, whether for salaried or wage work, or self-employment activities (barring work in household agricultural farm or tending to animals).

#### *Decision to collect firewood*

To capture time invested in collecting firewood, we use information at the household level on the number of minutes per week spent by adult men and adult women in firewood collection. To account for the possibility of household level self-selection in collecting firewood versus adopting other sources of energy, we follow a Heckman-control function approach. In this case,  $Z_i$  is measured as a dummy variable, taking the value of 1 for households that collect firewood and zero otherwise. The selection equation is identified by instruments that affect household level decisions on energy usage, with village-level market price of firewood, village-level price of liquefied petroleum gas (LPG), type of village road, and ratio of female to male wage rate for unskilled labour at the village level as key identifying instruments.

#### *Decision to fetch water*

To capture time invested in fetching water, we use household level information on the number of minutes per week spent by adult men and adult women in fetching water. The selection equation is identified by instruments that affect household level decisions that affect water usage. In this case,  $Z_i$  is measured as a dummy variable equal to 1 for households that reported spending time walking to water. Household level self-selection is identified by the identifying instruments such as access to sources of water, distance to nearest town, and ratio of female to male wage rate for unskilled labour.

## **5. Preliminary Results**

Results from Table 2 (columns I and III) indicate that share of time spent in employment activities by the mother is positively associated with children's study time. Although, these are

not statistically significant. The results, however, show that an increase in mother's share of unpaid work adversely affects children's study time, which includes both time spent in school and time spent in completing homework. Our findings for children's Math test score are reported in columns III (with Heckman type selection) and IV (without modelling for selection) in Table 2. The regressions for unpaid work related to water are estimated without correcting for self-selection – results from Wald test for independence of equations show that the null hypothesis that the system of equations are independent cannot be rejected, indicating that households do not self-select themselves into fetching water as the village water infrastructure systems is exogenous to household decision making - they are more driven by necessity than choice to fetch water because of inadequate village water supply system.

Table 3 show how change in mother's share of time spent in unpaid work affects the predicted probability of the respective test outcomes. The findings suggest that there's a higher probability of girls not recognizing numbers compared to boys when share of unpaid work rises by one percentage point. The results for subtraction also show that a one percentage point increase in share of unpaid work by the mother will decrease the probability that the child can subtract. The effect is slightly larger if the child concerned is a girl. We further observe that children are also less likely to be able to divide (top score) in case the mother is involved in unpaid work, although the effect is marginally larger in this case for boys. Interestingly though, mother's involvement in fetching water is associated with a greater decrease in children's likelihood of being able to subtract or divide compared to if she is involved in collecting firewood.

Table 2: Effect of Maternal Time on Children's Educational Outcome  
(Co-efficient estimates for key explanatory variables)

Predictors	Firewood		Water	
	Study Time I	Math Score II	Study Time III	Math Score IV
Mother's Paid work ratio	25.04 (27.43)	-0.12 (0.08)	8.70 (21.09)	0.08 (0.06)
Mother's (adult woman) unpaid work ratio	-84.61*** (24.65)	-0.12** (0.06)	-50.17*** (16.43)	-0.15*** (0.05)
State dummies	Yes	Yes	Yes	Yes
Wald Chi2	1386.75	553.79		1521.83
R-squared			0.1346	
Observations	15,932	5,428	23,343	7,727

Source: IHDS 2011-12, authors' calculations

Note: Significance levels: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Robust standard errors are reported in parentheses. Sample for columns I and III consists of children aged 6 to 14 years, while those for columns II and IV consists of children aged 8 to 11 years, who were administered arithmetic test. Columns I and III have been estimated using maximum likelihood approach with Heckman selection. Column III provides are OLS estimates (without selection), while column II show ordered-probit estimates (without selection). Wald test for independent equations for columns III and IV shows that we cannot reject the null hypothesis that the system of equations are independent at 5 percent level.

Table 3: Probability of Math Test Scores for Mother's Average Share of Unpaid Work

	Firewood		Water	
	Male	Female	Male	Female
Cannot read number = 0	0.033** (0.016)	0.036** (0.017)	.033*** (0.01)	.038*** (.012)
Can read numbers between 10 to 99 = 1	0.006 (0.004)	-0.0002 (0.002)	0.016*** (0.005)	(0.01*** (0.003)
Subtraction = 2	-0.016** (0.008)	-0.018** (0.008)	-0.018*** (0.005)	-0.021*** (0.006)
Division = 3	-0.022** (0.011)	-0.018** (0.009)	-0.031*** (0.01)	-0.025*** (0.01)

Source: IHDS 2011-12, authors' calculations

Note: Significance levels: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

## 6. Discussion

Much of the research on how women's work is associated with children's human capital development has focussed on mother's paid work activities. In contrast, this study analyses the transmission effect in terms of unpaid work carried out for household production. Such unpaid work can be particularly pervasive in rural areas, where lack of access to energy markets or inadequate village water supply system can result in heavy dependency on common pool resources and women sharing a greater proportion of the burden of being involved in collecting such resources. Our findings suggest a negative transmission effect of mother's unpaid work on children's educational outcome, as these could substitute time away from childcare activities.

In terms of policy response, it is important to the public policy discourse to develop time-saving technologies that can reduce time poverty faced by women due to inadequate access to resources. However, such access to time-saving technologies also need to be cost-effective for rural families, who often switch to common pool resources when energy prices go up. Further, it is also important to enhance access to energy markets in rural area, not only in terms of physical access via improved transportation systems and broader network of paved roads, but also providing financial access to such markets is vital. Along with aiding rural families to meet their energy needs, it is also pertinent to improve village water supply infrastructure to alleviate time burden on such families, particularly on women, who spend several hours a day travelling to water sources, and queuing up to collect water. The importance of developing programmes to reduce gender disparities in access to resources (Agarwal, 2001) becomes all the more critical in the light of findings in the current paper, particularly for disentangling any adverse channel of intergenerational transmission between the mother and her children.

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