Gender Differentiated Impacts of Kerosene Pricing Reform in Bangladesh

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Background

- This paper is one of a series developed to examine the gender-differentiated impacts of fuel pricing and their reform in Bangladesh, India and Nigeria .

- Begins with the hypothesis that because women are largely under-represented in decision-making processes relating to energy, and typically experience high levels of intra-household inequality and most exposure to indoor air pollution, any reform in price of domestic fuel will have the biggest impacts on women.

- The research focuses on kerosene using households in rural areas of Bangladesh.

Literature on Gender and Energy

- Energy policy can affect women and men in different ways due to the societal roles conventionally played by women and men in different cultures (Skutsch, 2005).

- In fast developing low- and middle-income economies, where energy systems are quickly changing, these differences can be even more pronounced (reviews by Haves (2012) and Köhlin et al. (2011).

- The relationship on energy price and household energy sources is substantial, but little research was found looking specifically at the gender disaggregated impacts of prices and their reforms.

- Some analysis has researched the linkages between household fuel subsidies and household choice of energy source for lighting and cooking, which has strong implicit relevance to women's welfare. Kojima et al. (2011), for example, finds through regression analysis of household survey data that pricing is one of the most important factors determining household take-up of liquefied petroleum gas (LPG) for cooking, alongside income and education

Research Focus

- How do Kerosene pricing policies affect the welfare, productivity and empowerment of women in households in eight districts of three divisions (Barisal, Rangpur, Chittagong) in Bangladesh considering......
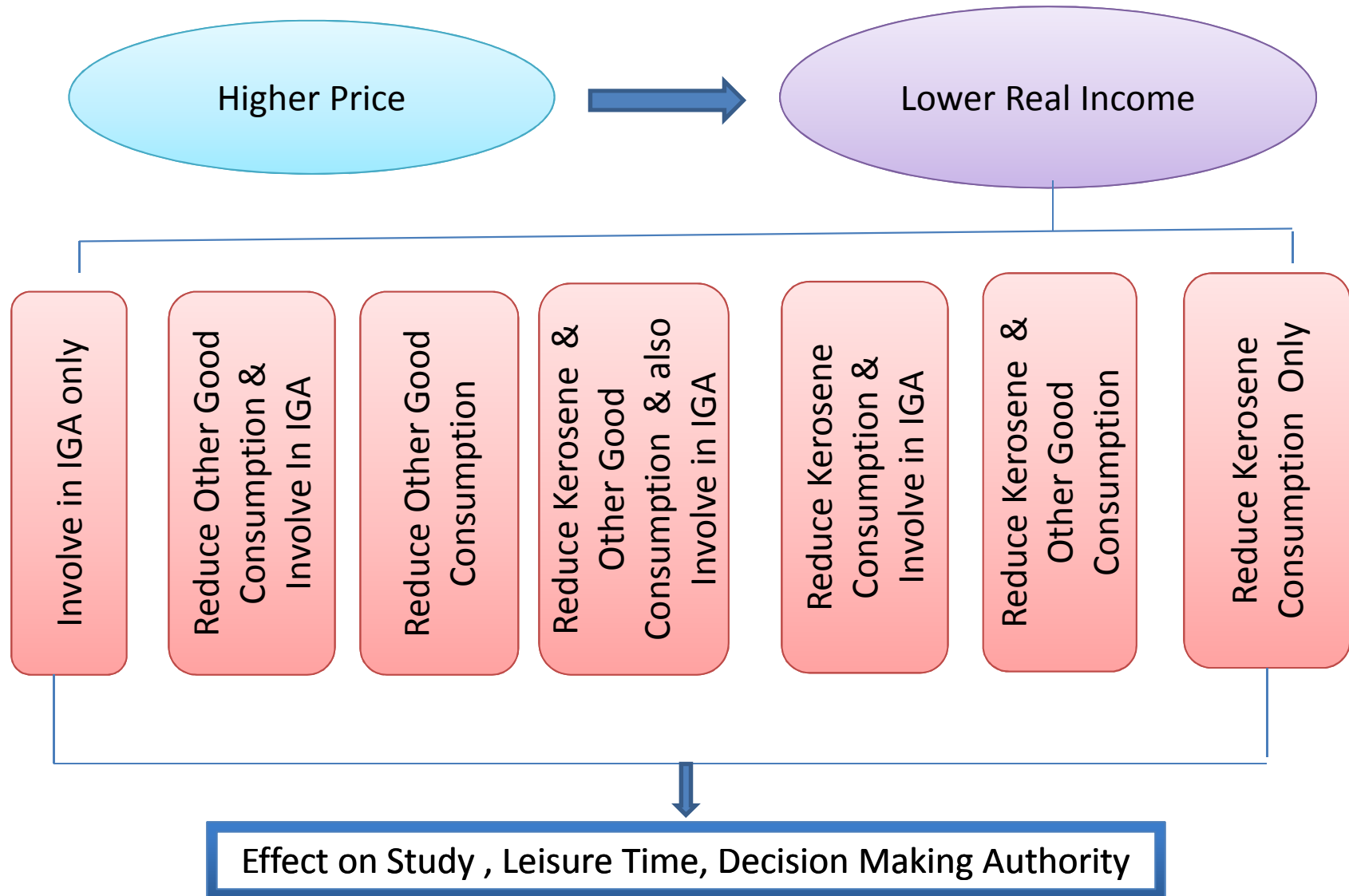
The extent to which price differential poses a gender differentiated effect upon welfare & productivity (study time & leisure time) and empowerment (decision making authority)

- Hypothesis based on the research focus

➤ *Hypothesis 1 : Higher price differential will always be associated with lower study duration for for female than male*

➤ *Hypothesis 2: Higher price differential will always be associated with lower leisure duration for for female than male*

➤ *Hypothesis 3: Price differential affects the decision making authority of women differently over using lighting fuel.*

Research Focus (cont…)

- **Considering Kerosene instead of any other lighting fuel -----**
  - Even electrification in Bangladesh had drastically reduced the households use of kerosene; still kerosene is used by those households for lighting which do not have access to electricity or Solar Home System (SHS).
  - Not only the access, affordability (low income) is another major factor contributing to adopt kerosene-based lighting system.
  - Government initiative of rapid electrification is expected to reduce the households use of kerosene more in near future ; therefore the exercise on the impacts of price reforms of kerosene will provide a guidance about the likely impacts of increased price of electricity (or any other HH fuel) of the poor rural households.

Coping Mechanisms of HH Against Kerosene Price Increase & Effect On Welfare, Productivity & Empowerment

Higher Price → **Lower Real Income**

- Involve in IGA only
- Reduce Other Good Consumption & Involve In IGA
- Reduce Other Good Consumption
- Reduce Kerosene & Other Good Consumption & also Involve in IGA
- Reduce Kerosene Consumption & Involve in IGA
- Reduce Kerosene & Other Good Consumption
- Reduce Kerosene Consumption Only

Effect on Study , Leisure Time, Decision Making Authority

Methodology

- Use of secondary resources
- Primary Survey : Households Survey with 630 households in three Divisions: Rangpur (Kurigram, Lalmonirhaat, Panchagarh), Barisal (Bhola, Patuakhali, Barguna) and Chittagong (Banderban and Khagrachari) ; 210 Households from each Divisions.

Regional Selection

To capture the effect of kerosene pricing on households, the selection criteria of survey regions were:

--The region where either electricity and/or solar system is not present and substantial proportion of households are using kerosene

-- The region where either electricity and/or solar system is present and substantial proportion of households are still using kerosene

-The regions where poverty level is comparatively higher.

- A mapping exercise as part of the data auditing exercise was used to find the areas with substantial number of kerosene users and high poverty at most disaggregated level (at zilla/district level).
- Based on data on Kerosene usage (Population and Housing Census) and Poverty level (HIES 2010), the districts from Rangpur, Chittagong and Barisal had been selected

Methodology (Cont..)

Mapping exercise with kerosene using HH and poverty level Using Population & Housing Census (PHC) and HIES data

Selection of Divisions & Districts by Secondary Sources

- No data on number of kerosene using HH from PHC at village level was available but data on electricity using HH at village level was available. Villages with low access to electricity were identified.
- BPDB data used to identify villages with access to grid electricity
- IDCOL data used to identify villages with access to solar home
- Pilot survey targeting "Census of Villages" to collect information on number of kerosene using HH ,number of total HH, access to grid or solar home of identified villages
- villages with highest proportion of kerosene using HH from each district were selected

Selection of Villages by "Census of Villages"

Five HH from each villages were randomly selected . Total 630 HH were surveyed during March 2017-April 2017.

Selection of HH by random sampling

Distribution of Sample across Selection Criteria

Division	District	No of Villages with prevalence of electricity and solar				No of villages
		both electricity and solar	only electricity	only solar	neither electricity nor solar	
RANGPUR	KURIGRAM	10		4		14
	LALMONIRHAAT	7		7		14
	PONCHOGARH	9		5		14
CHITTAGONG	BANDERBAAN	2	1	12	6	21
	KHAGRACHARI	4		9	8	21
BARISAL	BHOLA	2		12		14
	PATUAKHALI		6	-	8	14
	BARGUNA	8		6		14
Total		47	2	63	14	126

Sample Characteristics

Indicators		ALL	Rangpur (Three districts)	Chittagong (Two districts)	Barisal (Three districts)
Average HH size		5	4	5	5
% of male		50.56	51.15	50.71	48.92
Average age of all HH members		25.53	26.79	25.12	24.75
% of HH members across	**Occupation** — Agricultural Wage Labor	2.42	2.73	0.61	4.00
	Self Employed in Agriculture	1.65	2.51	0.00	2.52
	Non- Agricultural Wage Labor	11.56	13.77	13.67	7.26
	Self Employed in Non-Agriculture	10.79	6.67	16.53	8.83
	Service	2.67	2.19	3.78	2.00
	Business	1.76	1.86	1.02	2.42
	Remittance	0.91	1.75	0.10	0.95
	Student	31.03	31.37	32.14	29.55
	Housewife	22.00	25.46	15.82	25.03
	Elderly/Child	12.83	10.27	13.16	14.93
	Unemployed	2.04	1.20	2.55	2.31
	others	0.35	0.22	0.61	0.21
Average Monthly Per Capita HH Income		1643.1	1704.4	2205.4	1850.9
Average Monthly Fuel Expenditure (BDT) per HH		310	207	216	506
Average Monthly Per Capita Fuel Expenditure (BDT)		72	50	48.5	119

Sample Characteristics (Cont...)

	Indicators	ALL	Rangpur (Three districts)	Chittagong (Two districts)	Barisal (Three districts)
Education level of male	No Schooling (% of male to total male)	32.59	38.03	34.61	25.11
	Incomplete Primary (% of male to total male)	29.60	21.79	31.39	35.44
	Class 5 Passed % of male to total male)	13.41	13.46	8.85	18.14
	Class 8 passed (% of male to total male)	8.48	9.83	7.44	8.23
	SSC /equivalent passed (% of male to total male)	4.45	4.27	5.84	3.16
	HSC/equivalent passed (% of male to total male)	6.60	8.55	6.64	4.64
	HSC above (of male to total male)	4.86	4.06	5.23	5.27
Education level of female	No Schooling (% of male to total male)	38.10	42.51	44.93	27.04
	Incomplete Primary (%of male to total male)	28.78	22.15	27.33	36.48
	Class 5 Passed (% of male to total male)	11.58	8.28	6.63	19.71
	Class 8 passed (% of male to total male)	8.81	10.74	8.70	7.13
	SSC /equivalent passed (% of male to total male)	2.35	2.68	2.28	2.10
	HSC/equivalent passed (% of male to total male)	4.05	4.92	3.73	3.56
	HSC above (% of male to total male)	6.33	8.72	6.42	3.98
Dwelling type	Kutcha	94.8%			
	Semi-Pacca	4.3%			
	Pucca	1.0%			

Sample Characteristics (Cont...)

Division	Use of Fuel	Kerosene	Firewood	Cow dung/bhushi /wood-powder	Jute stick	Agri by products fuel: paddy, hag etc	dried plants leaf, plant residuals
% of HH with Use of Different Types of Fuel							
RANGPUR	Cooking	0.48	24.29	73.33	16.67	80.48	66.19
	Lighting	99.52	0.00	0.00	0.00	0.00	0.00
	Space Heating	0.48	0.00	0.00	0.48	0.00	0.00
	Others	0.00	0.00	0.00	0.00	0.00	0.95
CHITTAGONG	Cooking	0.00	99.52	1.90	0.00	5.71	74.76
	Lighting	100.00	0.00	0.00	0.00	0.00	0.00
	Space Heating	0.00	0.00	0.00	0.00	0.00	0.00
	Others	0.00	0.00	0.00	0.00	0.00	0.00
BARISAL	Cooking	3.33	97.62	37.14	0.95	70.95	89.52
	Lighting	99.05	0.00	0.00	0.00	0.00	0.00
	Space Heating	0.00	0.00	0.00	0.00	0.00	0.00
	Others	0.95	0.00	0.00	0.00	0.48	0.00
TOTAL	Cooking	1.27	73.81	37.46	5.87	52.38	76.83
	Lighting	99.52	0.00	0.00	0.00	0.00	0.00
	Space Heating	0.16	0.00	0.00	0.16	0.00	0.00
	Others	0.32	0.00	0.00	0.00	0.16	0.32

1. Does the existing distribution system of kerosene really facilitate the households in enjoying lower price?

To what extent the government registered price is actually reflected in the Kerosene retail prices paid by consumers?

Average Price Differential (%) across Districts

District	Value
Kurigram	8.61
Lalmonirhat	12.10
Panchagar	14.41
Banderban	15.24
Khagrachari	16.27
Bhola	17.06
Patuakhali	12.96
Barguna	10.88

Rangpur (avg Price Differential=11.71%) Chittagong (avg Price Differential=15.76%) Barisal ((avg Price Differential=13.63%)
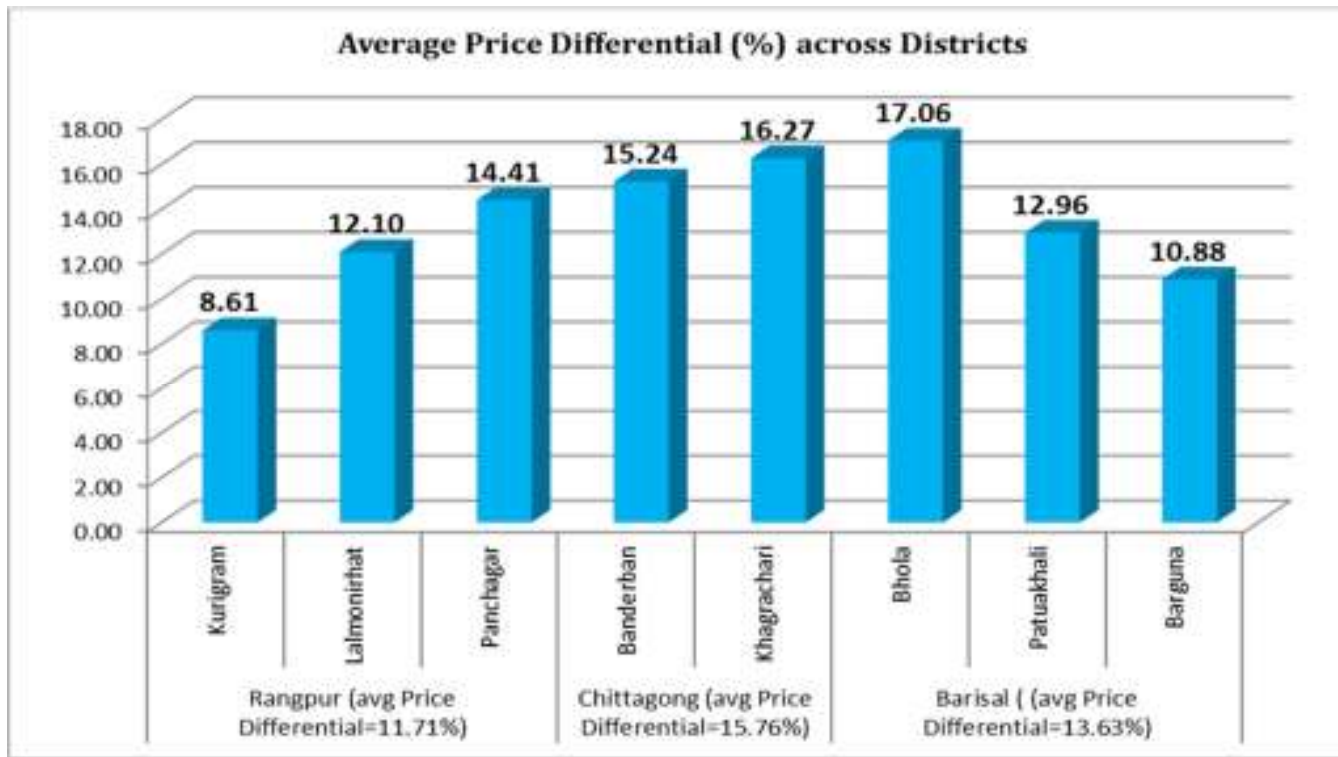
Field survey shows that the price paid by the households for kerosene is significantly higher than the market registered price (on average 13.7%)

Distribution system of Kerosene & Lower Price (cont..)

	Rangpur (Three Districts)	Chittagong (Two Districts)	Barisal (Three Districts)	All
Distance (km) to the nearest vendor	1.73	1.64	1.09	1.49
No of minutes (there and back) needed to get to nearest vendor of kerosene	40	52	46	46
share of fuel expenditure to total expenditure	4.26	3.16	6.44	4.62
Average Retail price (BDT) paid by HH per liter	76	79	77	77

Does Higher Retail Price of Kerosene Influence Household Kerosene Consumption ?

	Coeff.	Robust S.E	P value
Ln Price of kerosene (per liter)	-0.4845*	0.156	0.002
Ln Per Capita Monthly Income	0.4508*	0.031	0.000
Ln Distance from HH to kerosene purchase source	-0.0072	0.010	0.482
Ln Daily Lighting Hours (average) using kerosene	0.0685*	0.030	0.024
Share of Kerosene Expenditure to Total expenditure	0.1770*	0.008	0.000
Share of Energy Expenditure to Total expenditure	0.0265*	0.003	0.000
Student ratio in HH	0.0006	0.000	0.168
Female Ratio in HH	0.0003	0.000	0.492
Education of HH Head	0.0037	0.002	0.104
Proportion of kerosene using HH in village	0.0007*	0.000	0.028
SOLAR or GRID dummy_ base = neither solar nor grid			
Dummy _Solar Only (Only Solar System exists)	0.0586	0.031	0.062
Dummy _Grid Only (Only Grid Connection exists)	-0.0755*	0.022	0.001
Dummy_Both Grid & Solar	-0.1268*	0.025	0.000
Dummy_Decision on use of fuel for lighting (who decides, base=joint decision of female member & other HH member)			
solely by husband/father	0.1148*	0.016	0.000
Self by female member	0.1005*	0.025	0.000
Constant	-2.6946*	0.270	0.000
Number of Observation	630		
F(15, 612)	74.72		
Prob > F	0.000		
R-squared	0.650		
Root MSE	0.172		

Higher Retail Price of Kerosene & Household Kerosene Consumption (cont...)

• A 1% increase in price paid by HH will decrease per capita kerosene consumption by 0.48%. Hence, the price differential of kerosene consumption is negative and inelastic. Again, the response of kerosene consumption with respect to change in income is positive and inelastic. A 1% increase in per capita monthly income will increase per capita kerosene consumption by 0.45%.

• Higher consumption of kerosene (per capita) is driven by higher share of kerosene expenditure and energy expenditure, higher lighting hours and higher proportion of kerosene using households in locality.

• Per capita kerosene consumption is lower for those households which have either solar or grid connection or both in the respective village than those households which do not have neither electricity nor solar in the village. This is reflected by the variable "Solar or Grid Dummy".

• The households where decision of using lighting fuel is determined solely either by husband/father or by female member have higher kerosene consumption than those households where decision is made jointly by female and other family members. This is showed by the variable "Dummy Decision on use of fuel for lighting".

How Does price differential pose a gender differentiated effect upon welfare & productivity (study time & leisure time) and empowerment (decision making authority) of Households?

- To understand the effects of price changes, it is important to understand how the use of kerosene is related to activities carried out by the different household members. An OLS analyses had been carried out using duration of each activity by each household member as dependent variable.

- As price change is the variable of interest, price differential (difference between price currently paid by each household and market registered price) had been used as regressor considering number of daily lighting hours (using kerosene) of each household, , per capita kerosene consumption (liters) of each household, distance from house to kerosene buying source, share of energy expenditure to total expenditure, share of kerosene expenditure to total energy expenditure, per capita household income, proportion of students to total household members of each household, female (a dummy variable that indicates that if the respondents is male or female) as control variables.

- Two regression had been run for the two different activities separately .The main concern is to investigate if price differential really poses any gender differentiated effect on duration of these two different activities.

Gender Differentiated Impact of Price Differential on Study Duration

	Coefficient	Robust Std. Err.	P-value
Female _ dummy	-37.00*	12.96	0.004
Female*Price Differential	2.15*	1.00	0.032
Price Differential	-3.61*	0.74	0.000
Per Capita Monthly Income	0.01*	0.00	0.008
Share of Kerosene Expenditure to Total expenditure	17.68*	2.52	0.000
Share of Energy Expenditure to Total expenditure	-0.96	0.83	0.249
SOLAR or GRID dummy (If Solar or Grid Electricity exists in Village, base = neither solar nor grid))	---	----	----
Solar Only (Only Solar System exists)	25.80*	9.23	0.005
Grid Only (Only Grid Connection exists)	13.57*	4.93	0.006
Both Grid & Solar	33.22*	5.61	0.000
Student ratio in HH	0.30*	0.14	0.033
Female Ratio in HH	-0.05	0.11	0.669
Daily Lighting Hours (average) using kerosene	4.04*	1.81	0.026
Distance from HH to kerosene purchase source	-2.74*	0.90	0.002
Land Holding	0.08*	0.05	0.077
Education Stipend Dummy (1=If HH receives at least one stipend programme, 0=If HH receives no stipend)	-8.85*	3.78	0.019
Constant	95.27	16.65	0.000
Number of Observation	872		
F(15, 856)	14.85		
Prob > F	0		
R-squared	0.1898		
Root MSE	55.293		

Gender Differentiated Impact of Price Differential on Study Duration (cont...)

• As price differential is negatively related with study duration, higher price differential will always be associated with lower study duration for both male and female. Female member will always be affected more adversely than male for increased price differential. However, as the price differential increases, the rate of reduction in study duration will be less for female compared to male.

• The receipt of at least one education stipend by any HH member gives a surprising result. The respondent whose HH receives at least one education stipend study less than the respondent whose HH receives no stipend at all.

Gender Differentiated Impact of Price Differential on Leisure

	Coeff	Robust Std. Err.	P-value
Female _ dummy	-16.86*	8.22	0.040
Female*Price Differential	0.54	0.62	0.389
Price Differential	-1.92*	0.48	0.000
Per Capita Monthly Income	0.002	0.00	0.247
Share of Kerosene Expenditure to Total expenditure	11.06*	1.48	0.000
Share of Energy Expenditure to Total expenditure	-0.56	0.47	0.234
SOLAR or GRID dummy (If Solar or Grid Electricity exists in Village, base = neither solar nor grid))			
Solar Only (Only Solar System exists)	11.20*	5.37	0.037
Grid Only (Only Grid Connection exists)	9.53*	2.60	0.000
Both Grid & Solar	19.63*	2.99	0.000
Student ratio in HH	0.38*	0.06	0.000
Female Ration in HH	-0.04	0.06	0.558
Daily Lighting Hours (average) using kerosene	3.55*	1.00	0.000
Distance from HH to kerosene purchase source	-0.53	0.51	0.302
Land Holding	0.05	0.04	0.182
Constant	62.34*	9.65	0.000
Number of Observation		2,760	
F(14, 2745)		20.79	
Prob > F		0	
R-squared		0.0994	
Root MSE		56.665	

Gender Differentiated Impact of Price Differential on Leisure (cont…)

- As price differential is negatively related with leisure duration, increase in price differential will always reduce the leisure duration for both male and female. Female member will always be affected more adversely than male for increased price differential.

How Does price differential pose a gender differentiated effect upon empowerment (decision making authority) of Households?

- Multinomial logit regression had been exercised to depict the effect of price differential over the decision making authority in using lighting fuel across different family members. The dependent variable is the mode of decision which takes three values; if decision is made solely by father/husband of family; or solely by female members or jointly by family members. A multinomial logit regression was run to explore the effect of price differential over the mode of decision making authority

- Results:

- ✓ A one-unit increase in price differential is associated with a 0.12 increase in the relative log odds of decision making authority by husband/father vs. decision making authority by jointly with other family members. A one-unit increase in price differential is associated with a 0.10 increase in the relative log odds of decision making authority solely by female members vs. decision making authority by jointly with other family members. Hence, the likelihood of decision making authority over using lighting fuel by husband/father and by female members is almost same when compared to likelihood of the authority by other family members (base category).

Gender Differentiated Impact of Price Differential on Mode of Decision Making Authority

	Coeff.	Std. Error	p-value
Jointly_with_family_members (base outcome)			
Outcome 2: solely_by_husband_father			
Price Differential	0.115	0.026	0.000
Per Capita Monthly Income	0.000	0.000	0.049
Proportion of Kerosene Using Households in the village	0.007	0.004	0.059
Student ratio in HH	0.011	0.005	0.024
Female Ration in HH	0.000	0.006	0.929
Daily Lighting Hours (average) using kerosene	-0.156	0.078	0.046
Distance from HH to kerosene purchase source	-0.064	0.055	0.245
Share of Kerosene Expenditure to Total expenditure	-1.002	0.142	0.000
Share of Energy Expenditure to Total expenditure	-0.057	0.044	0.190
Per Capita Kerosene Consumption	4.812	0.762	0.000
constant	0.012	0.739	0.987
Outcome 2: Self_by_female_member			
Price Differential	0.098	0.042	0.021
Per Capita Monthly Income	-0.001	0.000	0.015
Proportion of Kerosene Using Households in the village	0.011	0.006	0.054
Student ratio in HH	0.015	0.008	0.060
Female Ration in HH	0.015	0.008	0.058
Daily Lighting Hours (average) using kerosene	-0.668	0.197	0.001
Distance from HH to kerosene purchase source	-0.315	0.140	0.025
Share of Kerosene Expenditure to Total expenditure	-0.765	0.249	0.002
Share of Energy Expenditure to Total expenditure	-0.130	0.087	0.136
Per Capita Kerosene Consumption	4.156	1.277	0.001
constant	1.230	1.383	0.374
Number of observation			630
LR chi2(20)			160.350
Prob > chi2	0.000		
Pseudo R^2	0.133		
Log likelihood	-524.515		

Gender Differentiated Impact of Price Differential on Decision Making Authority (cont…)

• A one-unit increase in per capita monthly income is associated with almost no (0.0003) decrease in the relative log odds of decision making authority by husband/father vs. decision making authority by jointly with other family members. In the same way, a one-unit increase in per capita monthly income is associated with a no (0.001) decrease in the relative log odds of decision making authority solely by female members vs. decision making authority by jointly with other family members.

• Therefore, mode of decision making authority (solely by female member/ solely by male member/jointly by family members) does not vary across different level of price paid and income of the family.

Conclusion

- Considering the results against hypothesis-----

➢ **Price differential has gender differentiated impacts on study duration and leisure hours of kerosene using households. Therefore,** female member will always be affected more adversely than male for increased price differential in terms of these two indicators.

➢ **Mode of decision making authority (solely by female member/ solely by male member/jointly by family members) does not vary much across different level of price paid by households.**

Hence,

Fuel pricing policy is likely to pose significant gender differentiated impact upon study time and leisure duration but very little impact on decision making authority of households members.

Thank You !!!!!