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The effect of time-saving household appliance ownership on outcomes for children and married women: evidence from India

Abstract

We use microlevel data from the India Human Development Survey to test our hypothesis that ownership of time-saving household appliances results in the following: an increase in employment rates for married women; an increase in school enrollment rates; and a decrease in employment rates for children. We address the concern of endogeneity of appliance ownership by instrumenting household ownership of time-saving appliances by two family-specific *time-using* household assets and (1) average ownership rate among single women living in the same primary sampling unit (for the adult female sample) or (2) average ownership among households with no children living in the same primary sampling unit (for the child sample). Our results suggest a *decrease* in married women's and children's employment when ownership of time-saving appliances increases. Disaggregating our measure of employment, we find that married women use time-saving appliances as a substitute for human capital and increase their probability of working in more productive employment outside of the household.

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1 Introduction

The Sustainable Development Goals were set by the United Nations General Assembly in 2015. These goals were intended to promote peace and prosperity for people and the planet, now and into the future.[1] Two of the goals that have been highlighted heavily in development research are quality education and gender equality. With many potential paths to improve gender equality and education, researchers face the challenge of determining which methods will best assist developing countries in achieving these goals. Additionally, with the recent coronavirus disease-2019 (COVID-19) outbreak, "there is a high risk that gender inequalities will widen during and after the pandemic and that gains in women's and girls' accumulation of human capital, economic empowerment, and voice and agency, painstakingly built over the past decades, will be reversed."[2] Now, more than ever, it is crucial for researchers to determine what methods most significantly improve females' well-being and prepare to step in and mitigate the negative side effects of the global pandemic. We explore one path that potentially affects both adult females and children: increasing the presence of household capital assets, which allow household members to substitute appliances for labor in home production.

Allocation of time within the household has been widely discussed since the paper by Becker (1965). Recent literature has incorporated time-saving appliance ownership into Becker's model. Greenwood et al. (2005) use this framework to explain increases in adult female labor force participation (LFP). They argue that appliances, such as washing machines and refrigerators, 'liberated' women from household work and allowed them to reallocate time to the workforce. Their model has been tested with data from the United States (Coen-Pirani et al., 2010) and China (Tewari and Wang, 2016), with both articles suggesting an increase in LFP among adult women who live in households that own time-saving durable goods. A similar relationship is found in Latin American countries (Cubas, 2016) and in Nigeria (Omotoso and Obembe, 2016, 2017). Cavalcanti and Tavares (2008) take advantage of a 24-year data set that contains the relative price index of home appliances for 17 Organisation for Economic Co-operation and Development (OECD) countries to examine the impact of home appliances on female LFP and find a larger increase in female LFP in countries that also experience larger drops in the relative price of home appliances, which supports findings in previous studies.

Kerr (2019) extends previous analyses by studying the relationship between these same time-saving appliances and child outcomes in China. She suggests that children reallocate time from household work to schooling when time-saving appliances are present in the household. Dao (2021) similarly examine the relationship between technological progress, housework, women in wage employment (nonagricultural sector), and daughters' education in >100 developing countries. Again, their results suggest an increase in daughters' schooling and an increase in female wage employment.

In this paper, we empirically test the hypotheses of the above researchers using microlevel data for Indian married women and children. This is the first paper to explore this question in the Indian context. India is unique in that, even with constant growth in overall LFP, India has experienced a decline in female LFP over the past 15 years. Female LFP reached its peak in 2005, with 32.17% of the female population aged ≥15 years participating. However, between

1 https://sustainabledevelopment.un.org/?menu=1300 Source: The United Nations Sustainable Development Goals.

2 https://blogs.worldbank.org/voices/coronavirus-not-gender-blind-nor-should-we-be?cid=ECR_LI_worldbank_EN_EXT Source: The coronavirus is not gender-blind, nor should we be.

2005 and 2012, the country experienced a steady decrease in participation among females according to the International Labour Organization (ILO), achieving only a 20.02% female LFP rate in 2012. There was a slight increase from 2012 to 2017, but rates have fallen again in recent years.[3] Female LFP is an important driver of economic growth and development, and India's curious decrease provides researchers the opportunity to explore whether methods that have been found to increase female LFP in other countries could also increase female LFP in India. Additionally, India's Hindu culture, unique caste system, and growing population warrants further research specific to this economy.

This paper exploits cross-sectional variation in household appliance ownership to explore the effect of family investments in time-saving durable goods on (1) employment for married women and older children and (2) schooling for older children. We use microlevel data for the years 2004–2005 and 2011–2012 and address the concern of potential endogeneity of appliance ownership, which arises from unobserved family preferences that affect both appliance ownership and our outcomes of interest, by using an instrumental variable (IV) strategy. When estimating the effect of appliance ownership on a married woman's LFP, we follow Coen-Pirani et al. (2010) and instrument the ownership of a time-saving appliance by average ownership rate among *single women* living in the same primary sampling unit. When estimating the effect of appliance ownership on a child's schooling or LFP, we follow Kerr (2019) and instrument the ownership of a time-saving appliance by average ownership rate among households living in the same primary sampling unit *but with no children*. The fundamental logic of these instruments is that single women and households with no children by construction cannot be motivated in their purchasing decisions by potential family outcomes. We include two family-specific variables as additional instruments in all two-stage least squares (2SLS) estimations. These variables include *time-using* household assets that are likely to be associated with ownership of time-saving appliances and are unlikely to directly affect married women and children's outcomes of employment or school enrollment.

Our results indicate that the presence of a refrigerator in households reduces the probability of married women's employment by 10.2 percentage points. This result is counterintuitive and is the opposite of what previous literature has found in other countries. Thus, we further explore this question by examining the impact of these same appliances on two different types of employment: work *inside* the household and work *outside* the household. We find that appliance ownership leads to an increase in the probability of women's employment in work outside the household and reduces the probability of women's employment in work inside the household.[4] These results suggest that women have the opportunity to reallocate their time to more-rewarding opportunities.

When analyzing children aged 12–18 years, we find no significant effect on enrollment or employment for children living in a household that owns a washing machine. However, our results suggest that children living in a household that owns a refrigerator experience a 15.3 percentage point increase in the probability of being enrolled and a 9.1 percentage point decrease in the probability of being employed.

3 https://data.worldbank.org/indicator/SL.TLF.CACT.FE.ZS?locations=IN Source: The World Bank's Databank on Female Labor Force Participation Rate (modeled International Labour Organization [ILO] estimate).

4 Specifically, among married women, the probability of participating in animal care and family businesses (two lower paying employment opportunities) is found to be reduced and the probability of participating in agricultural labor and salaried positions (two higher paying employment opportunities) is increased. Detailed employment results are available in Tables A4 and A5 in the Appendix.

These results imply that owning time-saving home appliances consequently avails family members the opportunity to reallocate their time from household chore work to other time-using activities, such as work outside the household for adult females and attainment of human capital in the form of schooling for children. The results presented in this paper suggest that one effective way to increase human capital development among children and increase female LFP among married women is to reduce household work obligations.

2 Background

2.1 Appliance ownership

Appliance ownership in India has increased during recent decades, owing, in large measure, to rising disposable incomes, urbanization, increasing organized retail, easier financing options, growing demand, and increasing electrification (Ernst & Young, 2015). The proportion of Indian households owning a television increased from 47% in 2011 to 65% in 2018. Refrigerators are the second most prevalent household asset, followed by washing machines.[5] These trends are reflected in the India Human Development Survey (IHDS) data. Ownership of a color television increased from 24% in 2005 to 58% in 2012; ownership of a refrigerator rose from 13% in 2005 to 24% in 2012; and ownership of a washing machine increased from 3% in 2005 to 8% in 2012.

In this analysis, we follow Bowden and Offer (1994) by distinguishing between two types of household appliances: time-saving and time-using. Time-saving technologies embody appliances that reduce time required to perform household work. In the IHDS data, available time-saving appliances include washing machines, refrigerators, microwave ovens, electric cooking pots, and pressure cookers. Time-using goods, on the other hand, enhance the quality of discretionary time. Examples available in the IHDS data include air conditioners, air coolers, cameras, color televisions, and electric fans.

In this study, we focus on two large time-saving appliances: washing machines and refrigerators. Ownership of these appliances provides households the opportunity to substitute between capital and labor in home production. When a household purchases a time-saving appliance, household members have the opportunity to reallocate time to leisure, schooling, or market work. Previous literature on durable goods ownership has found that the presence of time-saving durable goods increases adult female LFP in the United States (Greenwood et al., 2005; Coen-Pirani et al., 2010), China (Tewari and Wang, 2016), Latin American countries (Cubas, 2016), Nigeria (Omotoso and Obembe, 2016, 2017), and OECD countries (Cavalcanti and Tavares, 2008). These same appliances are found to increase school enrollment and decrease child LFP in China (Kerr, 2019). Time-conserving appliances provide women and children with more efficient ways to perform domestic tasks, making them more productive in the household, and thus increasing their intrafamily bargaining power.

This paper adds to the literature by studying the effect of household appliances on Indian adult females and children. With the drastic changes in appliance ownership occurring in India, as described above, and the cultural differences between India and the countries

5 https://www.livemint.com/Specials/bhWpWqj3AFuETVdsC05fdM/In-India-washing-machines-top-computers-in-popularity.html Source: Livemint, "In India, Washing Machines Top Computers in Popularity."

studied in previous research, exploring the relationship between appliance ownership and female and child outcomes within the Indian context is an important contribution to current literature.

2.2 **Female LFP**

As described above, appliance ownership has been found to be associated with increases in female LFP in multiple developed and developing countries. While prevalence in these same appliances has increased in India, India's female LFP has been declining while remaining visibly low. The ILO ranked India as the country with the 28th lowest female LFP in 2019, as female LFP declined from 31% in 1990 to 23.4% in 2019.[6]

One hypothesis as to why female LFP in India has declined even with extreme economic growth is that the Hindu culture and the caste system create a need for differential preferences for women. While Chinese women have increased their LFP with increased technological advancements, Indian women face different obstacles. India's average household size is 1.2 persons larger than China's, suggesting that family resources may be more diluted and require a larger time commitment at home for women.[7] Additionally, India has a caste system that limits female mobility in both marriage and employment. Women in India are expected to marry within their caste and have a complementary role in their husband's occupation (Bidner and Eswaran, 2015). These aspects are unique to India and, as the second most populous country in the world, it is warranted to take a look at what improves women's welfare and what still holds women back.

Understanding the underlying trends in female LFP is important to those interested in women's well-being. Beyond women's contribution to growth, being economically active affects women's progression toward economic independence, bargaining power, and their children's overall well-being (Klasen and Pieters, 2015; Mammen and Paxson, 2000). With India's decrease in female LFP, it is important to explore whether the appliances found to improve female outcomes in other countries also improve female outcomes in a country that is currently experiencing a consistent decline in female LFP. This study thus helps understand the relationship between appliance ownership and female LFP in the Indian context.

2.3 **School enrollment**

The education system in India, also known as the "10 plus 2" system, consists of 4–5 years of primary education, 3–4 years of middle education, 2–3 years of secondary education, and 2 years of senior secondary education. Children begin primary education by the age of 5 years.

According to Government of India's Ministry of Human Resource Development, the total gross enrollment ratio (GER) at the primary level increased from 109.4 in 2005 to 116 in 2012.[8] The GER for middle education increased from 71 in 2005 to 85.5 in 2012; and secondary

6 These are estimates of the participation rate of the female labor force (percentage of the female population aged ≥15 years).

7 https://population.un.org/Household/#/countries/840, accessed April 2020.

8 Gross Enrollment Ratio (GER) is defined as the total student enrollment in a given level of education, regardless of age, expressed as percentage of the corresponding eligible official age-group population in a given school year. This allows the GER to be >100%.

and senior secondary education increased from 52.2 and 28.5 in 2005 to 65 and 40.3 in 2012, respectively.[9] The reports show stark differences in the GER between boys and girls.

Kerr (2019) indicates that the presence of time-saving household appliances alleviates children from household work and provides them the opportunity to reallocate time to schooling in China. With the low secondary and senior secondary enrollment rates present in India, it is useful to explore whether these same appliances can help initiate similar changes in school enrollment rates.

3 Data and Descriptive Statistics

3.1 IHDS data

The data used in this analysis come from the IHDS. This survey was conducted by the University of Maryland and the National Council of Applied Economic Research, New Delhi. The IHDS is a nationally representative, two-wave longitudinal data set consisting of a first round of interviews completed in 2004–2005 and a second round of interviews, mostly reinterviews of households from the first wave, completed in 2011–2012. The first wave contains data on 41,554 households in 1,503 villages and 971 urban neighborhoods across India, and the second wave contains data on 42,152 households in the same villages and urban neighborhoods as the first wave.[10] The survey includes individual-, household-, and primary sampling unit (PSU)-level data. PSUs consist of both villages and urban neighborhoods. In this analysis, we focus on households with electricity, as electricity is required for both washing machines and refrigerators. Accordingly, 83% of households in the IHDS indicate having electricity, with availability increasing between the 2005 and 2012 waves (78% and 88%, respectively).

3.2 Descriptive statistics

Our first sample consists of 52,046 married women of working age, with 73,916 observations over the 2 years of data. Table 1 presents the descriptive statistics for this sample, partitioned by household ownership of a washing machine and a refrigerator. Less than 10% of the sample lives in a household that owns a washing machine. Refrigerator ownership is more prevalent, with nearly 30% of the sample living in a household that owns a refrigerator.[11] The sample consists of married women between the ages of 15 years and 59 years, as 60 years of age is the official retirement age in India. Relative to women who do not own appliances, appliance-owning women are better educated, have fewer children, are more likely to live in an urban area, and are less likely to belong to a scheduled caste (SC) or scheduled tribe (ST).[12] It appears that owning either appliance is highly correlated with owning other appliances. Women living in households that own an appliance are found to be wealthier, measured through the wealth

9 India's Right to Education Act makes schooling free and compulsory for children aged 6–14 years, which partially explains why GER drops during middle education.

10 For a full description of the survey design, see: https://ihds.umd.edu/ IHDS.

11 The summary statistics are similar regardless of whether we partition the sample by washing machine or refrigerator ownership. Thus, we discuss general differences between *appliance* ownership rather than washing machine and refrigerator ownership separately.

12 SC-ST refers to scheduled caste–scheduled tribe, the historically underprivileged sections of the Indian society.

Table 1 Summary statistics by ownership of appliance: married women aged 15–59 years

	Owns washing machine (9.6%)			Does not own washing machine (90.4%)		
Variable	**Mean**	**Standard deviation**	**N**	**Mean**	**Standard deviation**	**N**
Age, years	38.367	10.624	6,809	35.83	10.671	64,205
No. of children	1.459	1.565	6,809	1.768	1.629	64,205
Completed primary	0.873	0.333	6,801	0.52	0.500	64,006
Years of schooling	9.936	4.723	6,801	4.806	4.675	64,006
Currently employed	0.26	0.439	6,809	0.488	0.500	64,205
Hindu	0.718	0.450	6,809	0.822	0.382	64,205
SC or ST	0.121	0.326	6,780	0.279	0.449	64,142
Rural	0.277	0.447	6,809	0.645	0.479	64,205
Owns refrigerator	0.952	0.215	6,807	0.224	0.417	64,072
Owns color television	0.970	0.171	6,807	0.533	0.499	64,107
Wealth index	2.602	0.288	6,809	1.791	0.605	64,205
	Owns refrigerator (29.4%)			**Does not own refrigerator (70.6%)**		
Variable	**Mean**	**Standard deviation**	**N**	**Mean**	**Standard deviation**	**N**
Age, years	37.514	10.631	21,650	35.409	10.651	52,105
No. of children	1.524	1.533	21,650	1.838	1.67	52,105
Completed primary	0.800	0.400	21,614	0.457	0.498	51,929
Years of schooling	8.375	4.844	21,614	4.066	4.342	51,929
Currently employed	0.298	0.457	21,650	0.534	0.499	52,105
Hindu	0.770	0.421	21,650	0.832	0.374	52,105
SC or ST	0.164	0.370	21,604	0.301	0.459	52,059
Rural	0.384	0.486	21,650	0.700	0.458	52,105
Owns washing machine	0.311	0.463	20,855	0.007	0.081	50,024
Owns color television	0.927	0.260	21,637	0.423	0.494	52,080
Wealth index	2.449	0.352	21,650	1.638	0.558	52,105

Note: Summary statistics using IHDS data for married India women, aged 15–59 years.

IHDS, India Human Development Survey; SC/ST, scheduled caste/ scheduled tribe.

index (described in the following subsection), than women living in households that do not own an appliance.

Our variable of interest in the sample of married women is employment status. Since the IHDS does not provide data on LFP, we construct the variable using information on different work categories. The work categories include the following: work on family farm, work tending to the household's animals, family's nonfarm business work, agricultural wage labor, nonagricultural wage labor, and salaried position. Participation in each category is given a value of one if the individual spent ≥240 hours in that activity in the past year and zero otherwise. Employment status is indicated using a dummy variable, equaling one if the woman participates in any of the work categories listed above and zero otherwise. It appears that married women who live in households that own time-saving appliances are *less* likely to be employed than women who do not live in households that own a time-saving appliance.

In addition to studying the effect of time-saving appliance ownership on the overall employment rate, we analyze the effect of time-saving appliance ownership on different types of employment, as some employment types are viewed as more valuable than others. For example, Desai et al. (2010) suggest that salaried work (typically found outside the home) is at the top of

the job ladder, while manual labor positions (typically found inside the home) are valued much lower. We use IHDS data on each individual's work category, listed above, to classify whether an individual's employment is in work inside or outside the household. Using the definitions provided by the IHDS, we construct the variable work inside the household by combining the three work categories of animal care, farm work, and nonfarm family business work. These are mainly manual labor roles and are typically unpaid or low paid. Similarly, we construct the variable work outside the household for household members who work for payment (wage or salary) by combining the three work categories of agricultural wage labor, nonagricultural wage labor, or salaried position worker. These positions are viewed as more valuable, as they typically come with higher pay than for work inside the household. Our categories follow the categories used in previous literature (such as by Desai et al., 2010).

Table A1 in the Appendix presents the trends in employment rate separately for married and single women in the working-age population. The overall employment rate for married women declined from 52% in 2005 to 48% in 2012. At the same time, the overall employment rate for single women declined from 36% in 2005 to 34% in 2012. However, the table indicates that the decline in employment rate observed for married and single women occurs in all work inside the household job types. Married and single women experience an increase in two of the work roles outside the household (nonagricultural labor and salaried position) between 2005 and 2012, suggesting that the breakdown by employment type in the empirical analysis is warranted.

It is beneficial to examine the differences between married and single women beyond their employment decisions as we will use average appliance ownership rate among *single* women to estimate a married woman's ownership of an appliance, described in the following section. Table A1 in the Appendix presents additional summary statistics for married and single women separately. The proportion of women living in urban areas has increased over our two-wave sample for both married and single women, with a higher percentage of single women living in urban areas in each wave. Married women are older than single women, are more likely to be Hindu, and are more likely to have more kids living in the household than single women. When looking at education-related variables, we see that single women have more years of schooling, on average, and are more likely to be literate than married women. Wealth indices for both groups have increased over the two waves of data and are similar in size. While there are many differences between the married- and single-women samples, both groups have seen an increase in washing machine ownership from roughly 6% to 12% and an increase in refrigerator ownership from 24%–25% to 34%–36% (not shown in the table), suggesting that household appliance ownership decisions may be due to something other than marital status.[13]

To understand how an appliance affects a household as a whole, we additionally perform our empirical analysis, described in the following section, on a child sample consisting of 50,160 children over the 2 years of data. Descriptive statistics for the child sample are presented in Table 2, which follows the same format as Table 1. We analyze children between the ages of 12 years and 18 years, as the enrollment rate begins to decline from 96% to 92% and the employment rate doubles from 3% to 6% at the age of 12 years in the IHDS data. We observe that primary school completion rate is 10 percentage points higher for children

13 Given the higher prevalence of refrigerator ownership, we additionally present differences among women across waves partitioned by refrigerator ownership in Table A2 in the Appendix.

Table 2 Summary statistics by ownership of appliance: children 12–18 years of age

	Owns washing machine (7.3%)			Does not own washing machine (92.7%)		
Variable	**Mean**	**Standard deviation**	**N**	**Mean**	**Standard deviation**	**N**
Completed primary	0.965	0.185	3,607	0.855	0.352	45,882
Years of schooling	8.660	2.414	3,607	7.216	2.939	45,882
Currently enrolled	0.950	0.219	3,607	0.746	0.435	45,890
Currently employed	0.045	0.207	3,616	0.182	0.386	45,987
Female	0.468	0.499	3,616	0.488	0.500	45,987
Hindu	0.683	0.465	3,616	0.784	0.411	45,987
SC or ST	0.154	0.361	3,605	0.296	0.456	45,964
Rural	0.264	0.441	3,616	0.650	0.477	45,987
Owns refrigerator	0.943	0.232	3,613	0.187	0.390	45,898
Owns color television	0.956	0.205	3,616	0.473	0.499	45,932
Wealth index	2.582	0.299	3,616	1.726	0.596	45,987
Father's age	44.610	6.680	2,492	43.820	8.402	29,733
Father's years of schooling	10.514	4.064	2,490	5.916	4.610	29,680
Mother's age	39.448	7.132	2,700	38.404	8.246	31,803
Mother's years of schooling	8.641	4.897	2,700	3.710	4.270	31,752
	Owns refrigerator (24.3%)			**Does not own refrigerator (75.7%)**		
Variable	**Mean**	**Standard deviation**	**N**	**Mean**	**Standard deviation**	**N**
Completed primary	0.949	0.219	12,500	0.840	0.367	38,976
Years of schooling	8.436	2.490	12,500	6.997	2.961	38,976
Currently enrolled	0.898	0.302	12,500	0.718	0.450	38,985
Currently employed	0.080	0.271	12,521	0.199	0.399	39,069
Female	0.483	0.500	12,521	0.489	0.500	39,069
Hindu	0.731	0.443	12,521	0.792	0.406	39,069
SC or ST	0.192	0.394	12,505	0.311	0.463	39,051
Rural	0.380	0.485	12,521	0.695	0.460	39,069
Owns washing machine	0.284	0.451	11,983	0.006	0.074	37,528
Owns color television	0.912	0.284	12,514	0.376	0.484	39,051
Wealth index	2.421	0.356	12,521	1.598	0.548	39,069
Father's age	44.153	7.466	8,499	43.676	8.638	24,789
Father's years of schooling	9.305	4.282	8,492	5.277	4.416	24,737
Mother's age	38.868	7.594	9,187	38.254	8.435	26,385
Mother's years of schooling	7.058	4.856	9,181	3.118	3.911	26,337

Note: Summary statistics for children, using IHDS data.

IHDS, India Human Development Survey; SC/ST, scheduled caste/ scheduled tribe.

living in households that own an appliance than children living in households that do not own an appliance. In addition, these appliance-owning children are more likely to be enrolled in school and less likely to be employed. Children who live in a household that does not own an appliance are more likely to be from a SC or ST background and from a rural area. Similar to married women, most children who live in a household that owns a washing machine also own a refrigerator and color television. Parents' ages appear to be similar across children who live in households with and without appliances, but both parents possess a higher number of years of schooling for those children who live in a household that owns an appliance. Not surprisingly, the table suggests a higher index of wealth among appliance owners.

3.3 **Household wealth index**

One concern with estimating the effect of household appliances on individual outcomes is that the appliances considered in this analysis are a large purchase and are typically available to wealthier households. These appliances might pick up a wealth effect, whereby wealthier households simultaneously purchase appliances and alter their daily activities. To address this concern, we control for wealth using a wealth index, which uses detailed data and places households in the analysis on a continuous scale of relative wealth. This control assists with distinguishing between the wealth effect and the true effect of the time-saving appliance on LFP and schooling. Wealth indices are commonly used in research in developing countries. The Demographic and Health Surveys (DHS) regularly create wealth indices when studying health services, as "the distribution of health services to the poor can be determined by a wealth index as well as or better than an income or expenditure index. This is because of the lower volatility of wealth as compared with that of income and expenditures" (https://dhsprogram.com/pubs/pdf/cr6/cr6.pdf). Their logic follows when studying other services available in developing countries.

We use information on each household's ownership of time-using appliances and household infrastructure to construct a wealth index. A detailed description of the construction of this index is available in Kerr (2019). Briefly, we use a factor analysis approach and assign factor scores to household assets and infrastructure (see Kennedy [2008, p. 200] for an explanation on factor analysis). We then combine the scores by household to rank each household's overall wealth. The time-using assets in our wealth index include the following: air cooler, black- and-white television, bicycle, cable, car, cellphone, chair, computer, cot, generator, laptop, mixer, motorcycle, sewing machine, shoes, telephone, and two sets of clothes.[14] Ownership of each of these assets is indicated using dummy variables, with a value equal to one if a household owns the asset and zero otherwise.

Household infrastructure variables include discrete indicators for access to drinking water and toilet facilities; principal sources for water; and the types of chulha,[15] wall, roof, and floor. Drinking water access is indicated using a dummy variable, with a value equal to one if a household has indoor piped drinking water and zero otherwise. Toilet facility access is indicated with a value between one and four, with one as the lowest (open fields) and four as the highest (flush toilet). Main water source is indicated with a value between one and seven, with one as the lowest (hand pump) and seven as the highest (bottled). The chulha type is indicated with a value between one and four, with one as the lowest (open fire) and four as the highest (not biomass: kerosene, liquefied petroleum gas [LPG], etc.). Wall type is indicated with a value between one and four, with one as the lowest (grass or mud) and four as the highest (metal or cement). Roof value is indicated with a value between one and six, with one as the lowest (grass or tile) and six as the highest (concrete). Floor type is indicated with a value between one and four, with one as the lowest (mud) and six as the highest (tiles).

We use these infrastructure variables and asset ownership indicator variables to estimate the factor scores for each household in each year of the survey. Again, following Kerr (2019), we sum the factor scores within each household each year to create an index between the values 0 and 3.18, with 0 representing the least wealthy households and 3.18 representing the wealthiest households. We compare the index with available household income to verify that the households that report higher incomes also show higher wealth indices.

14 Air conditioner and color television are not included in our wealth index, as these two appliances are included in our instrument, which is described in the following section.

15 A chulha is a traditional Indian stove.

3.4 Summary of data description

Summary statistics presented above suggest differences in married women's employment and children's schooling and employment, which appear to be identified on the basis of ownership of durable appliances. The purpose of the empirical analysis is to ascertain the extent to which this difference is sustained in the multivariate context of Eqs (1) and (3), described in the following section.

4 Econometric Framework

We use detailed household data from the IDHS, described in the previous section, to estimate the model and examine the hypothesis that as households purchase time-saving durable goods, married women and children allocate their time away from household work to employment in economic activities or schooling. Employment is captured using a dummy variable, which equals one if the individual is engaged in any of the work categories described in the previous section and zero otherwise. Schooling is captured using a dummy variable, which equals one if the individual is currently enrolled in school and zero otherwise.

An expression that represents the relationship between appliance ownership and the two outcome variables explored in this analysis is given as follows:

$$Y_{ipt} = \beta_0 + \beta_1 appliance_{ipt} + X_{ipt}\beta_2 + \pi_d + \tau_t + \varepsilon_{ipt} \quad (1)$$

where $appliance_{ipt}$ is a dummy indicating whether individual i residing in PSU p during survey year t lives in a household that owns a washing machine at the time of the survey. The critical parameter is β_1, which measures the partial effect of appliance ownership on the dependent variable. In the empirical analysis, we estimate Eq. (1) separately for two representations of Y_{ipt}, namely, employment and school enrollment (for the child sample). In addition, to assess the robustness of the results, we estimate the model for the two dependent variables while replacing $appliance_{ipt}$ with a variable indicating ownership of a refrigerator. Washing machines and refrigerators are the two largest time-saving appliance purchases available in the data set.

Elsewhere in Eq. (1), X_{ipt} is a vector of individual-, household-, and PSU-level control variables that potentially affect married woman and child outcomes. Individual controls include age, age squared, years of schooling (in the married woman analysis), and gender (in the child analysis). Household controls include place of residence (rural or urban), an indicator of Hindu religion, an indicator of SC or ST status, a constructed index of household wealth (described in the previous section), number of children in the household (in the married woman analysis), and parents' ages and educational attainments (in the child analysis). As mentioned in the Introduction section, household preferences may differ. The household controls used in this analysis assist with mitigating the differences in ability and desire to obtain appliances, send married women or children to the labor force, and educate children at the household level. PSU controls include distance to the nearest town, distance to road access, an indicator of phone access, distance to railway station, distance to market, and distance to both secondary and higher secondary schools. These variables were collected only for village PSUs. Thus, when including PSU-level controls, we are analyzing the effect of appliance ownership on a subset of individuals in India, specifically individuals living in villages. Here, we are attempting to

capture features of the village that potentially explain household capital acquisition and married woman/child outcomes that would otherwise be unmeasured in the model. PSU variables control for differences across villages that make access to appliances easier.

Appended to Eq. (1) are latent fixed effects for the district of residence, π_d, where the subscript denotes the district in which the household is located, and the survey year, denoted as τ_t. The purpose of the district-level fixed effect is to control for unmeasured regional differences that are invariant over the two waves of the survey. The year-level fixed effect controls for unmeasured disturbances of a pervasive or macro nature, such as general economic growth, market reforms that have characterized India, and internal changes such as developments in infrastructure, all of which could potentially affect the dependent variable. Finally, with the fixed effects included, the random error term ε_{ipt} is assumed to possess zero mean and constant variance.

A concern when estimating Eq. (1) is the possibility that appliance ownership is correlated with unobserved factors that determine time allocation. Coen-Pirani et al. (2010) recognize this problem and explain potential biases that exist when using ordinary least squares (OLS) to test the effect of appliance ownership on married women's LFP. Kerr (2019) presents an adapted version of their reasoning, which is relevant to child outcomes. Both papers apply to our analysis, suggesting potential biases such as the following: (1) households with married women in the labor force or children in school are more likely to purchase appliances due to greater utility from their services, or (2) households with strong tastes for home-produced goods might invest heavily in both household work and household appliances. These household preferences are unobserved and are also possible determinants of married women's LFP and children's human capital investment. Stated differently, in the context of child outcomes, households may choose to invest in both schooling and appliances if they have a strong preference for child outcomes and believe that time-saving appliance ownership will relieve children of household duties. Alternatively, negative selection bias may be present if households purchase appliances for reasons other than to reduce household work.

Controlling for variables such as parental and village characteristics will mitigate these challenges as these variables represent measures of parental preferences and availability within the village, but there remains the potential for other unobservables to bias the results obtained from OLS. To address this issue, we use 2SLS estimation to address potential sources of endogeneity. As part of this approach, we use an IV strategy to identify the causal effect of owning a time-saving appliance on both married woman outcomes and child outcomes. For the instrument to be valid, it must affect the potentially endogenous variable (living in a household that owns a time-saving appliance) but have no direct effect on the dependent variable (employment or school enrollment). To determine the effect of household appliance ownership on married women's LFP, Coen-Pirani et al. (2010) instrument a married woman's ownership of an appliance by average ownership rate for that appliance among *single* women living in the same US state. Since LFP among single women did not increase during the time period used in their sample, they argue that "observed temporal and cross-section variation in single women's ownership of home appliances is driven by the (unobserved) appliance costs rather than by changes in women's labor force participation rates" (Coen-Pirani et al., 2010).

Moving to child outcomes, Kerr (2019) adapts Coen-Pirani et al.'s (2010) specification by instrumenting a child's household ownership of a time-saving appliance by the average ownership rate for that same appliance among households *without* children living in the same

community. The underlying assumption in this case is that households without children do not base their purchasing decisions on a desire to alter a child's time allocated to household work. Consequently, households without children do not face the same trade-off decisions among child outcomes and appliance ownership as households with children, and changes in ownership rates for childless households cannot be related to child outcomes. We calculate average appliance ownership in each PSU for single women and households with no children younger than 18 years of age.

In addition to the PSU-level instruments described above, we follow Kerr (2019) and include two family-specific time-using household assets in our first-stage estimation: family ownership of an air conditioner and color television. The logic underlying these choices is that these two appliances are (1) likely to be associated, on a household basis, with ownership of time-saving appliances such as washing machines and refrigerators and (2) unlikely to exert direct effects on married women's and children's employment or school enrollment. These two appliances are perhaps revealing about other characteristics of the household that might explain their acquisition of time-saving appliances.[16]

In the instrumented version of the model, we define household time-saving appliance ownership as a function of average PSU ownership and household ownership of two time-using appliances:

$$appliance_{ipt} = \alpha_0 + \alpha_1 avgownership_{pt} + X_{ipt}\alpha_2 + \alpha_3 AC_{ipt} + \alpha_4 CTV_{ipt} + \pi_d + \tau_t + \xi_{ipt}, \quad (2)$$

where, as described above, $avgownership_{pt}$ is average appliance ownership for single women or households with no children living in PSU p in year t; X_{ipt} is the vector of controls from Eq. (1); AC_{ipt} indicates whether individual i lives in a household that owns an air conditioner; and CTV_{ipt} indicates whether individual i lives in a household that owns a color television. Using this IV approach, Stage 1 of the 2SLS procedure estimates Eq. (2) for the twofold purpose of ascertaining the strength of the instruments and obtaining the fitted values of the dependent variable. Stage 2 estimates Eq. (1) with the fitted value of the regressor replacing $appliance_{ipt}$ on the righthand side. Thus, the causal impact of time-saving appliance ownership on married woman and child outcomes can be formalized as follows:

$$Y_{ipt} = \beta_0 + \beta_1 \widehat{appliance_{ipt}} + X_{ipt}\beta_2 + \pi_d + \tau_t + \varepsilon_{ipt}, \quad (3)$$

where $\widehat{appliance_{ipt}}$ is the fitted value from Stage 1. Since average ownership for single women and average ownership for households with no children are both continuous instruments, we are estimating the average marginal treatment effect of living in a household that owns a time-saving appliance on married woman and child outcomes.

5 Results of Estimation

The results of the estimation are presented in Tables 3–10. The principal focus of estimation is the parameter β_1 in Eqs (1) and (3), the effect of household appliance ownership on married woman and child outcomes. We present the estimates obtained by both OLS and the 2SLS

16 Results excluding these two family-specific time-using household assets from our instrument are available upon request.

procedure described in Section 4. Recall that OLS results are not believed to be causal. However, they are a useful point of departure and are used to assess our 2SLS results. We partition our child sample by gender to further examine the relationship between appliance ownership and child outcomes. To assess the robustness of our estimates, we present one set of estimates for Eqs (1) and (3) for which appliance ownership is identified by the presence of a washing machine and a second set based on ownership of a refrigerator.[17] All estimations include controls for unmeasured regional fixed effects at the district level and unmeasured temporal effects at the survey year level. Standard errors are clustered at the district level.

5.1 **OLS: married women**

As a point of departure, Table 3 presents the OLS estimates of Eq. (1), with appliance ownership defined as the presence of a washing machine in Columns 1 and 2 and the presence of a refrigerator in Columns 3 and 4. Living in a household that owns a washing machine increases married women's probability of employment by 3 percentage points (Column 1 of Table 3). Refrigerator ownership is found to be insignificant in married women's employment decisions (Column 3 of Table 3). Estimates obtained using PSU-level controls (which estimate the effect of appliance ownership on married women living in villages only) indicate insignificant changes in employment with ownership of either appliance (Columns 2 and 4 of Table 3).

Some of the control variables provide further insight into the Indian setting, where women appear to be reducing their LFP when a concomitant increase in other wealth-indicating characteristics occurs, which is inconsistent with general intuition. Our results suggest that women *decrease* employment when years of schooling increase and when the household becomes wealthier (as measured through the wealth index). This finding is consistent with previous literature (Bhargava, 2020): Indian women exhibit negative income elasticity of labor supply, which dominates over their positive own-wage elasticity of labor supply. Among other controls, age, rural status, and Hindu status are significant in all cases.[18] Number of children in the household is only significant in the village sample, along with distance to road access, market, and secondary school. These three variables suggest that village location influences access to jobs for married women.

5.2 **OLS: children**

Tables 4 and 5 present the OLS estimates of Eq. (1) for the child sample for washing machines and refrigerators, respectively. Columns 1–6 and 7–12 indicate the results for enrollment and employment, respectively. We find an insignificant increase in the probability of being enrolled and an insignificant decrease in the probability of being employed in nearly all specifications for both appliances. The wealth index is highly significant in all models and for both genders. Unlike the married-female sample, the direction of the effect follows intuition and is plausible: households characterized by greater wealth tend to (1) more actively enroll children in school

17 We additionally perform a second analysis excluding the two household-specific instruments from our first-stage estimation. However, these results are not included in the main text, as this approach is less conservative than the approach described in Section 4. These results are available on request.

18 The directions of these effects are plausible and consistent with previous literature on female labor supply in India. See Bhargava (2020), Klasen and Pieters (2015), Afridi et al. (2018), and Neff et al. (2012), among others.

Table 3 OLS: effect of living in a household that owns an *appliance* on married women's employment

	Washing machine		Refrigerator	
	(1)	(2)	(3)	(4)
Owns washing machine	0.030***	0.004		
	(0.009)	(0.018)		
Owns refrigerator			−0.001	−0.010
			(0.007)	(0.011)
Age	0.054***	0.064***	0.054***	0.063***
	(0.002)	(0.002)	(0.002)	(0.002)
Age-squared	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	-0.007***	-0.012***	-0.007***	−0.012***
	(0.001)	(0.001)	(0.001)	(0.001)
Rural	0.244***	0.043*	0.246***	0.043*
	(0.014)	(0.025)	(0.014)	(0.025)
Hindu	0.060***	0.078***	0.060***	0.079***
	(0.009)	(0.014)	(0.009)	(0.014)
SC or ST	0.015**	0.013	0.014**	0.013
	(0.007)	(0.009)	(0.007)	(0.009)
Wealth index	−0.146***	−0.112***	−0.144***	−0.110***
	(0.006)	(0.008)	(0.006)	(0.008)
No. of children (household)	0.000	−0.004*	−0.000	−0.005**
	(0.002)	(0.002)	(0.002)	(0.002)
Village controls				
Distance to nearest town (km)		−0.000		−0.000
		(0.000)		(0.000)
Distance to road access (km)		0.003**		0.003*
		(0.001)		(0.001)
Phone access		−0.014		−0.013
		(0.011)		(0.011)
Distance to railway station (km)		0.000		0.000
		(0.000)		(0.000)
Distance to market (km)		0.002**		0.002***
		(0.001)		(0.001)
Distance to secondary school (km)		0.002***		0.003***
		(0.001)		(0.001)
Distance to higher secondary school (km)		0.000		0.000
		(0.000)		(0.000)
Average *appliance* ownership	0.096	0.046	0.294	0.191
Average employment	0.466	0.619	0.465	0.619
N	70,263	38,109	73,078	39,398
R^2	0.303	0.228	0.302	0.225

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

OLS, ordinary least squares; SC/ST, scheduled caste/ scheduled tribe.

Table 4 OLS: effect of living in a household that owns a washing machine on children's outcomes

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Owns washing machine	0.001	0.019	−0.004	0.018	0.007	0.024	−0.004	−0.025*	−0.006	−0.024	−0.004	−0.023
	(0.008)	(0.013)	(0.011)	(0.015)	(0.010)	(0.019)	(0.007)	(0.014)	(0.010)	(0.020)	(0.009)	(0.018)
Age	0.142***	0.168***	0.167***	0.202***	0.108***	0.129***	−0.064***	−0.062**	−0.096***	−0.092***	0.012	0.016
	(0.017)	(0.024)	(0.022)	(0.030)	(0.027)	(0.038)	(0.017)	(0.025)	(0.023)	(0.032)	(0.023)	(0.035)
Age–squared	−0.007***	−0.008***	−0.008***	−0.009***	−0.005***	−0.006***	0.004***	0.004***	0.005***	0.005***	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	−0.016***	−0.032***					−0.055***	−0.051***				
	(0.005)	(0.008)					(0.005)	(0.007)				
Rural	0.030***	−0.034*	0.046***	−0.019	0.006	−0.048	0.058***	0.009	0.054***	0.017	0.062***	0.003
	(0.008)	(0.018)	(0.011)	(0.023)	(0.010)	(0.031)	(0.009)	(0.023)	(0.011)	(0.031)	(0.010)	(0.030)
Hindu	0.080***	0.073***	0.077***	0.065***	0.085***	0.084***	−0.007	−0.005	−0.019**	−0.020	0.003	0.010
	(0.010)	(0.014)	(0.011)	(0.014)	(0.012)	(0.020)	(0.006)	(0.010)	(0.009)	(0.015)	(0.007)	(0.013)
SC or ST	−0.011*	−0.020***	−0.018**	−0.027***	−0.003	−0.010	−0.009	−0.007	−0.007	−0.008	−0.013*	−0.009
	(0.006)	(0.008)	(0.008)	(0.009)	(0.008)	(0.011)	(0.006)	(0.008)	(0.007)	(0.010)	(0.007)	(0.011)
Wealth index	0.096***	0.079***	0.096***	0.076***	0.095***	0.083***	−0.067***	−0.054***	−0.065***	−0.050***	−0.068***	−0.058***
	(0.008)	(0.011)	(0.009)	(0.011)	(0.010)	(0.014)	(0.006)	(0.008)	(0.008)	(0.011)	(0.008)	(0.011)
Father's age	−0.003***	−0.002***	−0.002***	−0.002*	−0.004***	−0.003***	0.001**	0.001	0.001**	0.000	0.001*	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's age	0.000	−0.000	0.000	−0.000	0.000	−0.000	−0.000	0.000	−0.000	0.001	−0.000	−0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Father's years of schooling	0.012***	0.012***	0.012***	0.012***	0.013***	0.013***	−0.005***	−0.006***	−0.006***	−0.006***	−0.003***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's years of schooling	0.006***	0.006***	0.007***	0.006***	0.006***	0.005***	−0.004***	−0.005***	−0.005***	−0.006***	−0.003***	−0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

(*Continued*)

Table 4 Continued

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Village controls												
Distance to nearest town (km)		0.000		0.001		−0.000		−0.001		−0.000		−0.001**
		(0.001)		(0.001)		(0.001)		(0.000)		(0.001)		(0.001)
Distance to road access (km)		0.001		0.003		−0.000		0.000		−0.002		0.002
		(0.002)		(0.002)		(0.002)		(0.002)		(0.003)		(0.002)
Phone access		0.003		0.001		0.010		−0.030**		−0.027*		−0.029*
		(0.011)		(0.013)		(0.015)		(0.012)		(0.014)		(0.016)
Distance to railway station (km)		−0.000		−0.000		−0.000		−0.000		0.000		−0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Distance to market (km)		0.001		0.001		0.001		0.001		0.000		0.002*
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to secondary school (km)		−0.001		−0.000		−0.002		0.002**		0.002		0.002*
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to higher secondary school (km)		−0.000		−0.000		−0.000		−0.000		−0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.001)		(0.000)
Average washing machine ownership	0.079	0.037	0.076	0.038	0.083	0.037	0.079	0.037	0.076	0.038	0.083	0.037
Average Y_{ict}	0.819	0.806	0.813	0.806	0.827	0.807	0.152	0.194	0.184	0.226	0.110	0.152
N	30,348	17,127	17,168	9,744	13,176	7,378	30,363	17,132	17,177	9,748	13,182	7,379
R^2	0.248	0.245	0.249	0.246	0.281	0.290	0.170	0.167	0.196	0.196	0.163	0.166

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

OLS, ordinary least squares; SC/ST, scheduled caste/ scheduled tribe.

Table 5 OLS: effect of living in a household that owns a refrigerator on children's outcomes

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Owns refrigerator	0.017**	0.010	0.015*	0.003	0.018**	0.018	0.005	−0.001	0.006	0.001	0.002	−0.005
	(0.007)	(0.010)	(0.009)	(0.011)	(0.009)	(0.014)	(0.006)	(0.010)	(0.007)	(0.013)	(0.008)	(0.015)
Age	0.149***	0.169***	0.173***	0.201***	0.113***	0.133***	−0.067***	−0.068***	−0.100***	−0.099***	0.011	0.015
	(0.017)	(0.024)	(0.022)	(0.031)	(0.027)	(0.037)	(0.017)	(0.024)	(0.022)	(0.032)	(0.022)	(0.035)
Age−squared	−0.007***	−0.008***	−0.008***	−0.009***	−0.006***	−0.007***	0.004***	0.004***	0.005***	0.006***	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	−0.015***	−0.030***					−0.056***	−0.051***				
	(0.005)	(0.008)					(0.005)	(0.007)				
Rural	0.029***	−0.036*	0.044***	−0.022	0.005	−0.047	0.059***	0.010	0.056***	0.016	0.061***	0.007
	(0.008)	(0.018)	(0.011)	(0.023)	(0.010)	(0.031)	(0.008)	(0.023)	(0.010)	(0.031)	(0.010)	(0.029)
Hindu	0.080***	0.074***	0.077***	0.066***	0.085***	0.084***	−0.004	−0.001	−0.014	−0.013	0.003	0.010
	(0.009)	(0.014)	(0.011)	(0.014)	(0.012)	(0.020)	(0.006)	(0.011)	(0.009)	(0.015)	(0.007)	(0.013)
SC or ST	−0.010*	−0.019**	−0.016**	−0.025**	−0.003	−0.010	−0.008	−0.007	−0.007	−0.007	−0.011	−0.007
	(0.006)	(0.008)	(0.008)	(0.010)	(0.008)	(0.011)	(0.005)	(0.008)	(0.007)	(0.010)	(0.007)	(0.011)
Wealth index	0.090***	0.079***	0.092***	0.080***	0.088***	0.078***	−0.071***	−0.059***	−0.071***	−0.058***	−0.069***	−0.058***
	(0.008)	(0.011)	(0.009)	(0.012)	(0.011)	(0.015)	(0.006)	(0.008)	(0.008)	(0.011)	(0.008)	(0.011)
Father's age	−0.003***	−0.002***	−0.002***	−0.002*	−0.004***	−0.003***	0.001***	0.001	0.001**	0.000	0.001**	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's age	0.000	−0.000	0.000	−0.000	0.000	−0.000	−0.000	0.000	−0.000	0.000	−0.000	−0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Father's years of schooling	0.012***	0.012***	0.011***	0.012***	0.012***	0.013***	−0.005***	−0.006***	−0.006***	−0.006***	−0.003***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's years of schooling	0.006***	0.006***	0.007***	0.007***	0.006***	0.005***	−0.004***	−0.005***	−0.005***	−0.006***	−0.003***	−0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

(*Continued*)

Table 5 Continued

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Village controls												
Distance to nearest town (km)		0.000		0.001		−0.000		−0.001		−0.000		−0.001*
		(0.001)		(0.001)		(0.001)		(0.000)		(0.001)		(0.001)
Distance to road access (km)		0.001		0.002		−0.000		0.000		−0.002		0.002
		(0.001)		(0.002)		(0.002)		(0.002)		(0.003)		(0.002)
Phone access		0.003		0.000		0.009		−0.032***		−0.029**		−0.030*
		(0.011)		(0.012)		(0.015)		(0.012)		(0.014)		(0.016)
Distance to railway station (km)		−0.000		−0.000		−0.000		−0.000		0.000		−0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Distance to market (km)		0.001		0.001		0.001		0.001		0.000		0.002
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to secondary school (km)		−0.001		−0.000		−0.002		0.002**		0.002*		0.003**
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to higher secondary school (km)		−0.000		−0.000		−0.000		−0.000		−0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.001)		(0.000)
Average refrigerator ownership	0.261	0.166	0.250	0.164	0.276	0.169	0.261	0.166	0.250	0.163	0.276	0.169
Average Y_{ict}	0.819	0.807	0.812	0.805	0.828	0.808	0.151	0.194	0.183	0.227	0.108	0.151
N	31,376	17,518	17,833	10,009	13,539	7,506	31,391	17,523	17,842	10,013	13,545	7,507
R^2	0.247	0.244	0.248	0.246	0.280	0.289	0.170	0.167	0.195	0.195	0.162	0.165

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

OLS, ordinary least squares; SC/ST, scheduled caste/ scheduled tribe.

and (2) engage children to a lesser extent in market work. Among the controls, parents' years of schooling are significant in all cases, with signs that largely match those of the wealth index. The remaining controls are only sporadically significant, yet their inclusion is useful as a general principle in isolating the key independent variable, appliance ownership, after controlling for household and PSU characteristics.

The estimates presented in Tables 4 and 5 suggest that time-saving household appliances do not consistently exert significant effects on employment or enrollment for children. However, the important caveat is the possible endogeneity of appliance ownership. We address this by using a 2SLS estimation of Eq. (1), the results of which are discussed in the following sections.

5.3 **IV estimation: married women**

To address the concern of appliance ownership being endogenous, we begin our 2SLS estimation by estimating Eq. (2), which regresses household ownership of time-saving appliances for married women against average PSU ownership of time-saving appliances for single women, ownership of an air conditioner, ownership of a color television, and the set of controls included in our OLS estimation. The model is estimated separately for ownership of washing machines and refrigerators.

Estimates of Eq. (2) are compressed to the first four rows of Table 6 and suggest that the likelihood of owning either appliance increases for married women when the average PSU ownership of the same appliance increases for single women living in the same PSU.[19]

The remaining rows of Table 6 present our 2SLS results using Eq. (3) for married women. Columns 1 and 2 suggest insignificant effects of washing machine ownership on married women's employment. In contrast, we find that married women living in households that own a refrigerator decrease their probability of employment by 10 percentage points (Columns 3 and 4 of Table 6). This finding is significant in both the full sample (Column 3) and the village sample (Column 4) and does not follow most intuition or previous studies. The results suggest that time-saving appliances allow women to *reduce* their employment rather than increase it. We will explore this finding later in the paper. Similar to the OLS results, we find statistically significant effects of age, years of schooling, rural, Hindu, and the wealth index.[20]

Before moving on to the child sample, we split our sample of married women on the basis of their education to further distinguish the human capital effect. Table A3 in the Appendix presents these results, following the same empirical strategy as above, separately for women who did not complete primary education and for women with an education level of primary and above. The results presented in Table A3 in the Appendix are consistent with those presented in Table 6, suggesting insignificant effects of washing machine ownership for both education levels and significant effects of refrigerator ownership on the probability of married women's employment for both education levels. The coefficient is larger for the sample of married women who did not complete primary (–18.4% in Column 5 compared to –13.1% in

19 Tables including first-stage results that present all controls are available upon request.

20 For robustness, we generate another index by regressing appliance ownership on all household assets/infrastructure variables from the original wealth index, and then, we use the residual in our final specification as an alternative index to control for household wealth. The coefficients on washing machine and refrigerator ownership estimated using this strategy are larger than our main results and are highly significant. These results further validate our results and are available upon request. We thank an anonymous reviewer for suggesting this robustness check.

Table 6 2SLS: effect of living in a household that owns an *appliance* on married women's employment

	Washing machine		Refrigerator	
	(1)	(2)	(3)	(4)
First stage				
Owns washing machine (single women)	0.501***	0.485***		
	(0.017)	(0.031)		
Owns refrigerator (single women)			0.376***	0.352***
			(0.013)	(0.020)
Owns air conditioner	0.437***	0.523***	0.158***	0.223***
	(0.024)	(0.0450)	(0.019)	(0.031)
Owns color television	0.003	0.000	0.121***	0.100***
	(0.004)	(0.004)	(0.008)	(0.011)
F−statistic	638.36	146.45	495.87	193.80
2SLS				
Owns washing machine	0.030	−0.074		
	(0.035)	(0.061)		
Owns refrigerator			−0.102***	−0.097*
			(0.031)	(0.055)
Age	0.054***	0.064***	0.054***	0.064***
	(0.002)	(0.002)	(0.002)	(0.002)
Age−squared	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	−0.007***	−0.012***	−0.005***	−0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
Rural	0.242***	0.041	0.239***	0.036
	(0.014)	(0.025)	(0.014)	(0.026)
Hindu	0.060***	0.075***	0.057***	0.074***
	(0.009)	(0.014)	(0.009)	(0.014)
SC or ST	0.015**	0.012	0.013*	0.010
	(0.007)	(0.009)	(0.007)	(0.009)
Wealth index	−0.140***	−0.102***	−0.107***	−0.082***
	(0.007)	(0.009)	(0.010)	(0.016)
No. of children (household)	0.000	−0.004*	0.001	−0.004*
	(0.002)	(0.002)	(0.002)	(0.002)
Village controls				
Distance to nearest town (km)		−0.000		−0.000
		(0.000)		(0.000)
Distance to road access (km)		0.003**		0.003*
		(0.001)		(0.001)
Phone access		−0.014		−0.016
		(0.011)		(0.011)
Distance to railway station (km)		0.000		0.000
		(0.000)		(0.000)
Distance to market (km)		0.002**		0.001**
		(0.001)		(0.001)
Distance to secondary school (km)		0.002***		0.002***
		(0.001)		(0.001)
Distance to higher secondary school (km)		0.000		0.000
		(0.000)		(0.000)

(*Continued*)

Table 6 Continued

	Washing machine		Refrigerator	
	(1)	(2)	(3)	(4)
Average *appliance* ownership	0.096	0.046	0.294	0.194
Average employment	0.466	0.619	0.467	0.619
N	70,160	38,059	70,221	38,071
R^2	0.303	0.227	0.298	0.225

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

Column 7 of Table A3 in the Appendix), suggesting that these time-saving appliances have a larger impact on the probability of being employed for less-educated married women.[21]

5.4 **IV estimation: children**

First-stage estimates using Eq. (2) for the child sample are presented in the first three rows of Tables 7 and 8. Similar to the married women sample, the results suggest that ownership of time-saving appliances among households with children increases as the average PSU ownership among households with no children in the same PSU increases.

The remaining rows of Tables 7 and 8 present the estimates of Eq. (3) for ownership of a washing machine and a refrigerator, respectively. Table 7 is consistent with the findings presented in Table 6, suggesting that washing machine ownership does not significantly alter enrollment or employment decisions for children in the sample. One notable difference is found in the village sample of female children. These individuals experience a 16.2 percentage point decrease in the probability of being employed when living in a household that owns a washing machine, suggesting that washing machines alleviate some of the employment opportunities or needs for older female children. An analysis using time-use data would be beneficial to further understand why female children experience this significant change. However, time-use data are not available in this data set.

Observing refrigerator ownership in Table 8, we find statistically significant effects on both enrollment and employment decisions for children. Beginning with enrollment, we observe a 15.3 percentage point increase in the probability of being enrolled when a child lives in a household that owns a refrigerator (Column 1 of Table 8). These significant results hold when the sample is partitioned by gender (Columns 3 and 5). We find that the effect of refrigerator ownership on enrollment is larger for males than for females. Males (females) living in a household that owns a refrigerator experience an increase of 17.5 (12.7) percentage points in the probability of being enrolled. These refrigerator-owning children also experience a 9.1 percentage point decrease in the probability of participating in the labor force (Column 7 of Table 8).

21 We thank an anonymous reviewer for suggesting this robustness check.

Table 7 2SLS: effect of living in a household that owns a washing machine on children's outcomes

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
First stage												
Owns washing machine (no children)	0.379***	0.406***	0.405***	0.454***	0.348***	0.348***	0.379***	0.406***	0.405***	0.454***	0.348***	0.348***
	(0.027)	(0.042)	(0.026)	(0.045)	(0.034)	(0.055)	(0.027)	(0.042)	(0.026)	(0.045)	(0.034)	(0.055)
Owns air conditioner	0.483***	0.496***	0.460***	0.499***	0.515***	0.504***	0.484***	0.496***	0.460***	0.499***	0.515***	0.504***
	(0.028)	(0.075)	(0.035)	(0.093)	(0.033)	(0.091)	(0.028)	(0.075)	(0.035)	(0.093)	(0.033)	(0.091)
Owns color television	−0.002	0.004	0.005	0.008*	−0.009	−0.002	−0.002	0.004	0.005	0.008*	−0.009	−0.001
	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)
F−statistic	108.67	17.72	156.08	50.09	175.99	30.48	207.77	55.00	156.10	50.08	176.29	30.48
2SLS												
Owns washing machine	−0.014	0.034	−0.016	0.022	−0.020	0.036	0.009	−0.055	0.004	−0.002	−0.003	−0.162*
	(0.022)	(0.062)	(0.028)	(0.064)	(0.030)	(0.087)	(0.021)	(0.067)	(0.032)	(0.074)	(0.022)	(0.087)
Age	0.143***	0.169***	0.168***	0.203***	0.109***	0.129***	−0.065***	−0.063**	−0.098***	−0.094***	0.012	0.019
	(0.017)	(0.024)	(0.022)	(0.030)	(0.027)	(0.038)	(0.017)	(0.025)	(0.023)	(0.032)	(0.023)	(0.035)
Age−squared	−0.007***	−0.008***	−0.008***	−0.009***	−0.005***	−0.006***	0.004***	0.004***	0.005***	0.005***	0.000	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	−0.016***	−0.032***					−0.055***	−0.051***				
	(0.005)	(0.008)					(0.005)	(0.007)				
Rural	0.029***	−0.033*	0.045***	−0.019	0.004	−0.047	0.058***	0.006	0.054***	0.017	0.062***	−0.009
	(0.008)	(0.019)	(0.012)	(0.023)	(0.011)	(0.033)	(0.009)	(0.024)	(0.010)	(0.031)	(0.010)	(0.034)
Hindu	0.081***	0.074***	0.078***	0.066***	0.085***	0.086***	−0.007	−0.007	−0.019**	−0.021	0.003	0.006
	(0.010)	(0.014)	(0.011)	(0.015)	(0.013)	(0.020)	(0.006)	(0.011)	(0.009)	(0.015)	(0.007)	(0.014)
SC or ST	−0.011*	−0.020***	−0.018**	−0.027***	−0.002	−0.010	−0.009	−0.008	−0.007	−0.008	−0.013*	−0.010
	(0.006)	(0.008)	(0.008)	(0.009)	(0.008)	(0.012)	(0.006)	(0.008)	(0.007)	(0.010)	(0.007)	(0.011)

(*Continued*)

Table 7 Continued

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Wealth index	0.090***	0.072***	0.090***	0.069***	0.091***	0.076***	−0.065***	−0.050***	−0.063***	−0.050***	−0.064***	−0.046***
	(0.007)	(0.010)	(0.008)	(0.011)	(0.010)	(0.015)	(0.006)	(0.009)	(0.008)	(0.011)	(0.008)	(0.012)
Father's age	−0.003***	−0.002***	−0.002***	−0.002*	−0.004***	−0.003***	0.001**	0.001	0.001*	0.000	0.001*	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's age	0.000	−0.000	0.000	−0.000	0.000	−0.000	−0.000	0.000	−0.000	0.001	−0.000	0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Father's years of schooling	0.012***	0.013***	0.012***	0.012***	0.013***	0.013***	−0.005***	−0.006***	−0.006***	−0.006***	−0.003***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's years of schooling	0.007***	0.006***	0.007***	0.007***	0.006***	0.005***	−0.004***	−0.005***	−0.005***	−0.006***	−0.003***	−0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Distance to nearest town (km)		0.000		0.001		−0.000		−0.001		−0.000		−0.001**
		(0.001)		(0.001)		(0.001)		(0.000)		(0.001)		(0.001)
Distance to road access (km)		0.002		0.003		−0.000		0.000		−0.002		0.002
		(0.002)		(0.002)		(0.002)		(0.002)		(0.003)		(0.002)
Phone access		0.003		0.001		0.011		−0.030**		−0.028**		−0.029*
		(0.011)		(0.013)		(0.015)		(0.012)		(0.014)		(0.016)
Distance to railway station (km)		−0.000		−0.000		−0.000		−0.000		0.000		−0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Distance to market (km)		0.001		0.001		0.001		0.001		0.000		0.002*
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)

(*Continued*)

Table 7 Continued

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distance to secondary school (km)		−0.000		−0.000		−0.002		0.002**		0.002		0.002*
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to higher secondary school (km)		−0.000		−0.000		−0.000		−0.000		−0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.001)		(0.000)
Average washing machine ownership	0.079	0.037	0.076	0.038	0.083	0.037	0.079	0.037	0.076	0.038	0.083	0.037
Average Y_{ict}	0.819	0.806	0.812	0.806	0.827	0.807	0.152	0.194	0.185	0.226	0.110	0.152
N	30,322	17,119	17,150	9,737	13,168	7,377	30,337	17,124	17,159	9,741	13,174	7,378
R^2	0.357	0.245	0.248	0.246	0.281	0.290	0.170	0.167	0.196	0.196	0.163	0.162

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

Table 8 2SLS: effect of living in a household that owns a refrigerator on children's outcomes

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
First stage												
Owns refrigerator (no children)	0.290***	0.268***	0.310***	0.285***	0.264***	0.246***	0.290***	0.267***	0.310***	0.285***	0.265***	0.246***
	(0.019)	(0.030)	(0.022)	(0.034)	(0.022)	(0.035)	(0.019)	(0.030)	(0.022)	(0.034)	(0.022)	(0.035)
Owns air conditioner	0.167***	0.217***	0.159***	0.192**	0.174***	0.256***	0.167***	0.217***	0.160***	0.192**	0.174***	0.256***
	(0.028)	(0.052)	(0.033)	(0.077)	(0.028)	(0.052)	(0.028)	(0.052)	(0.033)	(0.077)	(0.028)	(0.052)
Owns color television	0.092***	0.073***	0.101***	0.080***	0.082***	0.066***	0.092***	0.073***	0.101***	0.080***	0.083***	0.066***
	(0.009)	(0.011)	(0.010)	(0.013)	(0.011)	(0.013)	(0.009)	(0.011)	(0.010)	(0.013)	(0.011)	(0.013)
F−statistic	154.95	58.22	165.63	49.05	83.00	35.51	156.18	58.14	166.03	49.01	84.50	35.49
2SLS												
Own refrigerator	0.153***	0.150***	0.175***	0.161**	0.127**	0.135*	−0.091**	−0.065	−0.075*	−0.014	−0.106**	−0.133
	(0.034)	(0.056)	(0.037)	(0.062)	(0.049)	(0.076)	(0.036)	(0.077)	(0.042)	(0.081)	(0.044)	(0.098)
Age	0.142***	0.169***	0.163***	0.199***	0.112***	0.134***	−0.065***	−0.065***	−0.096***	−0.095***	0.009	0.011
	(0.018)	(0.024)	(0.023)	(0.031)	(0.027)	(0.038)	(0.017)	(0.025)	(0.023)	(0.032)	(0.023)	(0.035)
Age−squared	−0.007***	−0.008***	−0.007***	−0.009***	−0.006***	−0.007***	0.004***	0.004***	0.005***	0.005***	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female	−0.016***	−0.030***					−0.056***	−0.051***				
	(0.005)	(0.008)					(0.005)	(0.007)				
Rural	0.032***	−0.024	0.047***	−0.010	0.008	−0.037	0.055***	0.005	0.051***	0.016	0.059***	−0.009
	(0.009)	(0.018)	(0.012)	(0.023)	(0.011)	(0.031)	(0.009)	(0.024)	(0.010)	(0.032)	(0.010)	(0.030)
Hindu	0.086***	0.079***	0.085***	0.072***	0.090***	0.090***	−0.010	−0.008	−0.021**	−0.020	0.000	0.004
	(0.010)	(0.014)	(0.011)	(0.015)	(0.012)	(0.020)	(0.007)	(0.011)	(0.009)	(0.016)	(0.008)	(0.015)
SC or ST	−0.010	−0.017**	−0.017**	−0.024**	−0.001	−0.007	−0.010*	−0.009	−0.007	−0.009	−0.014*	−0.012
	(0.006)	(0.008)	(0.008)	(0.010)	(0.008)	(0.012)	(0.006)	(0.008)	(0.007)	(0.010)	(0.008)	(0.011)
Wealth index	0.048***	0.038**	0.042***	0.032*	0.055***	0.046*	−0.040***	−0.038**	−0.043***	−0.046**	−0.035***	−0.025
	(0.011)	(0.016)	(0.012)	(0.018)	(0.016)	(0.023)	(0.010)	(0.019)	(0.013)	(0.021)	(0.014)	(0.024)
Father's age	−0.003***	−0.002***	−0.002***	−0.001*	−0.004***	−0.003***	0.001**	0.001	0.001**	0.000	0.001*	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)

(*Continued*)

Table 8 Continued

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Mother's age	0.000	−0.000	0.000	−0.000	0.000	−0.000	0.000	0.001	−0.000	0.001	0.000	−0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Father's years of schooling	0.011***	0.012***	0.010***	0.011***	0.011***	0.012***	−0.004***	−0.005***	−0.005***	−0.006***	−0.002**	−0.004**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mother's years of schooling	0.005***	0.005***	0.005***	0.005***	0.004***	0.004***	−0.003***	−0.004***	−0.004***	−0.006***	−0.001	−0.003*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Distance to nearest town (km)		0.000		0.001		−0.000		−0.001		−0.000		−0.001**
		(0.001)		(0.001)		(0.001)		(0.000)		(0.001)		(0.001)
Distance to road access (km)		0.001		0.002		0.000		0.000		−0.001		0.002
		(0.002)		(0.002)		(0.002)		(0.002)		(0.003)		(0.002)
Phone access		0.006		0.003		0.013		−0.032***		−0.028**		−0.031**
		(0.011)		(0.013)		(0.015)		(0.012)		(0.014)		(0.016)
Distance to railway station (km)		−0.000		−0.000		−0.000		−0.000		0.000		−0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Distance to market (km)		0.001		0.001		0.001		0.001		−0.000		0.001
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to secondary school (km)		−0.000		−0.000		−0.001		0.002**		0.002		0.002*
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Distance to higher secondary school (km)		−0.000		−0.000		−0.000		−0.000		−0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.001)		(0.000)

(*Continued*)

Table 8 Continued

	Enrollment						Employment					
	All		Male		Female		All		Male		Female	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Average refrigerator ownership	0.260	0.168	0.249	0.166	0.274	0.171	0.260	0.168	0.249	0.166	0.274	0.171
Average Y_{ict}	0.819	0.806	0.812	0.806	0.827	0.806	0.152	0.194	0.185	0.226	0.110	0.152
N	30,370	17,121	17,183	9,743	13,183	7,375	30,385	17,126	17,192	9,747	13,189	7,376
R^2	0.234	0.235	0.231	0.234	0.272	0.283	0.162	0.165	0.191	0.196	0.150	0.155

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

Again, the results hold when the sample is partitioned by gender (Columns 9 and 11). Females, however, experience a larger decrease in the probability of employment than males.

It is interesting to note that, while the full child sample presents significant findings on refrigerator ownership, performing the analysis on villages provides suggestive evidence that purchasing an appliance is not sufficient in altering labor force decisions for children (Columns 8, 10, and 12 of Table 8). One reason for this finding may be that refrigerator ownership is less prevalent in rural villages (17% ownership in villages compared to 26% ownership in the full sample). We do find a statistically significant increase in the effect of refrigerator ownership on enrollment for the village sample (Columns 2, 4, and 6 of Table 8). These results hold when partitioning the sample by gender. Males and females from the village sample experience a 16.1 percentage point and 13.5 percentage point increase, respectively, in the probability of being enrolled if they live in a household that owns a refrigerator.

Overall, results using the child sample indicate that refrigerator ownership significantly alters both education and employment decisions for older children. When focusing on village-level data, refrigerators increase the probability of enrollment but do not initiate a significant change in employment decisions for older children. Washing machines do not cause similar, significant changes in enrollment or employment decisions.

5.5 **Detailed analysis of married women's employment status**

The results from the married women sample seem perplexing at first, as most research finds appliance ownership to be liberating, allowing women to reduce household work and enter the labor force.[22] Our initial findings suggest the opposite in the Indian setting. Thus, we further investigate these results by analyzing women's employment in work inside and outside of the household separately. As described in Section 3, we follow definitions provided by the IHDS and construct the variable *work inside the household* by combining information on women's work on the household farm, work to take care of the household's animals, and work in the family's nonfarm business. Similarly, we construct the variable *work outside the household* by combining information on women's work in agricultural labor, nonagricultural labor, and salaried work. We present results with these additional outcome variables in Tables 9 and 10 for washing machine and refrigerator ownership, respectively.[23]

Table 9 presents the effect of washing machine ownership on married women's employment segmented by work inside and outside the household (Columns 1–2 and 3–4, respectively). We find that married women living in households that own a washing machine experience a decrease in the probability of being employed in work inside the household by 6.8 percentage points in the full sample (Column 1). Employment in work inside the household is reduced by 14.7 percentage points in the village sample (column 2). We find that married women's probability of employment in work outside the household increases by 15.4 and 8 percentage points in the full and village samples, respectively (columns 3 and 4).

Table 10 presents similar results of owning a refrigerator on married women's employment by different work types. The results suggest that ownership of a refrigerator decreases the

22 For example, see Coen-Pirani et al. (2010) and Greenwood et al. (2005).

23 Tables A4 and A5 in the Appendix show the results for the effect of washing machine and refrigerator ownership, respectively, on the detailed employment categories for married women.

Table 9 2SLS: effect of living in a household that owns a washing machine on married women's work

	Work inside household		Work outside household	
	(1)	(2)	(3)	(4)
First stage				
Owns washing machine (single women)	0.501***	0.485***	0.501***	0.485***
	(0.0171)	(0.0310)	(0.0171)	(0.0310)
Owns air conditioner	0.437***	0.523***	0.437***	0.523***
	(0.0239)	(0.0450)	(0.0239)	(0.0450)
Owns color television	0.00278	0.0000	0.00278	0.0000
	(0.00409)	(0.00407)	(0.00409)	(0.00407)
F−statistic	638.36	146.45	638.36	146.45
2SLS				
Owns washing machine	−0.068**	−0.147**	0.154***	0.080**
	(0.027)	(0.067)	(0.023)	(0.033)
Age	0.037***	0.050***	0.035***	0.039***
	(0.002)	(0.002)	(0.001)	(0.002)
Age−squared	−0.000***	−0.001***	−0.000***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	−0.008***	−0.010***	−0.003***	−0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Rural	0.286***	0.076***	0.014	−0.014
	(0.014)	(0.024)	(0.010)	(0.019)
Hindu	0.054***	0.088***	0.027***	0.013
	(0.009)	(0.016)	(0.006)	(0.009)
SC or ST	−0.064***	−0.078***	0.113***	0.137***
	(0.008)	(0.010)	(0.008)	(0.009)
Wealth index	−0.062***	−0.029***	−0.140***	−0.140***
	(0.007)	(0.009)	(0.007)	(0.009)
No. of children (household)	0.004**	−0.000	−0.005***	−0.005***
	(0.002)	(0.002)	(0.001)	(0.002)
Village controls				
Distance to nearest town (km)		−0.001		0.000
		(0.000)		(0.000)
Distance to road access (km)		0.003**		0.002
		(0.002)		(0.001)
Phone access		−0.043***		0.016
		(0.013)		(0.010)
Distance to railway station (km)		0.000		0.000
		(0.000)		(0.000)
Distance to market (km)		0.003***		−0.002***
		(0.001)		(0.001)
Distance to secondary school (km)		0.003***		0.000
		(0.001)		(0.001)
Distance to higher secondary school (km)		0.000		−0.000
		(0.000)		(0.000)
N	70,160	38,059	70,160	38,059
R^2	0.288	0.191	0.206	0.249

Notes: Work inside household includes the following employment categories: household farm work, animal care, and work in the family business. Work outside household includes the following employment categories: agricultural labor, nonagricultural labor, and salaried work. All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

Table 10 2SLS: effect of living in a household that owns a refrigerator on married women's work

	Work inside household		Work outside household	
	(1)	(2)	(3)	(4)
First stage				
Owns Refrigerator (single women)	0.376***	0.352***	0.376***	0.352***
	(0.0132)	(0.0204)	(0.0132)	(0.0204)
Owns air conditioner	0.158***	0.223***	0.158***	0.223***
	(0.0190)	(0.0313)	(0.0190)	(0.0313)
Owns color television	0.121***	0.0999***	0.121***	0.0999***
	(0.00848)	(0.0112)	(0.00848)	(0.0112)
F−statistic	495.87	193.8	495.87	193.8
2SLS				
Owns refrigerator	−0.145***	−0.106*	0.082***	0.010
	(0.030)	(0.058)	(0.026)	(0.045)
Age	0.037***	0.050***	0.034***	0.038***
	(0.002)	(0.002)	(0.001)	(0.002)
Age−squared	−0.000***	−0.001***	−0.000***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	−0.006***	−0.009***	−0.002**	−0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Rural	0.285***	0.072***	0.010	−0.016
	(0.014)	(0.026)	(0.011)	(0.020)
Hindu	0.053***	0.089***	0.026***	0.012
	(0.009)	(0.016)	(0.006)	(0.009)
SC or ST	−0.065***	−0.079***	0.113***	0.136***
	(0.008)	(0.010)	(0.008)	(0.009)
Wealth index	−0.025**	−0.012	−0.150***	−0.136***
	(0.010)	(0.016)	(0.010)	(0.014)
No. of children (household)	0.004***	−0.000	−0.005***	−0.005***
	(0.002)	(0.002)	(0.001)	(0.002)
Village controls				
Distance to nearest town (km)		−0.001		0.000
		(0.000)		(0.000)
Distance to road access (km)		0.003*		0.002
		(0.002)		(0.002)
Phone access		−0.046***		0.016
		(0.013)		(0.010)
Distance to railway station (km)		0.000		0.000
		(0.000)		(0.000)
Distance to market (km)		0.003***		−0.002***
		(0.001)		(0.001)
Distance to secondary school (km)		0.003***		0.000
		(0.001)		(0.001)
Distance to higher secondary school (km)		0.000		−0.000
		(0.000)		(0.000)
N	70,160	38,059	70,160	38,059
R^2	0.288	0.191	0.206	0.249

Notes: Work inside household includes the following employment categories: household farm work, animal care, and work in the family business. Work outside household includes the employment categories agricultural labor, nonagricultural labor, and salaried work. All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

probability of married women's participation in work inside the household by 14.5 percentage points in the full sample (Column 1). These results hold when we extend our analysis to the village sample, with married women's probability of being employed in work inside the household being reduced by 10.6 percentage points in the village sample (Column 2). Similar to the washing machine-related findings, refrigerator ownership is found to increase the probability of married women's employment in work outside the household by 8.2 percentage points in the full sample.

The results presented in Tables 9 and 10 are suggestive of appliances being used as a tool to assist women in altering their time commitments between employment in different work types. Appliances allow married women to reallocate their time to jobs that are of more value to them as both appliances are found to significantly alter work force decisions for married women. The results suggest that time-saving appliances allow women more freedom of choice, allowing them to select employment that is less home-based and potentially more lucrative and liberating.

6 Summary and Discussion

Previous literature has stressed the importance of household capital in the form of time-saving technologies in altering women's and children's labor force and education decisions in other countries (Coen-Pirani et al., 2010; Tewari and Wang, 2016; Kerr, 2019). Our paper is the first to discuss the effects of time-saving appliance ownership on adult female and child outcomes in the Indian context.

Using detailed data from the IHDS and observing two time-saving appliances, we study the effect of appliance ownership on married women's employment, older children's employment, and school enrollment. We find that time-saving appliance ownership reduces the probability of married women's overall employment. Ownership of time-saving appliances may increase the relative productivity of married women in household production, and if these appliances are complements to household work, we would expect to observe an increase in household production and decrease in overall employment for married women.[24]

However, when categorizing employment type by economic activity inside and outside the household separately, we find that married women decrease the probability of being employed inside the household and increase the probability of being employed outside the household when living in a household that owns a time-saving appliance. These results suggest that, even with India's Hindu culture, caste system, and reduction in overall female LFP, appliance ownership improves married women's outcomes.

Ownership of a refrigerator increases the probability of older children being enrolled in school and reduces the probability of them being employed. Living in a household that owns time-saving appliances increases a child's school enrollment by providing the child the opportunity to reallocate their time from household labor to schooling. The presence of a time-saving appliance lowers the opportunity cost of staying in school by directly reducing children's time allocated to household work.

24 Given the strong patriarchal nature of the Indian society and the presence of traditional gender roles, it is expected that Indian married women perform most of the household chores in an Indian household. This is supported by the data provided by the OECD at: https://stats.oecd.org/index.aspx?queryid=54757 OECD Statistics on time spent in unpaid work. While our model attempts to control for different preferences, this is not directly testable in our data as we lack time-use information.

Given the current and projected growth in the ownership of such time-saving durable household appliances in the Indian economy, our paper throws light on an important channel that affects both women and children outcomes. This is particularly relevant for researchers and policymakers who are interested in understanding the drivers of Indian married women's declining LFP, a phenomenon that is counterintuitive and the opposite of what is being observed in other developing and developed countries.

Declarations

Availability of data and material

https://ihds.umd.edu/data

Competing interests

The authors declare none.

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Authors' contributions

SB and AK participated in obtaining data, cleaning data, performing analysis, and writing manuscript equally.

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Appendix

Table A1 Summary statistics of the women in the study, by marital status

	Married women aged 15–59 years		**Single women aged 15–59 years**	
Variable	**2005**	**2012**	**2005**	**2012**
Urban	27.76	32.97	31.98	34.04
Age	35.15	36.64	25.16	26.72
Hindu	82.77	82.4	78.43	79.64
Mean number of kids in the household	1.674	2.049	0.796	1.639
	(1.585)	(1.99)	(1.242)	(1.909)
Education:				
Mean years of schooling	3.921	4.988	6.46	7.46
Literate	49.59	59.32	72.69	77.35
Employment:				
Work *inside* the household:				
Animal care	29.59	22.34	17.47	11.91
Farm work	20.93	18.31	9.94	8.92
Family business work	3.05	3.99	2.31	2.72
Work *outside* the household:				
Agricultural labor	14.38	11.96	9.03	8.24
Nonagricultural labor	4.39	7.12	3.44	5.06
Salaried position	3.47	4.69	5.36	6.85
Employment rate	51.73	48.25	35.64	33.63
Rural	63.71	60.48	43.3	39.09
Urban	20.57	23.37	19.34	23.07
Mean wealth index	1.537	1.760	1.607	1.757
	(0.687)	(0.693)	(0.679)	(0.674)
N	45,538	42,715	18,727	20,937

Note: Summary statistics for Indian women using IHDS data.

IHDS, India Human Development Survey.

Table A2 Summary statistics of the women in the study, by ownership of refrigerator

	Owns refrigerator		**Does not own refrigerator**	
Variable	**2005**	**2012**	**2005**	**2012**
Urban	68.62	64.3	20.95	22.07
Mean number of kids in household	1.358	1.634	1.727	2.194
	(1.42)	(1.70)	(1.60)	(2.06)
Mean years of education	8.68	8.48	3.12	3.77
Literate	85.89	85.48	43.5	50.22
Employment:				
Work *inside* the household:				
Animal care	12.13	11.88	32.53	25.98
Farm work	6.11	8.35	23.42	21.78
Family business work	3.48	4.96	2.98	3.66
Work *outside* the household:				
Agricultural labor	0.39	1.11	16.68	15.73
Nonagricultural labor	0.34	1.94	5.06	8.92
Salaried position	6.68	7.38	2.94	3.76
Mean wealth index	2.519	2.459	1.376	1.517
	(0.37)	(0.33)	(0.59)	(0.62)
Owns washing machine	24.94	30.87	0.2	0.62
Owns color television	88.13	96.55	15.46	49.11
Owns air conditioner	4.05	7.07	0.03	0.13
N	8,440	13,119	36,008	29,562

Note: Summary statistics for Indian women using IHDS data.

IHDS, India Human Development Survey.

Table A3 2SLS: effect of living in a household that owns an *appliance* on married women's employment by education

	Washing machine				Refrigerator			
	Below primary education		Primary & above		Below primary education		Primary & above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First stage								
Owns washing machine (single women)	0.394***	0.303***	0.472***	0.520***				
	(0.026)	(0.037)	(0.019)	(0.041)				
Owns refrigerator (single women)					0.336***	0.309***	0.350***	0.354***
					(0.018)	(0.025)	(0.015)	(0.026)
Owns air conditioner	0.509***	0.443***	0.385***	0.501***	0.318***	0.276***	0.0915***	0.148***
	(0.049)	(0.099)	(0.024)	(0.040)	(0.039)	(0.058)	(0.017)	(0.035)
Owns color television	0.0102***	0.00598*	−0.000673	−0.00571	0.100***	0.0808***	0.144***	0.121***
	(0.003)	(0.003)	(0.006)	(0.006)	(0.009)	(0.011)	(0.011)	(0.014)
F−statistic	141.1	32.11	372.77	133.3	209.87	72.14	295.98	105.74
2SLS								
Owns washing machine	−0.082	0.004	0.005	−0.100				
	(0.062)	(0.120)	(0.036)	(0.069)				
Owns refrigerator					−0.184***	−0.090	−0.131***	−0.117*
					(0.054)	(0.083)	(0.031)	(0.064)
Age	0.058***	0.065***	0.048***	0.061***	0.057***	0.064***	0.047***	0.061***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
Age−squared	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	−0.007***	−0.007**	0.003**	−0.008***	−0.006**	−0.006*	0.006***	−0.007***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)	(0.001)	(0.002)
Rural	0.274***	0.053	0.221***	0.020	0.273***	0.046	0.219***	0.016
	(0.016)	(0.033)	(0.016)	(0.028)	(0.016)	(0.033)	(0.016)	(0.030)
Hindu	0.075***	0.075***	0.037***	0.065***	0.072***	0.073***	0.034***	0.067***
	(0.011)	(0.016)	(0.010)	(0.020)	(0.012)	(0.016)	(0.010)	(0.020)
SC or ST	0.012	0.010	0.010	0.015	0.011	0.009	0.005	0.011
	(0.008)	(0.009)	(0.009)	(0.013)	(0.009)	(0.009)	(0.009)	(0.014)
Wealth index	−0.114***	−0.077***	−0.153***	−0.128***	−0.077***	−0.059***	−0.104***	−0.100***
	(0.009)	(0.010)	(0.008)	(0.013)	(0.013)	(0.017)	(0.013)	(0.022)
No. of children (household)	0.000	−0.005**	0.003	−0.002	0.001	−0.005*	0.004*	−0.001
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)

(*Continued*)

Table A3 Continued

	Washing machine				Refrigerator			
	Below primary education		Primary & above		Below primary education		Primary & above	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Village controls								
Distance to nearest town (km)		−0.001		0.000		−0.001*		0.000
		(0.000)		(0.000)		(0.000)		(0.000)
District to road access (km)		0.003*		0.003*		0.003*		0.003
		(0.002)		(0.002)		(0.002)		(0.002)
Phone access		−0.001		−0.035***		−0.003		−0.039***
		(0.012)		(0.013)		(0.012)		(0.013)
Distance to railway station (km)		0.000		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)
Distance to market (km)		0.001		0.002**		0.001		0.002*
		(0.001)		(0.001)		(0.001)		(0.001)
Distance to secondary school (km)		0.001*		0.003***		0.001		0.003***
		(0.001)		(0.001)		(0.001)		(0.001)
Distance to higher secondary school (km)		0.000		0.000		0.000		0.001
		(0.000)		(0.000)		(0.000)		(0.000)
Average *appliance* ownership	0.027	0.0167	0.151	0.08	0.1313	0.099	0.425	0.305
Average employment	0.618	0.722	0.344	0.498	0.6187	0.723	0.344	0.498
N	31285	20575	38875	17484	31309	20581	38912	17490
R^2	0.271	0.174	0.249	0.222	0.261	0.171	0.240	0.220

Notes: Columns 1–4 show the results for ownership of washing machine for women with lower−than−primary level of education (Columns 1 and 2) and for women with education level of primary and above (Columns 3 and 4). Similarly, Columns 5–8 show the results for refrigerator ownership for women with varying levels of education. All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

Table A4 2SLS: effect of living in a household that owns a washing machine on married women's employment by job type

	Animal care		Farm work		Agricultural labor		Nonagricultural labor		Salaried post		Family business	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
First stage												
Owns washing machine (single women)	0.501***	0.485***	0.501***	0.485***	0.501***	0.485***	0.501***	0.485***	0.501***	0.485***	0.502***	0.486***
	(0.0171)	(0.0310)	(0.0171)	(0.0310)	(0.0171)	(0.0310)	(0.0171)	(0.0310)	(0.0171)	(0.0311)	(0.0174)	(0.0309)
Owns air conditioner	0.437***	0.523***	0.437***	0.523***	0.437***	0.523***	0.437***	0.523***	0.437***	0.523***	0.437***	0.523***
	(0.0239)	(0.0450)	(0.0239)	(0.0450)	(0.0239)	(0.0450)	(0.0239)	(0.0450)	(0.0239)	(0.0449)	(0.0240)	(0.0449)
Owns color television	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000
	(0.00409)	(0.00407)	(0.00409)	(0.00407)	(0.00409)	(0.00407)	(0.00409)	(0.00407)	(0.00409)	(0.00407)	(0.00409)	(0.00404)
F−statistic	638.49	146.37	638.36	146.45	638.37	146.45	638.37	146.55	637.65	145.43	638	147.85
2SLS												
Owns washing machine	−0.068**	−0.136**	−0.002	−0.073	0.141***	0.098***	−0.016	−0.049***	0.032**	0.017	−0.023***	−0.016
	(0.027)	(0.069)	(0.018)	(0.051)	(0.015)	(0.022)	(0.011)	(0.018)	(0.015)	(0.020)	(0.008)	(0.013)
Age	0.030***	0.043***	0.019***	0.028***	0.017***	0.023***	0.009***	0.010***	0.011***	0.009***	0.007***	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age−squared	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	−0.007***	−0.008***	−0.005***	−0.006***	−0.007***	−0.012***	−0.003***	−0.003***	0.007***	0.007***	0.000	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Rural	0.206***	0.040*	0.211***	0.045**	0.052***	−0.009	−0.001	0.025*	−0.032***	−0.025	−0.008**	0.015*
	(0.013)	(0.022)	(0.016)	(0.021)	(0.010)	(0.011)	(0.006)	(0.015)	(0.004)	(0.019)	(0.004)	(0.008)
Hindu	0.026***	0.046***	0.074***	0.111***	0.031***	0.029***	−0.005	−0.014**	0.003	−0.002	−0.004	−0.005
	(0.007)	(0.013)	(0.008)	(0.012)	(0.005)	(0.007)	(0.004)	(0.006)	(0.003)	(0.004)	(0.003)	(0.005)
SC or ST	−0.039***	−0.050***	−0.051***	−0.069***	0.077***	0.103***	0.022***	0.029***	0.024***	0.017***	−0.009***	−0.007**
	(0.007)	(0.009)	(0.008)	(0.010)	(0.007)	(0.008)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
Wealth index	−0.053***	−0.034***	−0.050***	−0.025***	−0.106***	−0.120***	−0.027***	−0.022***	−0.015***	−0.007***	0.009***	0.011***
	(0.005)	(0.008)	(0.007)	(0.009)	(0.007)	(0.008)	(0.004)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)
No. of children (household)	0.001	−0.003	0.003**	0.001	−0.005***	−0.005***	0.001	0.001	−0.001**	−0.001*	−0.001	−0.001**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)

(*Continued*)

Table A4 Continued

	Animal care		Farm work		Agricultural labor		Nonagricultural labor		Salaried post		Family business	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Village controls												
Distance to nearest town (km)		−0.001		−0.000		−0.000		0.000		0.000**		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Distance to road access (km)		0.000		0.005***		0.003**		0.000		0.000		0.000
		(0.002)		(0.002)		(0.001)		(0.002)		(0.001)		(0.001)
Phone access		−0.025*		−0.062***		0.007		0.013*		0.003		−0.002
		(0.013)		(0.014)		(0.009)		(0.007)		(0.003)		(0.003)
Distance to railway station (km)		−0.000		0.000		0.000		0.000		0.000		0.000
		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
Distance to market (km)		0.003***		0.003***		−0.001*		−0.000		−0.000**		−0.001**
		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)		(0.000)
Distance to secondary school (km)		0.001		0.004***		0.000		0.000		−0.000*		0.001
		(0.001)		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)
Distance to higher secondary school (km)		0.000		0.000		−0.000		0.000		0.000*		0.000
		(0.001)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)
N	70,146	38,048	70,160	38,059	70,156	38,056	70,155	38,054	70,154	38,058	70,048	38,015
R^2	0.256	0.193	0.276	0.223	0.277	0.279	0.101	0.119	0.061	0.050	0.024	0.031

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.

Table A5 2SLS: effect of living in a household that owns a refrigerator on married women's employment by job type

	Animal care		Farm work		Agricultural labor		Nonagricultural labor		Salaried post		Family business	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
First stage												
Owns refrigerator (single women)	0.376***	0.352***	0.376***	0.352***	0.376***	0.352***	0.376***	0.352***	0.376***	0.352***	0.376***	0.352***
	(0.0132)	(0.0204)	(0.0132)	(0.0204)	(0.0132)	(0.0204)	(0.0132)	(0.0204)	(0.0132)	(0.0204)	(0.0132)	(0.0204)
Owns air conditioner	0.158***	0.223***	0.158***	0.223***	0.158***	0.223***	0.158***	0.223***	0.158***	0.223***	0.158***	0.224***
	(0.0190)	(0.0313)	(0.0190)	(0.0313)	(0.0190)	(0.0313)	(0.0190)	(0.0313)	(0.0190)	(0.0313)	(0.0189)	(0.0314)
Owns color television	0.121***	0.0999***	0.121***	0.0999***	0.121***	0.0999***	0.121***	0.0999***	0.121***	0.0999***	0.121***	0.100***
	(0.00848)	(0.0112)	(0.00848)	(0.0112)	(0.00848)	(0.0112)	(0.00848)	(0.0112)	(0.00848)	(0.0112)	(0.00848)	(0.0112)
F−statistic	497.52	193.73	495.87	193.8	495.88	193.82	495.68	193.6	495.54	193.74	495.69	193.82
2SLS												
Owns refrigerator	−0.106***	−0.076	−0.105***	−0.139**	0.100***	0.021	−0.008	−0.012	−0.008	−0.010	−0.021**	−0.007
	(0.028)	(0.054)	(0.029)	(0.057)	(0.019)	(0.035)	(0.016)	(0.030)	(0.013)	(0.014)	(0.009)	(0.013)
Age	0.030***	0.044***	0.019***	0.028***	0.017***	0.023***	0.009***	0.010***	0.011***	0.009***	0.007***	0.006***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Age−squared	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of schooling	−0.006***	−0.008***	−0.003***	−0.005***	−0.007***	−0.011***	−0.003***	−0.004***	0.008***	0.007***	0.000	0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Rural	0.206***	0.039*	0.209***	0.036	0.050***	−0.012	−0.001	0.026*	−0.034***	−0.026	−0.008**	0.015*
	(0.013)	(0.023)	(0.016)	(0.023)	(0.010)	(0.012)	(0.006)	(0.015)	(0.004)	(0.019)	(0.004)	(0.008)
Hindu	0.025***	0.047***	0.072***	0.110***	0.030***	0.028***	−0.005	−0.013**	0.003	−0.002	−0.004	−0.005
	(0.007)	(0.013)	(0.008)	(0.013)	(0.005)	(0.007)	(0.004)	(0.006)	(0.003)	(0.004)	(0.003)	(0.006)
SC or ST	−0.040***	−0.050***	−0.053***	−0.072***	0.077***	0.102***	0.022***	0.029***	0.023***	0.017***	−0.009***	−0.007**
	(0.007)	(0.009)	(0.008)	(0.010)	(0.007)	(0.008)	(0.004)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)
Wealth index	−0.027***	−0.023	−0.019*	0.006	−0.122***	−0.118***	−0.027***	−0.023**	−0.009**	−0.003	0.013***	0.012***
	(0.009)	(0.015)	(0.010)	(0.016)	(0.009)	(0.011)	(0.006)	(0.009)	(0.004)	(0.004)	(0.003)	(0.004)
No. of children (household)	0.002	−0.003	0.003**	0.001	−0.005***	−0.005***	0.001	0.001	−0.001**	−0.001*	−0.001	−0.001**
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)

(*Continued*)

Table A5 Continued

	Animal care		Farm work		Agricultural labor		Nonagricultural labor		Salaried post		Family business	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Village controls												
Distance to nearest town (km)	−0.001		−0.000		−0.000		0.000		0.000**		0.000	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Distance to road access (km)	0.000		0.005***		0.003**		0.000		0.000		0.000	
	(0.002)		(0.002)		(0.001)		(0.002)		(0.001)		(0.001)	
Phone access	−0.027**		−0.065***		0.007		0.013*		0.003		−0.003	
	(0.013)		(0.014)		(0.009)		(0.007)		(0.003)		(0.003)	
Distance to railway station (km)	−0.000		0.000		0.000		0.000		0.000		0.000	
	(0.000)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
Distance to market (km)	0.003***		0.003***		−0.001**		−0.000		−0.000**		−0.001**	
	(0.001)		(0.001)		(0.001)		(0.000)		(0.000)		(0.000)	
Distance to secondary school (km)	0.001		0.004***		0.000		0.000		−0.000*		0.001	
	(0.001)		(0.001)		(0.001)		(0.001)		(0.000)		(0.000)	
Distance to higher secondary school (km)	0.000		0.000		−0.000*		0.000		0.000*		0.000	
	(0.001)		(0.000)		(0.000)		(0.000)		(0.000)		(0.000)	
N	70,207	38,060	70,221	38,071	70,217	38,068	70,216	38,066	70,215	38,070	70,109	38,027
R^2	0.249	0.193	0.269	0.217	0.275	0.279	0.101	0.120	0.059	0.049	0.022	0.030

Notes: All columns include district and year fixed effects. Standard errors are presented in parentheses.

*Denotes significance at 10%.

**Denotes significance at 5%.

***Denotes significance at 1%. Standard errors are clustered at the district level.

2SLS, two−stage least squares; SC/ST, scheduled caste/ scheduled tribe.