# The Impact of Increasing Female Labour Force Participation on Female Empowerment in Household Decision-Making: Evidence from the MGNREGA in India.

**Abstract**

This dissertation examines the impact of increasing female labour force participation on household expenditure through the MGNREGA, a rural employment guarantee scheme in India. I construct a Difference-in-Difference model to disentangle male and female preferences. I find that men and women share the same preferences in reducing spending on staple foods, but women have a stronger preference towards increasing nutritious food intake. I find changes in educational and demerit spending are statistically insignificant across gender. I assess the extent to which female education affects bargaining and propose that women with high education have stronger preferences towards nutritional and educational spending.

# 1 Introduction

"There is no tool for development more effective than the empowerment of women" were the words of Kofi Annan, former Secretary General of the UN as he coined gender equality a prerequisite to achieving UN development goals. There is a two-way causality between gender equality and poverty reduction and vast literature has tested whether income in the hands of women has a different impact on household consumption than income in the hands of men (Duflo, 2012).

Empowerment of women depends on a range of interconnected factors such as female income shares, inherited human and physical asset shares and female property ownership. From a policy perspective, improving female labour force participation to raise income shares is the most viable strategy to improve female bargaining over consumption.

The difficulty in analysing the impact of female labour force participation on consumption expenditure is twofold. Firstly, labour force participation is endogenous to consumption itself (Doss, 2006) leading to reverse causality. Secondly, it is difficult to disentangle *income effects* from *bargaining power effects*. The *income effect* is the change in consumption as the budget constraint is relaxed which is equal for men and women. As women gain empowerment from working, they exert an additional *bargaining power effect* by changing consumption according to their preferences. It is the latter effect we are interested in measuring.

Hence, I utilise the characteristics of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA, hereafter referred to as NREGA) in rural India to develop a unique empirical strategy to investigate how the *bargaining power effect* affects the allocation of goods in a household.

I overcome the endogeneity of labour force participation by comparing households who applied to the NREGA and were accepted to work with those who applied the NREGA but were rejected due to a lack of supply (Ravi & Engler, 2015). Since NREGA access is legally fair to all applicants, I assume its job rationing is exogenous to household characteristics. As wages, hours and days of work are identical for males and females under the NREGA, it provides for an equal comparison of labour force participation by gender. Thus, I am able to disentangle male preferences (*income effect*) and female preferences (*income effect* and *bargaining power effect*) by investigating how consumption patterns change depending the NREGA recipient.

I find a significant and negative *income effect* on staple foods (cereals, sugar and pulses) with no differences in preference across gender. A positive and significant *bargaining power effect* is observed for expensive food items as women spend ₹20, ₹41 and ₹20 more than men monthly on cereal products, eggs & meat and fruit & vegetables respectively. This corroborates existing findings of strong female preferences towards dietary diversity and expensive calorie items which

could be fuelled by women's preferences towards child nutrition (Thomas, 1990). Liu & Deininger (2010) find a 3-5% rise in calorie and 4-7% rise protein intake from NREGA work which I propose originates from a substitution from staple goods to highly nutritious food items, the effect being greatest in households where women have undertaken NREGA work. I find no significant changes in educational spending for men or women in the full sample. This can be explained since 80% of educational spending consists of school fees and NREGA income alone is not sufficient to change households decision about school enrollment from public to private schools (Ganita & Abdoul, 2014).

When exploring heterogeneities in preferences by female education, I find female bargaining power towards nutrition and education is only significant for highly educated women. Further, due to positive assortative mating by education, male preferences in the high educated female sample also exhibit a significant positive *income effect* on nutritious foods, emphasising the significance of education on the awareness of dietary diversity (Pangaribowo, 2019).

## 2 Literature Review

This paper builds on two strands of literature. Firstly, a variety of proxies for female bargaining power have been tested to understand if preferences differ across gender. Factors include female income share (Hoddinott & Haddad, 1995), unearned income (Thomas, 1990), inherited human and physical asset shares (Quisumbing & Mallucio, 2003; Pangaribowo, 2019) and female property ownership (Doss, 2006). These papers reject the unitary household allocation model (Becker, 1973, 1974, 1981) and propose collective models such as those by Chiappori (1988, 1992), Ulph (1988) and Duflo & Udry (2004). In the Indian context, Kumar & Sangwan (2021) study the impact of female labour force participation in the private labour market on household nutrition and find a 0.0023% rise in dietary diversity from a marginal increase in workdays.

Although Hoddinott & Haddad (1995) use female labour participation as a proxy for bargaining power, these conclusions might not apply to the rural India context. Hoddinott & Haddad's sample in Côte d'Ivoire consists of richer households with higher levels of discretionary spending in entertainment and meals consumed out of the home hence external validity is unlikely to apply to rural India. Although Kumar & Sangwan (2021) focus on rural India, they analyse the marginal effect of additional days worked by females rather than the marginal effect of wages. However, wages, hours and nature of work vary across individuals in the private labour market. This makes the NREGA a unique program to analyse since employment characteristics are idential for all recipients.

Secondly, research on the NREGA program spans several themes such as its impact on equilibrium wages (Zimmermann, 2012; Imbert & Papp, 2015), children's educational outcomes (Afridi et al., 2016), sizes of outstanding debt (Patwardhana & Tasciotti, 2023), infant malnutrition (Nair, 2013)

and food consumption (Jha et al., 2011; Liu & Deininger, 2010; Ravi & Engler, 2015; Ganita & Abdoul, 2014). The NREGA papers closest to my study are Liu & Deininger (2010) and Ravi & Engler (2015) which find that NREGA wages lead to a 9-11% rise in annual consumption, a significantly positive rise in calorie and protein intake as well as 3.2 fewer meals foregone by households in a week.

Despite the vast research on female bargaining power and the NREGA, I add to the existing literature in two ways.

Firstly, I use the IHDS dataset to investigate which food items cause the rise in calorie and protein intake from the NREGA. Liu & Deininger (2010) and Ravi & Engler (2015) do not explore whether it is a rise in purchase of staple foods and necessities which improves nutrition or if there exists a substitution towards nutrient rich foods. Specifically, I explore the heterogeneity across gender, which has not yet been studied with sufficient robust evidence.

Secondly, I use unique characteristics of the NREGA to develop an estimation strategy with exogenous labour participation decisions, leading to unbiased estimates of female bargaining power. Thomas (1990) emphasises the issue of endogeneity of labour force participation when studying consumption effects. This is because labour force participation is determined by previous consumption, causing a reverse causality problem. Further, female labour force decisions are themselves determined by past female bargaining power (Doss, 2006). Hence, existing research focusses on asset shares as a proxy for bargaining power which are exogenous to consumption decisions.

# 3 Program Background

The NREGA provides the legal right to employment in unskilled manual labour, beginning with a phased rollout in 2006 and eventually spanning all districts in India by 2008. It guarantees at least 100 days of work in a financial year to one member of every household in rural areas at the state level statutory minimum wage. Since all households in rural areas are eligible to apply for the NREGA irrespective of their employment status and income, there is self-selection into the program. During the survey period of IHDSII, the national average daily wage was ₹117 (Government Of Meghalaya, 2013).

The process of being allocated work under the NREGA takes up to one month and stages of the application are shown in Figure 1 (Kumar & Joshi, 2013). First, rural households who would like to be eligible to submit NREGA applications must apply for a job card to the Gram Panchayat (village council). Job card holders can then apply to the NREGA through the Gram Panchayat by specifying how many days (0-100 days) they would like to work under the program in the next year. The Gram Panchayat prepares an annual 'Shelf of Work' available in the village including jobs such

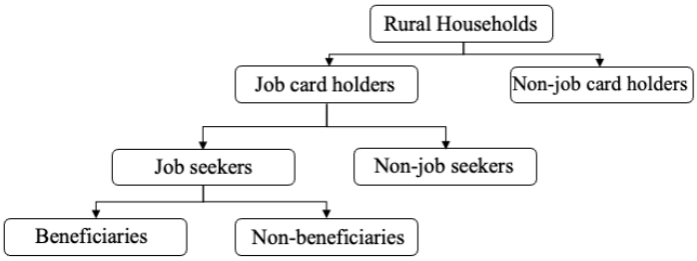



Figure 1: Self selection into the NREGA.

as creating rural assets or water and soil conservation. Work is then allocated to job seekers.

If the Gram Panchayat is unable to offer work to job seekers for the number of days requested within 15 days, the program officer attempts to fulfill requests by reallocating the fixed state NREGA budget towards the village (Dey & Drèze, 2007) to create work. If there remains a lack of supply of work, the state government must provide an unemployment insurance to non-beneficiaries which is 25% of the NREGA daily wage rate for the first 30 days of employment requested and 50% of the wage rate for the remaining requested days (Government Of India, 2014). The Gram Panchayat is responsible for facilitating equal access to work based on demand without prioritising households of certain characteristics (Government Of India, 2014). The shortage of NREGA work supply especially in the early years of rollout mean there is heterogeneity across job seekers: beneficiaries gain employment and non-beneficiaries are entitled to a lower, unemployment insurance.

The NREGA aims to increase job security and reduce the cyclicality of wages by providing a casual employment opportunity which farmers can undertake in agriculturally lean seasons[1] or after extreme weather events. Reducing farmers vulnerability to unpredictable shocks and allowing consumption smoothing over the year are the key objectives of the program.

# 4 Theoretical Background

The traditional unitary model of allocation (Becker, 1973, 1974, 1981) concludes either all members of households have the same preferences over the allocation of goods or that a dictator is responsible for maximising household utility. This has been rejected by several empirical studies, concluding that male and female preferences differ and there is bargaining between agents over the household allocation of resources.

[1]This varies across state but is generally between the three cropping seasons: Kharif, Rabi and Zaid

Chiappori (1988, 1992) develops an alternative Pareto-efficient collective model which I generalise in this paper by assuming a Cobb-Douglas (CD) consumption function over $N$ private goods with varying male and female altruism levels. I use Chiappori's collective model than those by Ulph (1988) or Duflo & Udry (2004) since the latter assume that male and female incomes are not pooled within a household. Although this may be the case in Côte d'Ivoire where these theories are based, in the Indian cultural context, there is strong literature to suggest there is income pooling within and across households within a community to insure against risk (Fafchamps & Shrinivas, 2022).

Assume two agents in a household: $M$ (husband) and $F$ (wife). Both have different preferences for $N$ private goods, $x_i$, $i \in \{1, N\}$, where preferences follow the CD utility function:

$$U_{M_1}(x) \quad \text{such that} \quad U_{M_1} = x_1^{\alpha_1} x_2^{\alpha_2} \dots x_N^{\alpha_N} \text{ and } \sum_{i=1}^{N} \alpha_i = 1$$

$$U_{F_1}(x) \quad \text{such that} \quad U_{F_1} = x_1^{\beta_1} x_2^{\beta_2} \dots x_N^{\beta_N} \text{ and } \sum_{i=1}^{N} \beta_i = 1$$

Hence, if $\alpha_i \neq \beta_i$ then agents have different preferences over good $i$.

Assume both agents are altruistic and care about the private consumption of each other: $M$ cares about $F$'s private utility with weighting $m$ ($m \geq 0$) and $F$ cares about $M$'s private utility with weighting $f$ ($f \geq 0$). Hence, male and female utility functions are:

$$U_M = U_{M_1} + m\, U_{F_1} \quad \text{and} \quad U_F = U_{F_1} + f\, U_{M_1}$$

Assume the household utility function is a weighted average of male and female utility functions depending on female bargaining power $\rho$ ($\rho > 0$), which is the decision-making power $F$ has over household allocation. Household utility is characterized as:

$$U_H = U_M + \rho U_F \quad \text{which is equivalent to} \quad U_H = (1 + \rho f) U_{M_1} + (\rho + m) U_{F_1}$$

That is, the household utility is a weighted average of the male and female preferences over private goods, weighted by each agent's level of altruism and female bargaining power. Assume household income ($Y$) is pooled hence $Y = Y_M + Y_F$.

The household optimization problem is:

$$
\begin{aligned}
\max_{x_i \geq 0} \quad & (1+\rho f)\left(\alpha_1 \ln(x_1) + \cdots + \alpha_N \ln(x_N)\right) \\
& + (\rho + m)\left(\beta_1 \ln(x_1) + \cdots + \beta_N \ln(x_N)\right) \\
\text{subject to} \quad & \sum_{i=1}^{N} p_i x_i = Y_M + Y_F, \\
& \sum_{i=1}^{N} \alpha_i = 1, \\
& \sum_{i=1}^{N} \beta_i = 1.
\end{aligned}
$$

This yields the following demand function for each good:

$$
x_i^* = \frac{Y}{p_i}\left(\frac{(1+\rho f)\alpha_i + (\rho + m)\beta_i}{1 + \rho f + \rho + m}\right)
$$

To analyze how the demand of $x_i$ responds to a rise in female bargaining power ($\rho$):

$$
\frac{\partial x_i^*}{\partial \rho} = \frac{\frac{Y}{p_i}\left(mf\,\alpha_i - \alpha_i - mf\,\beta_i + \beta_i\right)}{(1 + \rho f + \rho + m)^2}
$$

This means

$$
\frac{dx_i^*}{d\rho} > 0 \quad \text{if} \quad \alpha_i(mf-1) > \beta_i(mf-1)
$$

Assuming each agent cares about their own utility more than the utility of their partner, it implies that $m$, $f < 1$. This means $(mf-1) < 0$, hence $\frac{dx_i^*}{d\rho} > 0$ if $\beta_i > \alpha_i$. This implies, given a rise in $\rho$, the consumption of $x_i$ will rise if females have intrinsic preferences to spend a higher budget share towards it. Female bargaining power is a function of $M$ factors, increasing in factors such as income and asset shares:

$$
\rho = f(\theta_1 \cdots \theta_M)
$$

I will assess how household consumption changes if females undertake NREGA work, raising income share and $\rho$. I define the *income effect* from NREGA income as $\frac{\partial x_i^*}{\partial Y}$, **the change in consumption given a change in income, holding bargaining power constant**. I define *bargaining power*

*effect* if women undertake NREGA work as $\frac{\partial x_i^*}{\partial \rho}$, **the change in consumption given a change in bargaining power, holding income constant.**

# 5 Dataset

I utilise the India Human Development Survey (IHDS) (Desai et al., 2018*a*, 2018*b*), an individual-level panel survey consisting of two rounds, IHDSI and IHDSII. The datasets include questionnaires at the individual, household, eligible woman and village level, conducted in face-to-face interviews. The IHDS has an 83% reinterview rate and surveys 26,734 and 27,579 households in IHDSI and IHDSII respectively. The initial sample is drawn using stratified random sampling containing 13,900 households previously interviewed in the Human Development Profile of India survey. For daily food consumption, expenditures are recorded for the past 30 days. I control for seasonality in my analysis since households may purchase different items by season. Non-food expenditures are recorded at an annual level since these are more infrequent purchases.

I use the IHDS due to its high level of granularity. Within food consumption, the dataset asks households for detailed breakdowns of expenditure within each macronutrient. For example, I can analyse changing consumption patterns within proteins since there is data on consumption of pulses, meat and eggs. No other individual-level dataset in rural India within the desired time-frame contains this level of granularity. The timing of each survey allows me to analyse pre-treatment and post-treatment periods since IHDSI was recorded in 2004-2005, before the program's implementation and IHDSII was recorded in 2011-2012 after all districts had access to the NREGA for at least two years. This dataset has detailed NREGA questions which is essential in developing control and treatment groups. Due to the breadth of the themes covered in the IHDS, I can control for several household characteristics. Further, the eligible woman questionnaire means I can control for factors entering the female bargaining power function ($\rho$).

However, the household head is responsible for answering expenditure related questions in the survey. In my dataset, 92% of households report the husband as the head. This could lead to measurement error in food expenditure since it is more likely that women, who are responsible for preparing food, are more knowledgeable about monthly food expenditure. Consumption data could also be subject to recall bias (Gaddis et al., 2021) which is the cognitive burden of recalling past events. There may be an under-reporting of demerit goods since respondents could be untruthful. Table 1 reports summary statistics of key variables in my final dataset which I explain further in Section 6.

| Household Control Variables | N | Mean | Median | SD | Min | Max |
|---|---|---|---|---|---|---|
| Hindu | 7528 | 0.86 | 1 | 0.35 | 0 | 1 |
| Muslim | 7528 | 0.08 | 0 | 0.27 | 0 | 1 |
| Other religion | 7528 | 0.06 | 0 | 0.24 | 0 | 1 |
| Assets | 7528 | 9.19 | 9 | 4.61 | 0 | 26 |
| Total annual non NREGA Income (₹) | 7528 | 63513.32 | 43713 | 76251.03 | -93517 | 1900000 |
| No. Children | 7528 | 1.76 | 2 | 1.59 | 0 | 12 |
| No. Adults | 7528 | 3.32 | 3 | 1.73 | 0 | 14 |
| No. Teens | 7528 | 0.71 | 0 | 0.91 | 0 | 5 |
| Average years of schooling | 7528 | 4.15 | 4 | 2.58 | 0 | 15 |
| Female | 7528 | 0.44 | 0 | 0.5 | 0 | 1 |
| Ration card | 7528 | 0.88 | 1 | 0.32 | 0 | 1 |
| Female Bargaining Power Variables | | | | | | |
| Average years of schooling for females | 7528 | 2.81 | 2.5 | 2.85 | 0 | 15 |
| Social capital | 7528 | 0.16 | 0 | 0.31 | 0 | 1 |
| Hours of female media consumption per day | 7528 | 1.51 | 1 | 1.71 | 0 | 22 |
| Is female head of the household? | 7528 | 0.08 | 0 | 0.27 | 0 | 1 |
| Expenditure (₹) | | | | | | |
| Total Food Spending | 7528 | 35522 | 31487 | 20079 | 0 | 303190 |
| Alcohol and Tobacco Spending | 7528 | 155 | 94 | 264 | 0 | 12000 |
| Total Education Spending | 7528 | 2706 | 523 | 8578 | 0 | 215600 |
| NREGA specific variables | | | | | | |
| HH surveyed after policy introduction | 7528 | 0.5 | 0.5 | 0.5 | 0 | 1 |
| HH who undertake NREGA work | 7528 | 0.38 | 0 | 0.49 | 0 | 1 |
| HH surveyed after policy introduction who undertake NREGA | 7528 | 0.19 | 0 | 0.39 | 0 | 1 |
| HH surveyed after policy introduction where females undertake NREGA | 7528 | 0.1 | 0 | 0.3 | 0 | 1 |

Table 1: Summary Statistics of the final dataset. HH refers to Household. There are 1427 households in the treatment group and 2337 households in the control group.

# 6 Methodology

I use a Difference-in-Difference (DID) framework (Snow, 1849) to estimate the average treatment effect (ATE) of NREGA participation on expenditure. I analyse the consumption patterns of 8 categories: cereal, sugar, pulses, cereal products, eggs & meat, fruit & vegetables, alcohol & tobacco and children's education.

Since wages, hours and days of work are identical across gender under the NREGA, it provides for an equal comparison when comparing consumption patterns depending on who undertakes work. However, in the private labour market, male wages exceed female wages (Zimmermann, 2012) and there are heterogeneities in hours and conditions across gender making a comparison of male and female labour force participation unequal here (Kumar & Sangwan, 2021).

When choosing the control and treatment groups, there are two interrelated issues with classifying the control group as households who did not undertake NREGA work the treatment group as households who undertook NREGA work (beneficiaries).

Firstly, there is an issue of reverse causality. Although being in the treatment group is likely to increase consumption through higher incomes, low consumption of normal goods can incentivise households to undertake NREGA work and enter the treatment group to boost household income (Afridi et al., 2016). This endogeneity of labour force participation will lead to a negative bias on the consumption of normal goods.

Secondly, there is self-selection into the program since everyone in rural areas is eligible to apply. This means the DID analysis will measure the effect of the treatment on the treated (ATT) group rather than measuring the ATE. This is because the control group includes (i) non job card holders (ii) non-job seekers and (iii) non-beneficiaries (see Figure 1). Job card holders have lower average incomes to non-job card holders and often only demand NREGA work when they face a shock to their primary source of income (Liu & Deininger, 2010). The heterogeneity of characteristics within the control group means the parallel trends assumption is less likely to apply with this choice of treatment and control groups.

To overcome the two issues, I use an alternative identification strategy based on Ravi & Engler (2015)'s paper. I define the treatment and control groups as follows:

**Treatment group**: job card holders who applied for 100 days of work under the NREGA and were successful in their application hence worked between 90-100 days.

**Control group**: job card holders who applied for 100 days of work under the NREGA but received fewer than 25 days of work due to a shortage of supply in the village.

This specification means there is no longer self-selection or reverse causality into the treatment

group. All households have applied for the scheme but due to a shortage of work, only the treatment group has been successful in obtaining work (Kumar & Joshi, 2013). As evaluated in section 9, I argue this choice of treatment and control groups can also be seen as a Randomised Control Trial (RCT) style analysis if there are no oberserved differences between treatment and control groups pre-treatment.

Equation (1) shows the DID regression I estimate:

$$\begin{aligned} Y_{it} = {} & \beta_0 + \beta_1 \,\text{Female}_i + \beta_2 \,\text{NREGA}_{it} + \beta_3 \,\text{After}_{it} \\ & + \beta_4 \,(\text{NREGA}_{it} \times \text{After}_{it}) + \beta_5 \,(\text{NREGA}_{it} \times \text{After}_{it} \times \text{Female}_i) \\ & + \alpha_{\mathbf{1}}' \mathbf{X_{it}} + \gamma_{\mathbf{1}}' \mathbf{Z_{it}} + \epsilon_{it} \end{aligned} \tag{1}$$

$Y_{it}$ is expenditure. $\boldsymbol{X_{it}}$ is a vector of household characteristic controls: religion, assets, total non-NREGA income, number of children, teenagers and adults, average adults' years of schooling, whether households have a ration card, state-time dummies, and month of survey. I include these to minimise omitted variable bias (OVB) and to ensure parallel trends is satisfied.

$\boldsymbol{Z_{it}}$ is a vector of female bargaining power control variables for all eligible women in a household: female average years of schooling (Thomas, 1990), female social capital (Agarwal, 1997; Pangari-bowo, 2019), female media consumption, and whether the female is the head of the household. Social capital is a dummy variable equal to one if the female is a member of at least one of the following groups: mahila mandal (women's clubs), self-help groups, credit group, savings groups, political organisation.

Rising income from NREGA participation leads to two effects on consumption: (i) the pure *income effect*, $\frac{\partial x_i^*}{\partial Y}$, (Kumar & Sangwan, 2021) is the rise (fall) in consumption expenditure of normal (inferior) goods due to a relaxing of the budget constraint; (ii) the *bargaining power effect*, $\frac{\partial x_i^*}{\partial \rho}$, is the additional change in expenditure above the *income effect* which arises if females undertake NREGA work and exert their preferences over allocation. In other words, $\beta_4$ is the ATE for men and represents the *income effect* on NREGA participation. $\beta_5$ is the difference between ATE for men and women and represents the *bargaining power effect*.

I include the dummy variable $\text{Female}_i$ to control for inherent differences between households where men and women apply to work to ensure that NREGA participation is exogenous. For example, in households where men work further away in the city, women may be more likely to decide to apply for the scheme. Hence, $\beta_0$ is the average consumption of rejected households where men applied to work and $\beta_0 + \beta_1$ is the average consumption of rejected households where women applied to work. $\beta_2$ represents the differences in consumption between accepted and rejected households before the treatment, and $\beta_3$ is the time trend. $\beta_2$ should be insignificant if we truly have a pure RCT. I

include the time trend since other policies could lead to a change in consumption across time, such as an extension of the Public Distribution System (PDS) and the launch of the National Food Security Mission.

# 7 Base Model Results

I present my base model results in Table 2, reporting key variables of interest. My analysis consists of 5 categories.

## 7.1 Necessities

Necessities are staple foods to allow households to meet their basic subsistence needs. They consist of the cheapest form of calorie intake. I define cereals, sugar and pulses as necessities since these are available in the ration shop[2]. I find that men significantly reduce expenditure on these necessities, spending ₹90, ₹32 and ₹20 less on cereals, sugar and pulses respectively a month if they undertake NREGA work. Men and women share the same preferences for these goods since there are no statistically significant differences between male and female spending, implying no *bargaining power effect*. Both individuals have a negative *income effect* and view subsistence goods as inferior goods as they substitute spending towards nutritious foods.

## 7.2 Highly Nutritious Food Items

Highly nutritious food items are more expensive forms of calorie intake. For example, within proteins, pulses are considered low biological value protein as they do not contain all the 8 indispensable amino acids which must come from a diet. Eggs and meat are high biological value protein since they satisfy the full amino acid requirement. I define highly nutritious food items as cereal products, fruit & vegetables, eggs & meat.

I find women have a stronger preference than men to increase expenditure of highly nutritious food since $\beta_5$ is positive and statistically significant on all 3 food items. Women prefer to spend ₹20, ₹41 and ₹20 more monthly than men on cereal products, eggs & meat and fruit & vegetables respectively. This shows female preferences towards towards dietary diversity, bargaining for more expensive calorie items. This could be exacerbated by women's higher preferences towards child nutrition and health (Thomas, 1990) hence they ensure their children receive a nutritious diet. This matches the literature since Kumar & Sangwan (2021) find a 0.0023% rise in dietary diversity from a rise in female workdays in India. Pangaribowo (2019) also find that higher female bargaining power from asset ownership leads to increasing expenditure on meat and fish and significant decrease in

[2]where PDS distributes necessities at a subsidised price to the poor.

expenditure on staple foods. Further, Liu & Deininger (2010) find a 3-5% rise in protein intake and 4-7% rise in calorie intake from NREGA wages. From my analysis, I propose the rise in protein and calorie intake originates from a substitution from staple goods to highly nutritious food items and this effect is greatest in households where women undertake NREGA work.

However, as Kumar & Sangwan (2021) analyse, the significantly positive coefficient on $\text{NREGA}_{it} \times \text{After}_{it} \times \text{Female}_i$ may be entangling an additional substitution effect as well as the *bargaining power effect*. NREGA work has a labour-leisure trade-off and can affect the shadow prices of goods (Doss, 2006). Labour force participation leads to less time for domestic work such as food preperation, resulting in substitution to more processed and readily prepared foods. Since women bear the burden of domestic work in South Asia in this cultural context (Agarwal, 1997), the substitution effect is likely to only be present in households where women undertake the NREGA. In my analysis, cereal products are the only good which have a time saving aspect in preparation as they consist of goods such as bread whereas cereals consist of wheat which must be processed further. Hence, the coefficient on $\text{NREGA}_{it} \times \text{After}_{it} \times \text{Female}_i$ is likely to entangle *bargaining power effects* and substitution effects for cereal products. Further evidence for this additional substitution effect on cereal products is analysed in Section 8.

### 7.3 Demerit Goods

Contradictory to existing literature, I find that although men increase spending on demerit goods given a rise in income and women have a negative *bargaining power effect*, neither coefficient is statistically significant at the 10% significance level. This does not match the literature since Hoddinott & Haddad (1995) find a significantly negative female *bargaining power effect* from gaining cash income shares in Côte d'Ivoire. There is likely to be under-reporting of demerit goods in India, especially in states such as Gujarat with strict alcohol prohibition laws. External validity is also unlikely to hold since Hoddinott & Haddad's sample consists of households in both urban and rural areas who have higher disposable income for discretionary spending on demerit goods which does not apply to rural India.

### 7.4 Education

I find that total educational spending is not statistically significant for men or women undertaking NREGA work. This result initially seems to contradict a long strand of literature which suggests women have strong maternal preferences for childhood education spending (Quisumbing & Mallucio, 2003, Doss, 2006). However, when analysing the components of total education spending, I find that 80% of this is school fees for the median household. Although the NREGA scheme is important in increasing job security, it is also only available for 100 days a year and is a small proportion of total household income. Hence, it is unlikely to cause households to change their decision about school

enrollment from public to private schools (Ganita & Abdoul, 2014) as this is a decision affecting expenditure for up to 15 years in the future.

Although not significant, when analysing magnitudes, I find that men prefer to reduce educational spending by ₹655 annually and women prefer to increase spending by ₹660 comparatively leading to little net effect. Afridi et al. (2016) conclude that greater female NREGA participation leads to better educational outcomes for children, measured in terms of time spent in school whereas male NREGA participation has a negative effect on school attendance. My results match the literature in showing maternal preferences towards educational outcomes and paternal preferences away from education. I suggust the improved school attendance of children due to female NREGA workdays is due to improved child nutrition and encouragement to attend school rather than from higher educational expenditure.

## 7.5 Total Food Expenditure

Although not statistically significant, the change in total food consumption differs depending on who the NREGA wage recipient is. Men reduce food spending by ₹252 annually (-0.9% for the median household) whereas women raise food spending by ₹445 (+1.5%). This matches my previous results where I find that women show a stronger substitution from staple goods to expensive foods. The fact that the rise in food consumption is statistically insignificant implies that households do not lack a subsistence diet but rather lack a nutritious diet which they aim to fulfill through a substitution from staples to expensive calories given the opportunity.

| | (1) Cereal | (2) Sugar | (3) Pulses | (4) Cereal Products | (5) Eggs Meat | (6) Fruit Veg | (7) Demerit | (8) Education | (9) Total Food |
|---|---|---|---|---|---|---|---|---|---|
| Female | -1.10 | -2.57 | -0.88 | -1.95 | -3.87 | 0.77 | 10.15 | 63.31 | -496.62 |
| | (0.935) | (0.494) | (0.824) | (0.405) | (0.623) | (0.868) | (0.168) | (0.786) | (0.207) |
| After | -236.18*** | -13.72*** | 28.82*** | -12.66*** | 42.66*** | 8.90* | 9.79 | 1063.10*** | -766.61* |
| | (0.000) | (0.001) | (0.000) | (0.000) | (0.000) | (0.070) | (0.214) | (0.000) | (0.069) |
| NREGA | 42.31** | 18.12*** | 11.60* | -10.92*** | -24.46** | -4.79 | 24.02** | -378.69 | 251.49 |
| | (0.014) | (0.000) | (0.021) | (0.000) | (0.014) | (0.411) | (0.010) | (0.200) | (0.614) |
| NRGEA_After | -89.94*** | -32.03*** | -19.52** | -2.84 | 36.51** | 1.06 | 8.46 | -655.20 | -252.67 |
| | (0.001) | (0.000) | (0.012) | (0.553) | (0.017) | (0.906) | (0.556) | (0.150) | (0.742) |
| NREGA_After_Female | 42.73 | 3.12 | -5.93 | 19.61*** | 40.96** | 20.24** | -12.19 | 660.20 | 697.64 |
| | (0.123) | (0.684) | (0.464) | (0.000) | (0.011) | (0.031) | (0.418) | (0.172) | (0.385) |
| _cons | 112.11*** | 19.78** | 152.75*** | -23.40*** | -97.51*** | -40.64*** | 64.23*** | -3808.81*** | 5788.47*** |
| | (0.001) | (0.036) | (0.000) | (0.000) | (0.000) | (0.000) | (0.001) | (0.000) | (0.000) |
| R-squared | 0.448 | 0.306 | 0.262 | 0.297 | 0.362 | 0.120 | 0.096 | 0.141 | 0.554 |

*p*-values in parentheses

* p < 0.10, ** p < 0.05, *** p < 0.01

Table 2: Full Sample Results.

# 8 Heterogeneity across Education

To explore the heterogeneity of female preferences with education, I restrict the sample to high and low average female years of schooling (median is 2.5 years). I report results in Tables 3 to 4 and Figure 2.

When exploring heterogeneities across food consumption, female bargaining power is positive and statistically significant in the highly educated group for all three highly nutritious food items. However, in the low educated group, it is only positive and statistically significant for cereal products. For educational spending, bargaining power is only positive and statistically significant for the high educated group. Bargaining power on alcohol and tobacco consumption remains negative and statistically insignificant in both subsamples.

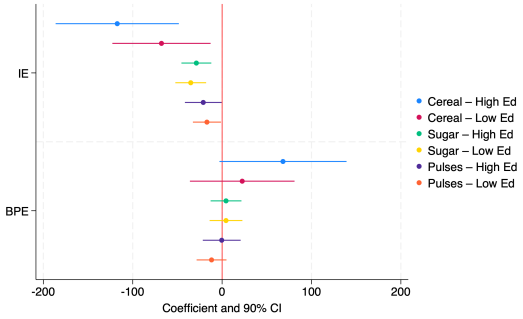
A possible channel to explain these heterogeneities is that higher female education leads to increasing awareness and knowledge about the importance of dietary diversity and healthy eating (Padmaja et al., 2019). With education, women become increasingly aware on how to promote household welfare (Pangaribowo, 2019). Further, to explain educational spending, women with high education have experienced returns to education and are increasingly keen for their children to be well educated, leading to stronger preferences for educational spending. The coefficient on demerit consumption is never statistically significant which is likely due to untruthful reporting.

However, the bargaining power coefficient on cereal products remains positive and statistically significant for both subsamples which can be explained by the existence of an equal substitution effect in both samples. Although the *bargaining power effect* is likely to be lower in the low educations sample (since women are less knowledgeable about the importance of dietary diversity), there is an equal labour-leisure trade-off from working under the NREGA, leading to an equal substitution effect.

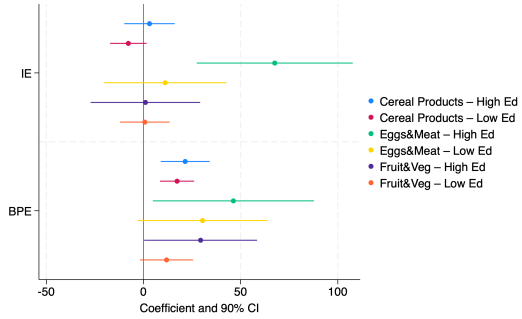
Further, I also observe heterogeneities across male preferences in both samples. The *income effect* on eggs and meat is only positive and statistically significant for the high education sample. Men in the high (low) education sample have a significantly negative (positive) *income effect* on demerit good spending. There is also a negative *income effect* on children's education spending in both subsamples, which is signfincant in the high education sample.

There is likely to be positive assortative mating by education (Dalmia & Lawrence, 2001; Barua & Goel, 2021) which means the households with high female education are more likely to have high male education too. High education is likely to have a similar learning effect on men by increasing awareness and importance of dietary diversity and healthy eating, explaining the significantly positive spending on eggs and meat in the high education sample. Also, education will warn men about health hazards of demerit goods such as smoking and alcohol. However, spending on children's

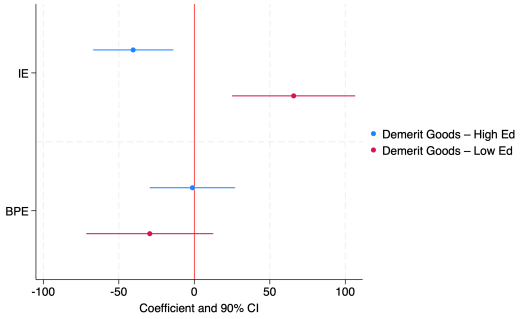
education remains negative in both subsamples and becomes significant in the high education subsample. This corroborates Afridi et al. (2016)'s findings where male NREGA participation worsens children's educational attainment.



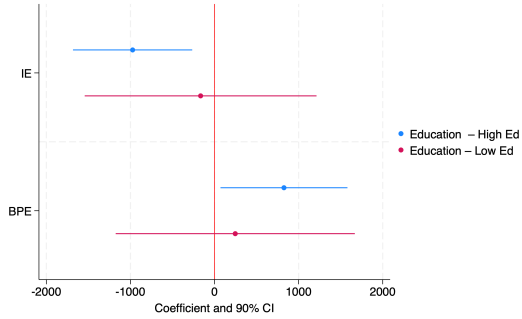

(a) Staple foods spending across gender




(b) Nutritious foods spending across gender




(c) Demerit goods spending across gender




(d) Education spending across gender

Figure 2: Heterogeneity across **education** results. *Income effect* (IE) and *bargaining power effect* (BPE) coefficients reported with 90% Confidence Intervals (CI).

Table 3: Heterogeneity across education: High education subsample.

| | (1) Cereal | (2) Sugar | (3) Pulses | (4) Cereal Products | (5) Eggs Meat | (6) Fruit Veg | (7) Demerit | (8) Education |
|---|---|---|---|---|---|---|---|---|
| Female | 5.04 | -6.80 | -0.44 | -5.35 | -9.59 | -2.31 | 10.47 | 191.30 |
| | (0.811) | (0.185) | (0.944) | (0.166) | (0.436) | (0.789) | (0.216) | (0.397) |
| After | -223.62*** | -27.59*** | 28.87*** | -16.53*** | 31.64** | 5.72 | 21.23** | 461.31* |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.020) | (0.550) | (0.017) | (0.052) |
| NREGA | 43.59 | 15.73** | 13.08 | -13.16*** | -54.80*** | -4.64 | 36.46*** | -224.13 |
| | (0.110) | (0.017) | (0.107) | (0.008) | (0.001) | (0.677) | (0.001) | (0.425) |
| NRGEA_After | -117.32*** | -28.80*** | -21.08* | 3.10 | 67.54*** | 0.99 | -40.50** | -974.19** |
| | (0.005) | (0.005) | (0.091) | (0.694) | (0.006) | (0.954) | (0.012) | (0.024) |
| NREGA_After_Female | 68.12 | 4.38 | -0.43 | 21.47*** | 46.25* | 29.39* | -1.23 | 825.54* |
| | (0.115) | (0.676) | (0.973) | (0.005) | (0.066) | (0.096) | (0.943) | (0.072) |
| _cons | 145.72** | 24.55* | 136.97*** | -26.26** | -114.42*** | -59.61** | 84.16*** | -1815.08*** |
| | (0.011) | (0.079) | (0.000) | (0.013) | (0.001) | (0.011) | (0.000) | (0.003) |
| R-squared | 0.426 | 0.342 | 0.281 | 0.297 | 0.407 | 0.094 | 0.111 | 0.127 |

*p*-values in parentheses

* p < 0.10, ** p < 0.05, *** p < 0.01

Table 4: Heterogeneity across education: Low education subsample.

| | (1) Cereal | (2) Sugar | (3) Pulses | (4) Cereal Products | (5) Eggs Meat | (6) Fruit Veg | (7) Demerit | (8) Education |
|---|---|---|---|---|---|---|---|---|
| Female | -4.05 | -0.60 | 0.05 | 1.77 | 5.18 | 4.25 | 12.32 | -66.57 |
| | (0.817) | (0.913) | (0.992) | (0.530) | (0.605) | (0.298) | (0.324) | (0.875) |
| After | -244.79*** | -2.04 | 30.93*** | -8.19*** | 56.00*** | 11.83*** | 1.82 | 1842.37*** |
| | (0.000) | (0.723) | (0.000) | (0.005) | (0.000) | (0.006) | (0.895) | (0.000) |
| NREGA | 41.31* | 20.01*** | 9.80 | -8.79** | 1.29 | -3.47 | 10.44 | -422.29 |
| | (0.058) | (0.003) | (0.115) | (0.012) | (0.917) | (0.494) | (0.517) | (0.438) |
| NRGEA_After | -67.83** | -35.10*** | -16.98* | -7.81 | 11.16 | 0.66 | 65.82*** | -165.52 |
| | (0.042) | (0.001) | (0.075) | (0.171) | (0.559) | (0.933) | (0.008) | (0.843) |
| NREGA_After_Female | 22.51 | 4.36 | -11.81 | 17.28*** | 30.37 | 11.87 | -29.50 | 246.37 |
| | (0.527) | (0.696) | (0.245) | (0.001) | (0.135) | (0.152) | (0.249) | (0.776) |
| _cons | 97.00** | 2.77 | 151.54*** | -16.66** | -49.52* | -25.93** | 66.87** | -7825.82*** |
| | (0.038) | (0.850) | (0.000) | (0.026) | (0.064) | (0.017) | (0.050) | (0.000) |
| R-squared | 0.476 | 0.285 | 0.246 | 0.296 | 0.310 | 0.204 | 0.099 | 0.152 |

*p*-values in parentheses

* p < 0.10, ** p < 0.05, *** p < 0.01

# 9 Robustness

I conduct three robustness checks to ensure the internal validity of my analysis.

## 9.1 Exogeneity of job rationing

The parallel trends assumption is necessary for DID estimates to have internal validity. It states that in the absence of NREGA, the trends between treatment and control groups are constant overtime (Wooldridge, 2016). Since the IHDS dataset is only a 2-panel dataset, I cannot conduct a visual inspection of further pre-treatment periods or introduce lags and placebo tests to test for this assumption.

Legally, NREGA job rationing is exogenous to household characteristics since the Gram Panchayat must allow equal access to work without prioritising certain households. Hence, there should be no significant differences between characteristics of control and treatment groups in the pre-treatment survey. Therefore, the identification is equivalent to a RCT with stratified randomisation of NREGA beneficiaries by state. If the probability of being successful in an NREGA application depends entirely on locational factors, we do not need to consider parallel trends since the treatment group is randomly selected within a state.

To empirically test the exogeneity of job rationing, I run the following logit regression to analyse if household characteristics influence the probability of being successful with the NREGA application ($P_i$). I use the pre-treatment period since the NREGA may affect post-treatment characteristics such as assets.

$$P_i = \beta_0 + \beta_{\mathbf{1}}\mathbf{X_i} + \gamma_{\mathbf{1}}'\mathbf{STATE}_i + \epsilon_i \tag{2}$$

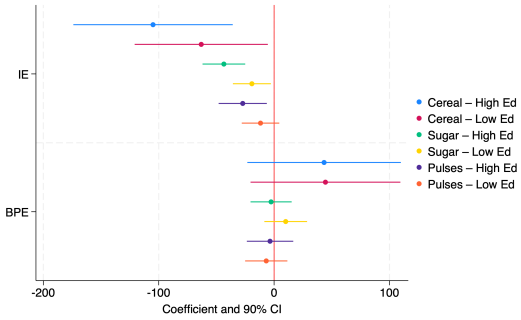
$\boldsymbol{STATE_i}$ is a dummy variable for the 34 states and union territories in the dataset. Results are reported in Table 5. I find that none of the household characteristics are statistically significant at the 10% level but state dummy variables are statistically significant. Further, when I run an F-test with the null hypothesis that $\beta_{\mathbf{1}} = 0$, there is insufficient evidence to reject the null. In my sample, job rationing is independent of observable household characteristics and is only dependent on the location of household. There is no statistical differences between treatment and control groups which means we do not need to consider parallel trends as this is equivalent to an RCT. However, as discussed in Section 11, despite controlling for several factors, a degree of OVB may remain. Hence there may be differences between pre-treatment groups based on unobservable household characteristics.

State-level variation of NREGA job acceptance rates can be explained since states which have

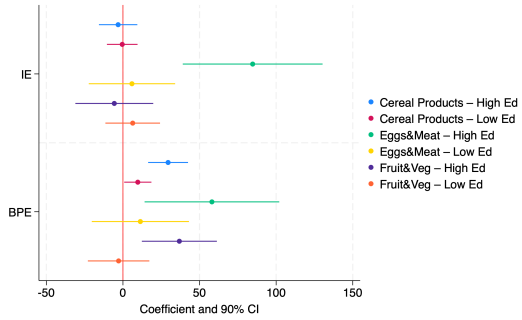
recently faced weather shock are likely to have higher demand for NREGA work from agricultural workers. I argue that state-time dummies are sufficient to control for locational differences in acceptance rate. Although NREGA work is allocated at a village level, there is unlikely to be significant heterogeneity in acceptance rates across villages in a state. This is since NREGA budgets are fixed annually at the state level and on the occasion that a village has an excess demand of work, program officers are able to redirect funds within a state to meet demand.

## 9.2 Heterogeneity across media

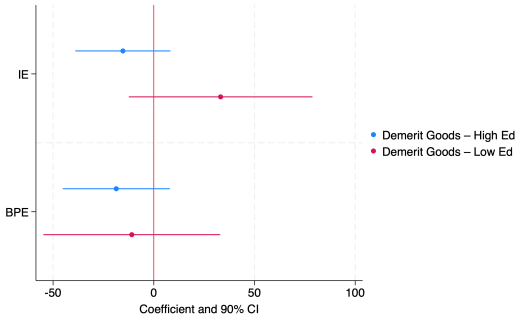
I use hours of daily female media usage in a household as another measure of education since this is an important source of informal education (Cagé & Rueda, 2016; Dellavigna & La Ferrara, 2015). I split the sample into high and low female media usage by median and compare the heterogeneity across **average female years of schooling** with heterogeneity across **average female media consumption**. I find the same conclusions (Figure 3) are reached with both measures of education, highlighting robustness across the measures of education used.



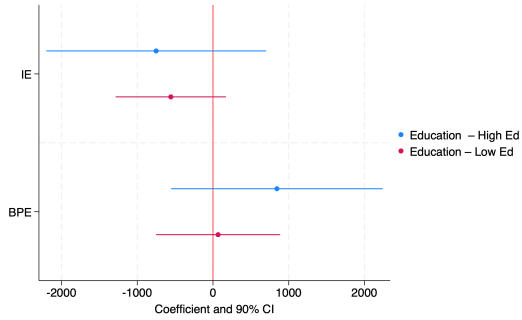

(a) Staple foods spending across gender




(b) Nutritious foods spending across gender




(c) Demerit goods spending across gender

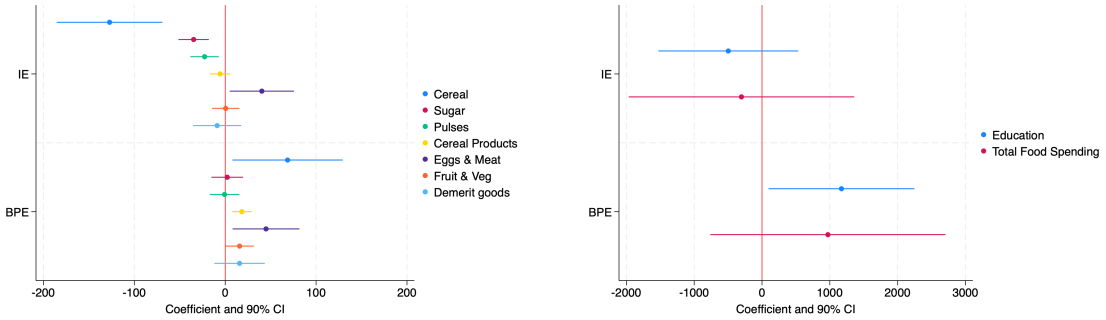



(d) Education spending across gender

Figure 3: Heterogeneity across **media** results. *Income effect* (IE) and *bargaining power effect* (BPE) coefficients reported with 90% Confidence Intervals (CI).

## 9.3 Restricting treatment and control groups

Since the NREGA is a continuous treatment, I further restrict my treatment and control groups to ensure a lower variation in days worked within groups. I run the same regressions with the treatment group working between 95-100 days and the control group working between (i) 0-20 days and (ii) 0-15 days. For brevity, I report results for (i) in Figure 4 and find the same general results hold. However, restricting the groups further also restricts the sample size, leading to a trade-off.




(a) Staple foods spending across gender

(b) Nutritious foods spending across gender

Figure 4: Restricting treatment group to 95-100 days (sample size 806) and control group to 0-20 days (sample size 2082). *Income effect* (IE) and *bargaining power effect* (BPE) coefficients reported with 90% Confidence Intervals (CI).

Table 5: Robustness Equation (2). Note state dummy variables are omitted if all households in the state were accepted (rejected) NREGA work hence there is no variation in $P_i$.

| Variable | Coefficient | $p$-value |
|---|---|---|
| Female | $-0.11$ | 0.199 |
| Assets | 0.05 | 0.150 |
| Hindu | $-0.36$ | 0.191 |
| Muslim | $-0.25$ | 0.429 |
| Non_NREGA_income | 0.00 | 0.335 |
| No_adults | $-0.00$ | 0.923 |
| No_children | 0.03 | 0.298 |
| No_teens | 0.12 | 0.114 |
| Ration_card | $-0.24$ | 0.111 |
| Winter | 0.00 | 0.625 |
| Summer | $-0.00$ | 0.546 |
| Monsoon | $-0.00$ | 0.582 |
| State_ID_1 | $-1.86^{***}$ | 0.000 |
| State_ID_3 | $-2.01^{***}$ | 0.000 |
| State_ID_5 | $-1.15^{***}$ | 0.003 |
| State_ID_6 | $-1.92^{***}$ | 0.000 |
| State_ID_8 | 0.19 | 0.314 |
| State_ID_9 | $-1.67^{***}$ | 0.000 |
| State_ID_10 | $-0.85^{***}$ | 0.002 |
| State_ID_13 | $-1.86^{**}$ | 0.013 |
| State_ID_16 | $2.11^{***}$ | 0.000 |
| State_ID_18 | $-1.90^{***}$ | 0.000 |
| State_ID_19 | $-3.12^{***}$ | 0.000 |
| State_ID_20 | $-0.63^{*}$ | 0.069 |
| State_ID_21 | $-2.31^{***}$ | 0.000 |
| State_ID_22 | $-0.95^{***}$ | 0.000 |
| State_ID_23 | $-0.81^{***}$ | 0.000 |
| State_ID_24 | $-1.67^{***}$ | 0.000 |
| State_ID_27 | $-1.83^{***}$ | 0.000 |
| State_ID_28 | $0.34^{*}$ | 0.083 |
| State_ID_29 | $-1.33^{***}$ | 0.000 |
| State_ID_30 | 0.00 | 0.283 |
| State_ID_32 | 0.36 | 0.230 |
| State_ID_33 | $1.54^{***}$ | 0.000 |
| Constant | 0.20 | 0.596 |

$^{*}p < 0.10,\ ^{**}p < 0.05,\ ^{***}p < 0.01$.

# 10 Qualitative Work

To supplement my empirical analysis, in December 2024, I had the invaluable opportunity to visit Dugri and Chandpur, two villages in Punjab offering NREGA work. I interviewed 10 female beneficiaries who were previously out of the labour force allowing the NREGA to supplement their family incomes by ₹32,000 annually. When asked how they used the additional income, all women explained that investment into their children's nutrition and education was their priority and the income allowed them to purchase higher quality food for the household. Women explained that after entering the labour force, they felt as though they had a higher authority within the household since they were contributing to family income. I was especially inspired by Mandeep, an NREGA supervisor in Chandpur who explained that all her income was directed towards providing a protein rich diet including chicken and paneer for her children since they were national-level football and hockey players. The maternal preference towards child nutrition and education is evident and women clearly felt they had additional power in the household, corroborating my quantitative analysis.

# 11 Limitations

I discuss two key limitations of my analysis and a potential extension for future research.

Although I have controlled for several household characteristics, I am unable to control for factors such as caste which are not publicly available in the IHDS, causing OVB. If scheduled castes are discriminated against and have lower expenditures, there will be a positive bias on the estimates of treatment on consumption. However, it is unlikely that conditional on income, caste will significantly affect expenditure and further research can control for this. It could also be the case that there is discrimination in NREGA acceptance by caste as Dutta et al. (2012) find, which means we do not have a pure RCT.

Since there is a fixed supply of NREGA work per state according to annual budgets, job seekers who apply for work after all work has been allocated annually are automatically rejected. This leads two issues. (i) The probability of being assigned to the treatment group is not exogenous and depends on the time of the year households apply for work. If they apply after all work has been allocated, they have no chance of success. (ii) If households know that all work has been allocated, they may apply for the NREGA knowing they will be rejected and will receive unemployment insurance. To address the first concern, the majority of NREGA work occurs in the agriculturally lean season (Johnson, 2009), hence application to the NREGA is not distributed through the year but is heavily concentrated at the start of the agriculturally lean season. Hence the timing of the application is unlikely to vary across households within states causing little OVB. I cannot address the second

concern and must assume revealed preferences are identical to stated preferences.

To further understand parents' preferences towards education, it would be interesting to analyse heterogeneities across preferences depending on child gender (Thomas, 1990).

# 12 Conclusion

In this dissertation, I use a novel empirical strategy to decompose the *income effect* and *bargaining power effect* to analyse how preferences vary across gender. The exogenous job rationing within states and equal wages, hours and nature of work across gender are key characteristics of the NREGA allowing me to conduct my analysis. I find both male and female NREGA recipients have preferences towards lower consumption of staple goods. However, women have stronger preferences towards expensive calorie spending, allowing them to promote dietary diversity and household welfare to a greater extent than men. In the full sample, there are no statistically significant changes in demerit and educational spending under treatment. Demerit good consumption is susceptible to under-reporting, especially in states with strict alcohol prohibition laws. It is also reasonable to assume that the magnitude of the NREGA is not sufficient to change households decisions about school enrollment.

When analysing heterogeneities in preferences by formal female education (schooling years) and informal education (media consumption), I observe a significant learning effect on nutrition, and demerit good spending for both men and women. The positive *bargaining power effect* on educational spending also becomes statistically significant for women with high education but men in the high education samples prefer lower educational spending.

The policy implications from my analysis are twofold. Firstly, although the NREGA already has a 57% female participation (Press Information Bureau, Government of India, 2024), policies to raise female labour force participation in the private labour market is essential. Features of the NREGA which make it attractive to women should be implemented in private labour markets. These include the fact that NREGA work is available within 5km of residence, childcare is available at worksites and there is flexibility of work across the year. Secondly, my robustness analysis shows the power of media as a tool for providing informal education to adult women in rural India. Given mobile phone penetration in rural India is already at 94% (Ministry of Statistics and Programme Implementation, Government of India, 2023), a promotion of household nutrition, education and warnings about demerit goods through internet media can significantly alter male and female preferences towards promoting household welfare.

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