Fuel Prices in India and How it Affects Energy Consumption Choices

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Abstract

Fuel prices in India have risen, causing consumer decision making changes for transportation, cooking, and lifestyle. This paper discusses the fuel price volatility from 2020-2023 and the causes of price increases. This consists of supply shocks caused by the lack of a kerosene subsidy, the repercussions of price freezing in diesel and petrol, and the volatility caused by political elections. Furthermore, it is uncovered whether the government should subsidise fuel for rural households in Uttar Pradesh, India. Results from a survey of 200 households show a rise in fuel prices, which have caused homes to shift from kerosene (a source of light and cooking) to solid fuels such as dung cakes, firewood and plastic. Lastly, the paper finds that the government could subsidise fuel for households in rural India in order to provide support for basic necessities like cooking fuel. In order to discover these findings, a preliminary literature review was conducted, as well as original research collection in the state of Uttar Pradesh, India. Survey questions pertaining to income, fuel use, and fuel type were gathered.

Keywords

Social Sciences; Economics; Rural Development; Fuel Subsidy; Household Energy

Introduction

Fuel, one of life's necessities, plays an integral part in the workings of an Indian household. It runs tractors, irrigation pumps, and other agricultural machinery important to farmers. Fuels such as diesel and petrol are essential in the workings of the large agriculture sector in the rural parts of the country. Another important fuel is kerosene which is used as a source of light and cooking fuel for the lower economic strata of the country. Kerosene is a driving force for rural India.

For this paper, fuel is to be considered as a basket term, which contains three different fuel sources: petrol, diesel and kerosene.

From 2020-2023, fuel prices sharply rose, specifically in Uttar Pradesh. In thIs Indian state, the price of diesel increased from 62.87 rupees per litre in April 2020, to 89.74 rupees per litre in 2023.[1] Petrol meanwhile increased from 71.92 rupees per litre to 96.62 rupees per litre in 2023.[2] The cost of diesel and petrol increased in 2020 due to increased government tax rates on these fuels. This was done to cope with the loss of government revenue from other sources due to the COVID-19 pandemic.[3] There has also been an increase in the price of kerosene, caused by supply shocks and increased inflation in the country. The supply of kerosene has drastically reduced in Uttar Pradesh, as the Indian government's Ujjwala Yojana initiative has been attempting to minimise kerosene usage in the country in hopes of shifting rural India towards a cleaner energy source: Liquid petroleum gas (LPG). Furthermore, the price of kerosene had risen due to the government halts in fuel subsidies.

Furthermore, fuel rates increased exponentially in 2022 in Uttar Pradesh due to earlier price freezes during state elections.[4] This freezing of prices was done when international prices for

crude oil were extremely high during the Russian invasion of Ukraine. Therefore, this sudden unfreezing in the state led to an exponential increase, as shown in *Figure 1.*

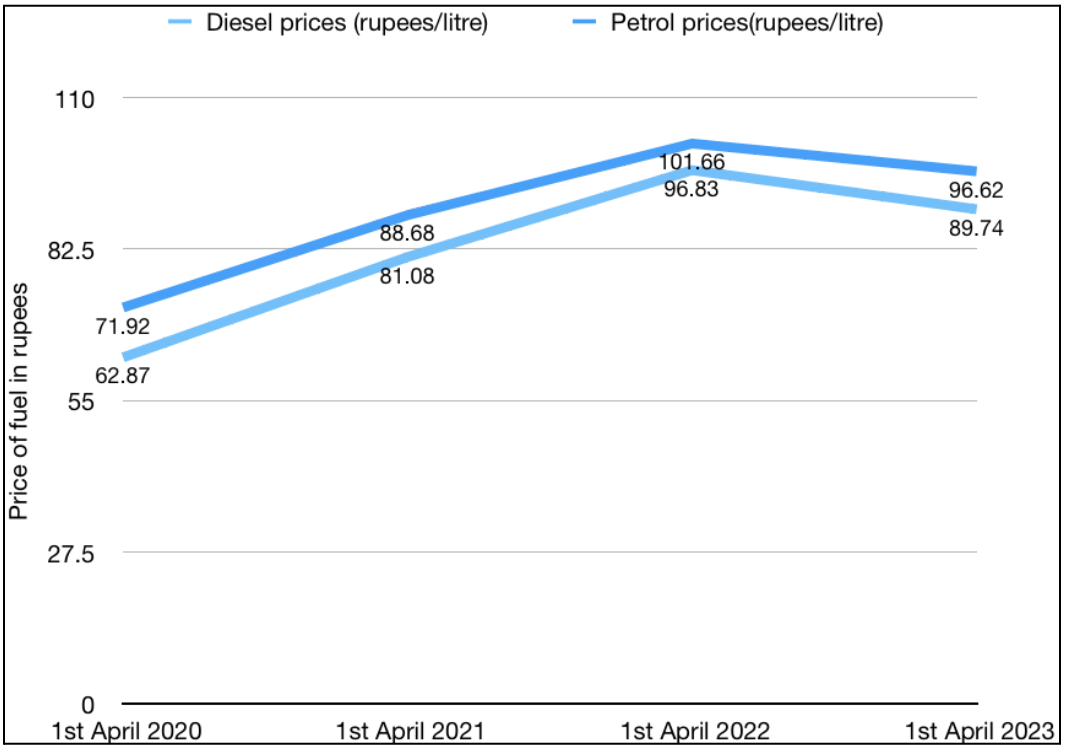

Figure 1: The graph above showcases the trend in the price of diesel and petrol in the state of Uttar Pradesh from 1st April 2020 till 1st April 2023. The price of the fuel is in the y axis, in the unit of rupees per liter while the x axis represents the dates throughout the three years.

The voluntary supply shocks of kerosene evolved in multiple states - including Uttar Pradesh. The government hoped to shift India through the “Pradhan Mantri Ujjwala Yojana” programme. The Pradhan Mantri Ujwala Yojana's goal has been to increase the use of LPG in the country, by reducing the amount of solid fuels being burnt as cooking fuels. To further this programme's goal, the government has been reducing the supply of kerosene in the country, as stated in the introduction.

However according to Farzana Afridi (2021), despite rapid increases in LPG access in rural areas and subsidised LPG refill consumption, regular LPG use in India remains low. In June 2019, the paper talks about how average annual usage of LPG in rural households remains less than half of what it is thought to be to eliminate solid fuels use. The main causes of this low LPG use are the lack of information regarding the health and subsidy benefits of using the fuel, as well as household financial constraints. The state of Uttar Pradesh voluntarily surrendered 68,632 kl of kerosene on the 7th of October 2019.[5] This led to Uttar Pradesh receiving 75,764 kl of kerosene in the 4th quarter of 2019.[6] The kerosene distributed to Uttar Pradesh was further reduced to 52,969 kl in the 2nd quarter of 2020.[7] Finally, the kerosene distributed in the 4th quarter of 2020 was 0 kl. This sudden decrease in kerosene supply caused a spike in the prices in the state.

Rising fuel prices can trap people in poverty in a country by significantly burdening households with limited incomes. As fuel prices increase, transportation costs escalate, affecting the prices of essential goods and services. This leads to a higher cost of living, making it increasingly difficult for low-income individuals and families to meet their basic needs. The additional financial strain can push people closer to or deeper into poverty, as a substantial portion of their income is allocated to fuel expenses. Moreover, rising fuel prices can have a resulting effect on the overall economy, leading to inflationary pressure. This can reduce the purchasing power of individuals, making it harder for them to afford essential goods and services. Additionally, sectors dependent on fuel, such as agriculture and transportation, may suffer greater, leading to reduced job opportunities and further hindering individuals' ability to escape poverty. Therefore, rising fuel prices can perpetuate poverty traps by negatively affecting economic stability in a country.

Furthermore, due to the inaccessibility of kerosene in Uttar Pradesh, households are forced to switch to more unhealthy fuel sources such as wood, dung cakes, and plastic. The reason for this is that the majority of the population do not have LPG and electricity connections as alternative methods for cooking fuel and light (respectively). This leaves them vulnerable to unhealthy and potentially life threatening gasses.

Thus, this paper explores:

1. **How have rising fuel prices affected the fuel consumption and financial decisions of households in rural India?**
2. **How much are households willing to pay for fuel, and should the government subsidise it once again?**

The Pradhan Mantri Ujjwala Yojana's goal has been to increase the use of LPG in the country, by reducing the amount of solid fuels being burnt as cooking fuels. To further this programme's goal, the government has been reducing the supply of kerosene in the country, as stated in the introduction. However according to Farzana Afridi (2021), despite rapid increases in LPG access in rural areas and subsidised LPG refill consumption, regular LPG use in India remains low.[8] In June 2019, the paper talks about how average annual usage of LPG in rural households remains less than half of what it is thought to be to eliminate solid fuels use. The main causes of this low LPG use are the lack of information regarding the health and subsidy benefits of using the fuel, as well as household financial constraints.

Despite the subsidy, the cost of LPG can still be high for poor households in India. The results of the study highlighted the financial constraints that rural households face in India. Moreover, the system of implementing an LPG connection to a household can be seen as capital intensive for the lower economic strata of India, as there is an upfront cost of 3200 rupees (45 USD). This is approximately 47.8% of the household income in the Bulandshahr district, Uttar Pradesh. According to another study done by the Council of Energy, Environment and Water (CEEW; 2019), it was indicated that if LPG was used exclusively as the cooking fuel, a typical household would have to allocate a significantly higher share of its overall monthly expenditure, approximately 9.3% in rural India.[9]

This 2019 paper highlights a similar issue to the usage of only LPG: that it is too expensive for households to use as their only source of cooking fuel. This point has been further presented in

another paper written by Farzana Afridi (2023) where her analysis shows “while 67.5% of the sample reported using LPG for cooking in the “previous month”, a large share of households report also using dirty fuels (74.8% firewood, 87.8% dung cakes, and 11.3% crop residue) for cooking”.[10] Households tend to use solid fuels frequently and regularly for cooking regardless of LPG account status.

Farzana Afridi (2023) explains how the lack of awareness regarding the health benefits and the subsidy of LPG has caused many not to use their LPG connections regularly, as households assume the LPG connection was a one time “gift” by the government.[11] An LPG connection refers to the provision of access to liquefied petroleum gas (LPG) for domestic use. LPG is a flammable hydrocarbon gas that is commonly used as a clean-burning fuel. In the context of the Pradhan Mantri Ujjwala Yojana Programme, an LPG connection refers to providing households with the necessary equipment such as a gas cylinder, regulator, and pipes in order for them to access and use LPG safely and conveniently for cooking.

The results of the paper show that the sample group which received both the health and subsidy information were the most likely to refill their LPG purchase. To explain, the experimental group–which was only provided with the health benefit–was seen to have behavioural changes that reduced smoke inhalation in households. These results were similar to Madajewicz (2007) in which households in Bangladesh which used arsenic contaminated wells were more likely to switch to a safer source of water once the well was marked unsafe.[12] The information provided to the households in Bangladesh led to a change in their behaviour regarding the source of water they would use. These results show the impact of the unawareness of health benefits, not only in the area of energy.

Furthermore, the findings shown in Afridi’s research highlight the complementarity between health and subsidy awareness. Another group which was presented with both the health + the subsidy information showed the largest increase in LPG refills. This further suggests the importance in increasing information dissemination regarding the subsidy. It also shows the key role that financial constraints play in household decision making regarding chosen fuel sources.

Therefore, Farzana Afridi suggests looking towards “a relaxation of financial constraints with new access to female employment and income”, (Afridi 2021), which can be seen as a fix that would help nudge households towards using cleaner fuels; however, it is not proven that an increase in female employment would lead to a greater usage of cleaner fuels.

Methods

To investigate the research question comprehensively, primary and secondary data was acquired and analysed. Since the paper examines how “**How have rising fuel prices affected the finances and consumption decisions of households?**” It is important to understand the cause of increased fuel price over the last three years in Uttar Pradesh.

For this, secondary data was collected, which consists of papers, blogs, government sites and data think-tank websites. A literature review was done for these papers to understand the cause of price increases and critically understand the roles that the income effect* and the substitution effect** have played in household consumption decisions over the last three years. It is also important to observe the changes in fuel prices in the state of Uttar Pradesh from the time span of 2020-2023, along with changes in average wages/income.

To understand the extent of the income effect and substitution effect, primary data is crucial to collect. This was done through a survey, a wealth index and an expenditure table. The survey consisted of 14 questions found in *Table 1* below:

1. What is the number of household members you have?
2. What is the number of household members at the age of 17 or under?
3. What is your household income per month?
4. What are your areas of expenditure per month?
5. Do you think your expenditure in these areas has changed over the last 3 years?
6. In what daily activities do you use fossil fuels (such as kerosene, diesel, petrol, coke/coal)?
7. In the activity of cooking, what source of energy did you use earlier (3 years ago)?
8. Now, has the amount of this energy source increased, decreased or stayed the same?
9. If it has decreased, what alternatives have you started to use more in the area of cooking?
10. What source of energy did you use as a source of light earlier (3 years ago)? (To be used as a form of light to study, or to have a lit home for dinner, or having company over)
11. Now, has the amount of this energy source increased, decreased or stayed the same?
12. If it has decreased, what alternatives have you started to use more?
13. What is your monthly expenditure on fossil fuels?
14. Do you think fuel is more expensive now, or was fuel more expensive a year ago?

Table 1: List of Survey Questions

Each question was asked to uncover differences in the following household variables from 2020 to 2023:

- The change in income
- The daily fuel usage
- Whether there was a change in the cooking fuel
- Whether there was a change in the fuel used for a light source
- What the population would be willing to spend on fuel

Along with these results, the sampled population, from the district of Bulandshahr, Uttar Pradesh, were asked to fill in a wealth index survey. The purpose of the wealth index was to find out the approximate wealth of the person sampled, considering that those with higher wealth would be less affected by price changes than those that have a lower wealth level. Considering

the area of study is one of the poorest districts in India, the difference between high levels of wealth and low levels of wealth is marginal at best.

The sample of the population surveyed are farmers that send their children to a (Non Governmental Organisation) NGO school called Pardada Pardadi Educational Society. The significance of mentioning the group sampled allows us to control another indicator of wealth, which is whether the household sends their children to school with no tuition cost. This sample population was specifically targeted due to the relationship with the school and a lesser reluctance for these families to share private information in surveys. A significantly large sample of 201 households were surveyed, which were randomly selected within the sample population, thus allowing the results of this paper to be generalised to the sample population. To limit the variability of the results, certain control variable questions were asked:

- Whether the household was under the Pradhan Mantri Ujjwala Yojana government scheme
- What material is the house made of
- Number of household members
- Number of household members 17 years old or younger.

These variables are important to consider since the number of household members could affect the amount of resources a household would have. For instance, a house with 10 members could have better housing infrastructure due to a greater collective income. The number of household members 17 years or younger provides us with the relevant data needed to understand the number of dependent members in a household. After analysing the survey data, an evaluation of whether the government should subsidise kerosene was completed

Results and Discussion

The data for the graphs were collected through the wealth index and the question survey. The 201 responses were then tabulated and multiple graphs were drawn to show correlations of different parameters of the survey and the wealth index score.

Participation in the Government Program

Overall, the graphs constructed to support the literature review and the introduction proved to be helpful. This can be seen in *Figure 2* which represents the number of households under the government LPG subsidy programme. This is important as it justifies the point made in the literature review regarding the lack of families under the LPG programme.

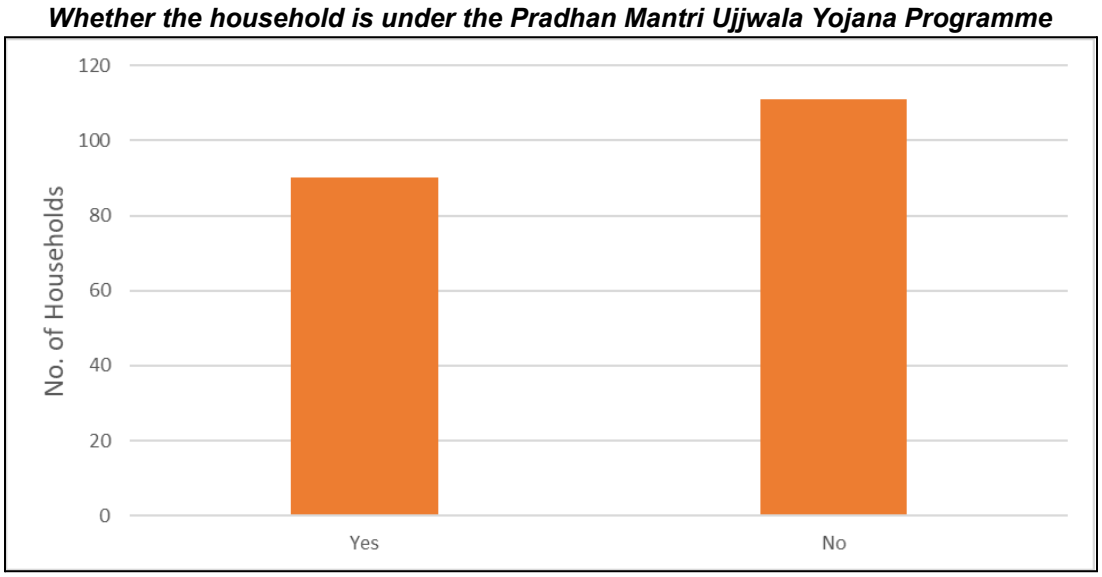

Figure 2: The plot above shows a bar graph to identify the number of households under the government subsidy programme.

As seen in *Figure 3*, out of 201 farmers, only 90 are under the government programme. This justifies the point made in the literature review regarding the lack of families under the LPG programme because households are forced to use cheaper, more toxic alternatives. If we extrapolate the results of this graph, we can see that despite 31,40,00,000 crore families having been provided an LPG connection, a large portion of the Indian population has not installed LPG pipelines in their houses.

Regarding the following chart, results between the average wealth index score for a family under the government subsidy scheme and a family not under the scheme is shown.

Average Wealth Index Score vs Whether the household is under the Pradhan Mantri Ujjwala Yojana Programme

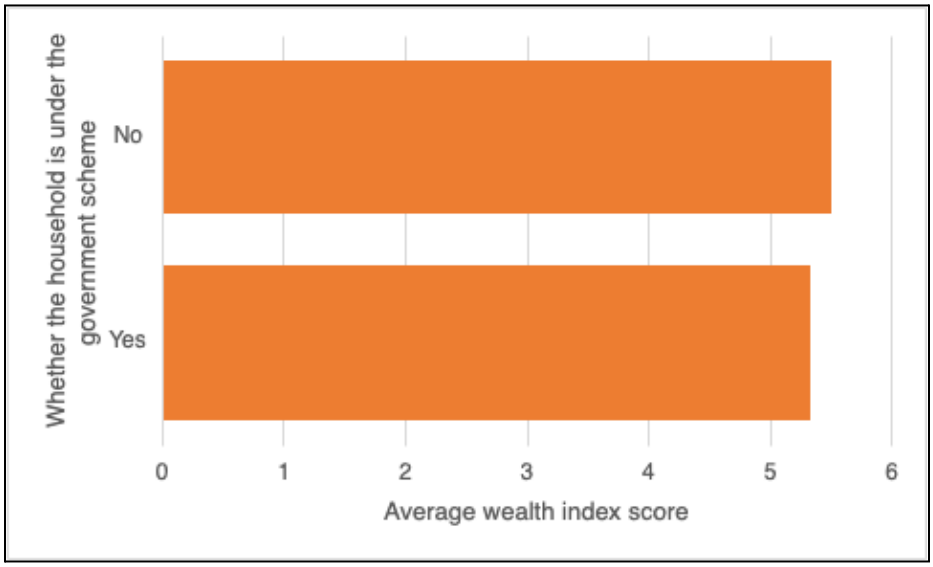

Figure 3: The graph represents a bar graph showing the average wealth index score for a family under the government subsidy scheme and a family not under the government subsidy scheme.

Households under the subsidy programme have a lower wealth index, which could possibly be reasoned to lack of income to spend on wealth indicators such as beds, chairs and other parameters considered in the wealth index, hence leading to a lower score. This claim is made with the assumption that those with an LPG connection are more likely to purchase the gas more frequently that those households without the connection.

As the bar graph shows, the average wealth index score for families not under the government subsidy scheme can be seen as larger than those under the government scheme. Although the difference in the average wealth index is only marginal, this may support another claim made in the literature review and the introduction: LPG is too expensive.

Changes in fuel use and income over time

In *Figure 4*, it can be seen that over the last three years the survey responses show a decrease in the usage of LPG from 84 (out of 201) in 2020, to 77 participants using the source regularly. Moreover, there was a slight decrease in the usage of dungcakes, from 185 out of 201 participants using it in 2020 to 166 participants using the source on a regular basis in 2023. In 2020, 73 out of 201 survey respondents were using firewood as a source of cooking fuel, however there was a decrease in its usage for 29 participants until 2023.

Three years ago, 121 out of 201 survey responders used kerosene as a source of fuel for cooking; however, now, only five responders use kerosene as a cooking fuel source. Moreover, 101 out of 201 survey responders used kerosene as a source of fuel for light. However, now, only 18 responders use kerosene as a light source.

Number of participants using kerosene (in a 3 year span) vs Type of activity

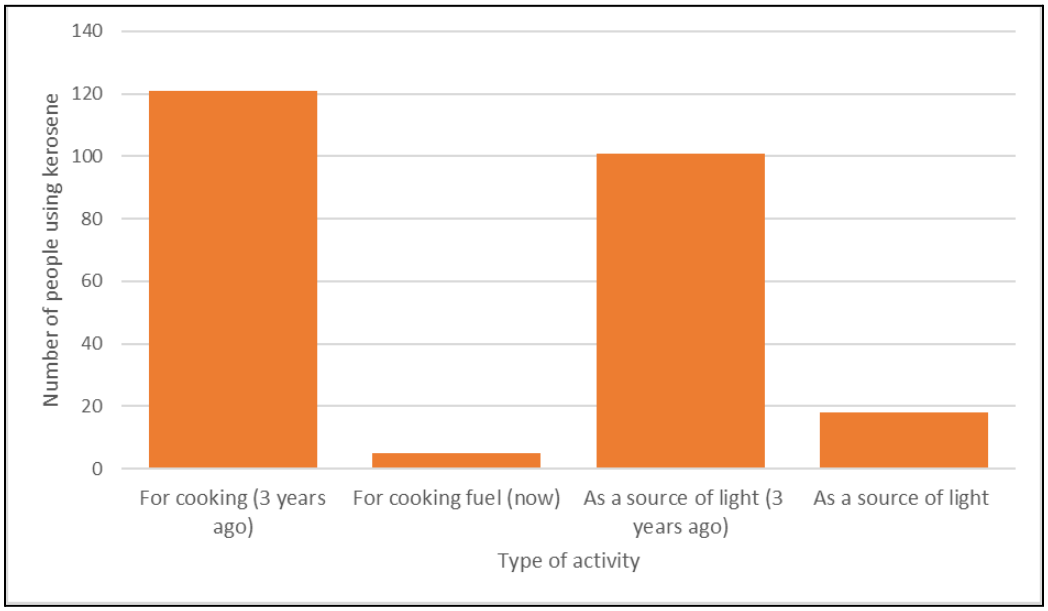

Figure 4: The graph above shows the change in kerosene usage over the last three years as a source of light and cooking fuel

The increase in price due to supply shocks has subsequently decreased the quantity demanded of kerosene. The graph shows the drop in the usage of kerosene as a source of light and as a cooking fuel.

Additional analysis shows that a single fuel is rarely used for cooking. Rural households utilize a combination of fuel sources and see a decrease in the usage of LPG. There is also a greater percentage of the survey responders using dung cakes as a source of fuel, approximately 82.5% in 2023. This can be attributed to the stark rise in kerosene prices, forcing many to increase their consumption of solid fuels such as dung cakes.

The results from the change in income is also extremely interesting as shown in *Figure 5*. The average income three years ago was 165.8209 rupees (USD 1.99) per day. Whereas now, the average income is reported to be 223.1343 rupees (USD 2.68) per day, and 23 participants of the sample surveyed showed an increase of income greater than the average change of 57.3 rupees per day.

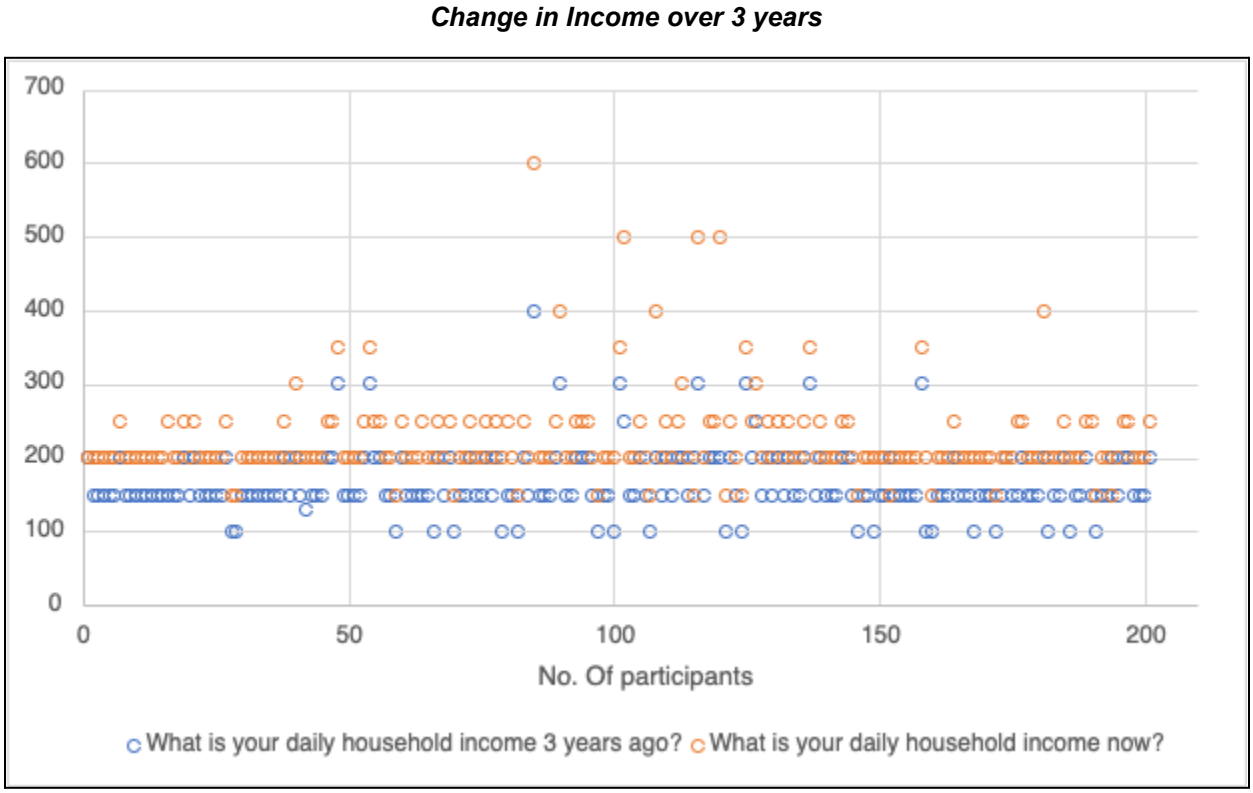

Figure 5: The graph above shows the daily income of each farmer sampled 3 years ago and their income now. The graph shows a clear indication that the daily income now is much greater for most farmers than their income 3 years ago. More specifically, out of the 201 sampled, 198 survey responders showed an increase in their average daily income. While 2 responders showed no change, and for 1 person, the change in income was negative.

Due to the large proportion of the survey responders showcasing a positive change in their income, it is possible that people have higher incomes to make up for the higher prices. However, due to the marginal change in the average income, it is possible that any increase played no role in affecting the quantity demanded of fuel for households.

Willingness to pay and perceived fair price for fuel

The percentage of people surveyed who believe fuel is more expensive now is 99.00498%. This provides evidence for an increase in fuel prices over the last three years. Furthermore, the average expenditure on fuel is 346 rupees (monthly), while the average reasonable price reported for fuel is 260.199 rupees (monthly) among the survey respondents. By analysing the survey data, we are able to learn that 98.5% of the survey respondents believe that their total expenditure has increased.

According to a distributor in West Uttar Pradesh, kerosene prices are 120 rupees per liter, while the average monthly expenditure on the basket of fuels is 346 rupees. This shows that one liter of kerosene covers 34.6% of the monthly expenditure on fuel. Hence, we can conclude that the prices are way too high and must be reduced. Therefore, the government must subsidise this particular fuel source, since their initial plan to promote LPG has not created a significant enough impact to completely reduce the usage of solid fuels. Stopping the supply of kerosene

was not the solution as evidenced by the results of this research showing an increase in the usage of solid fuels such as dung cakes, instead of a greater increase in LPG usage.

Conclusion

This paper documents the cause of the rise in fuel prices in Uttar Pradesh. It discusses how such rises have subsequently affected fuel consumption decision-making for rural households in India. It has been found that kerosene price increase has been caused by massive supply shocks by the state government, and that the state's complete stoppage of the kerosene subsidy. Furthermore, high price fluctuations in the fuel sources diesel and petrol have been caused by political influence when the Uttar Pradesh government froze prices during the global fuel price instability from Ukrainian-Russian wars. Moreover, the government implemented the increase in kerosene prices to reduce this fuel usage and promote the use of LPG. The usage of LPG as a cooking source was further promoted through the government subsidy Pradhan Mantri Ujjwala Yojana. However, as seen in the literature review, there are still many areas where the government must improve this subsidy program for fuel sources. These areas include a lack of information regarding the health and subsidy benefits of using fuel and the financial constraints of households. Due to the rising kerosene prices, households were forced to switch to solid sources, such as dung cakes and firewood which can cause health and environmental problems.

As the results show, the survey responders spend an average of 364 rupees per month on fuel and believe a reasonable price is 260 rupees per month. Therefore, the government could possibly subsidise fuel at least 100 rupees. This subsidy amount could be larger, based on the argument that higher prices over the last three years have led households to use less than necessary fuel in their day-to-day lives. If this is true, the subsidy rate should be greater than 100 rupees monthly. Implementing this subsidy would be difficult (since fuel has been considered a basket term for diesel, petrol and kerosene) but practical. Since the Ujjwala Yojana program is a “cash back subsidy” program, instead of a direct subsidy on the gas, households will not be able to afford it, as rural households in India are not liquid in cash (Afridi, 2023). Hence, the government could use another method of providing a subsidy, for instance:

1. Give rural households monthly "vouchers" of 100 rupees that they must use on fuel. This method is simple and easy, allowing homes to spend on any fuel necessary, excluding solid fuels such as dung cakes.
2. Make it mandatory that households provide proof that they have spent money on fuel. Since the infrastructure is already constructed for this through the Ujjwala Yojana, the government can use it.
3. When the proof is approved, households automatically receive monthly vouchers for three months. By providing vouchers for three months, any technical delays in approval would not negatively affect the lives of families, as we would recommend they send the proof every month.

This subsidy method would help rural households in states such as Uttar Pradesh.

Although the Pradhan Mantri Ujjwala Yojana programme has done well in increasing the access to clean cooking fuel through financial support, LPG is still too expensive for households to refill

throughout the year. Furthermore, there is a need for effective awareness and education campaigns to ensure safe usage of the fuel.

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*Income effect: The change in the quantity demanded of a good or service resulting from a change in consumer real income, assuming all other factors remain constant.

**Substation effect: The change in the quantity demanded of a good or service due to a change in its relative price compared to other goods, assuming consumer income and preferences remain constant

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