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ADBI Working Paper Series

EMPOWERED WOMEN PRIORITIZE THE ENVIRONMENTAL AND HEALTH IMPACTS OF FUEL CHOICE: EMPIRICAL EVIDENCE FROM CENTRAL ASIA

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Abstract

Women face substantial and specific challenges from the use of solid fuels. The persistence and prevalence of traditional gender roles in many societies mean that women and girls are often responsible for gathering and managing solid fuel supplies. Significant time and effort is required for collecting solid fuels, and using them for domestic purposes increases exposure to the health risks of household air pollution and could limit educational and employment opportunities. As a result, strategies to address energy poverty and advance the green transition need to pay particular attention to women's empowerment, including improving their access to energy, reducing their dependence on polluting fuels, and ensuring their representation in energy decision-making processes. To investigate the energy choices of the energy-poor population, we conducted a survey of 1,522 households from the Fergana Valley in three Central Asian countries: eastern Uzbekistan, the southern Kyrgyz Republic, and northern Tajikistan. The majority of household heads explicitly acknowledge that fossil fuels are harmful for the environment and/or the health of their families. Nevertheless, most prioritize financial costs, the reliability of their energy supply, or their existing heating system in their fuel choice. The empirical evidence shows that employed females are more likely than employed males to prioritize the environmental and health impacts of fossil fuels. This provides evidence of the importance of female empowerment through employment for promoting energy transition.

Keywords: gender, female, Central Asia, heating, fossil fuel, air pollution

JEL Classification: G50, G51, G53

Contents

1.	INTRODUCTION.....	1
2.	LITERATURE REVIEW.....	4
3.	DATA AND METHODOLOGY.....	8
3.1	Data and sampling	8
3.2	Dependent Variable: Green Prioritization.....	10
3.3	Gender	13
3.4	Employment	13
3.5	Children	13
4.	RESULTS.....	14
4.1	Main Results.....	14
4.2	A Blinder–Oaxaca Decomposition.....	18
4.3	Robustness check: Regression.....	18
5.	CONCLUSION	20
	REFERENCES	21
	ANNEX A	26

1. INTRODUCTION

The use of solid fuels for cooking, heating, and other domestic purposes remains a material reality for significant proportions of the global population, particularly in developing Asia and the Pacific. Despite recent progress, between 2.3 and 3.0 billion people worldwide—over a third of the global population—continue to rely on coal, wood, crop waste, dung, and other biomass to fulfil their basic needs (Stoner et al. 2021; McCarron et al. 2020). Global averages conceal significant variations across regions. For instance, between 1.2 and 1.6 billion people in developing Asia and the Pacific continue to use solid fuels as their primary source of energy (IEA 2019) (ADB 2023). This accounts for more than half of those globally without cleaner options. This causes substantial harm to human health and environmental sustainability. The emission of harmful particulate matter contributes to mortality and morbidity risks in the form of respiratory illness, cardiovascular disorders, and cancer (WHO 2016; Kenessary et al. 2019; Kankaria et al. 2014). Across the globe, between 2.8 and 4.0 million people die from indoor air pollution¹ each year, and more than a million of these deaths are in the People's Republic of China (PRC) (ADB 2023) (C. Li and Zhou 2020). Most of those deaths are due to fuel combustion: in 2020, 3.2 million deaths were caused by indoor air pollution from using combustible fuels (WHO 2023). This has broader consequences for climate change, with the widespread burning of wood and open fires accounting for roughly 2%–3% of global CO₂ emissions (ADB 2023). This is roughly the same proportion of total worldwide emissions as those from all civil aviation combined (Ritchie 2024). Fuel combustion by households (direct emissions) is one of the major sources of global GHG emissions (Gómez, Dopazo, and Fueyo 2015; ADB 2023). The excessive extraction of solid fuels and firewood also contributes to deforestation and ecosystem degradation (Mishra et al. 2024).

Central Asia is at the forefront of the intersection between the use of polluting fuels, environmental sustainability, and human health. This is partly a function of geography and climate. Heating and cooling are critical for human life, health, and well-being amid substantial fluctuations in temperature, from up to 35°C in summer down to –20°C in winter. This is compounded by long “heating seasons”, which last for between four and six months (Azhgaliyeva et al. 2021). A sparse population is dispersed across a vast landmass, raising issues for infrastructural electrification and gas connectivity, and amplifying rural–urban divides. The region is also highly exposed to climate change. An arid landscape coexists with growing exposure to extreme precipitation and flooding events, and many Central Asian countries face water scarcity challenges (Wei and Lin 2024). Household dependence on solid fuels for heating and cooking is high in the region. Kazakhstan ranks second in the world for coal consumption per capita, at an average of 157 kg per year (Kerimray et al. 2018). In the Kyrgyz Republic, 72% of households use solid fuels for heating, while the figure is 30% in Kazakhstan (Azhgaliyeva et al. 2023; Azhgaliyeva et al. 2021). The usage increases in winter, in rural communities, among those with lower incomes, and in larger households (Kerimray et al. 2020; Kapsalyamova et al. 2021). The Fergana Valley provides a practical illustration of these trends, and a sound basis for further exploration in this study. This encompasses eastern Uzbekistan, which accounts for some 60% of its overall territory, as well as parts of the south of the Kyrgyz Republic and northern Tajikistan (Koparkar 2019). The mountains that surround the valley cause temperatures in summer to be higher as heat is trapped within the valley and

¹ Indoor air pollution includes not only pollution from fuel combustion but also pollution from other sources such as smoking.

temperatures in winter to be lower because of stagnant air currents (Mashrabovich 2021). The Fergana Valley is home to roughly 14 million people, equivalent to 20% of the total population of Central Asia. The region is characterized by its comparatively productive agricultural land and relatively advanced level of industrial development (Kurbanov 2021). There is a relatively high incidence of poverty, which ranges between 38% and 50% in parts of the Kyrgyz Republic and Tajikistan, and a widespread dependence on remittances (ibid).

Women are disproportionately exposed to the economic, health, and environmental challenges associated with the use of polluting solid fuels. Women frequently bear a greater responsibility for the collection, transportation, processing, and use of fossil fuels for domestic purposes (Mishra et al. 2024; Foell et al. 2011). Globally, this amounts to a daily average of two extra hours spent gathering biomass, and three extra hours of cooking, preparation and tending to the fire for heating (IEA 2021). This entrenches existing gender inequalities, limits educational and employment prospects, and increases women's physical security risks when gathering and transporting biomass, with an overall cost estimated at \$0.8 trillion annually (R. H. Acharya and Sadath 2019; IEA 2021). Household air pollution (HAP) carries particularly severe health consequences for women, who generally spend more time performing domestic tasks and in residential spaces. Women and children account for 60% of premature deaths from HAP, and indoor pollution is the third most prominent cause of early mortality for these groups globally (IEA 2021; WHO 2023; UNICEF 2024). Women also face a higher incidence of energy poverty, due to lower incomes and education levels, higher rates of unemployment and more constrained labor force participation, and limited decision-making power with respect to household finances and fuel selection (Gould and Urpelainen 2020; Moniruzzaman and Day 2020). Even when the household head is employed, a female-headed household is more likely to fall within a lower income bracket, making it more sensitive to rising prices (ADB 2012; Dim 2023). This may exacerbate access and affordability challenges, and increase reluctance to incur the upfront costs and short-term price rises that can be associated with switching to a more climate-friendly household fuel. Taken together, this underscores the importance of women's empowerment in the green transition. In particular, women's employment often raises the opportunity costs of solid fuel collection and consumption, increases income, and enhances intra-household decision-making power, which work in conjunction to accelerate and broaden the adoption of more climate-friendly alternatives.

The dynamics of household fuel use are complex, with several barriers confronting efforts to transition from polluting solid fuels to more sustainable alternatives. Evidence from the Kyrgyz Republic suggests that access to gas and electricity is a central determinant of fuel switching (Sabymbekov and Ukueva 2019). Both the coverage of energy networks and the consistency of electricity supply is crucial in this respect, with power outages creating obstacles to shifting away from solid fuels (Azhgaliyeva et al. 2021). Affordability also presents a key challenge, with 28% of households spending more than 10% of their income on energy—a widely-used indicator of affordability and energy poverty—even in resource-rich Kazakhstan (Kerimray et al. 2018). Both access and affordability constraints are heightened in rural areas, which are more isolated from power grids and host a higher proportion of low-income groups (M. Li and Zhou 2023). Sociocultural and demographic factors may also play a role, with larger, less educated, and older households less likely to adopt cleaner fuels (Pallegedara, Mottaleb, and Rahut 2021). Overcoming these barriers brings considerable social, economic, and environmental benefits for sustainable development in Central Asia and beyond. Given the immense proportion of household solid fuel consumption in Central Asian energy portfolios, switching from coal to gas in Kazakhstan by 2030 has the potential to reduce

CO₂ emissions by 93% and PM_{2.5} by 88% from 2018 levels (IEA 2020; Kapsalyamova et al. 2021). Fuel switching has the capacity to reduce the number of deaths from air pollution by 4,500 and save up to \$3.5 billion dollars in public health expenditure in the Kyrgyz Republic alone (Landrigan et al. 2018; Azhgaliyeva et al. 2021). The adoption of cleaner alternatives can also enhance educational outcomes and unlock productivity gains, through reduced pollution exposure and less time spent gathering and burning solid fuels—especially for women.

The behavioral drivers of fuel use represent an emerging and increasingly essential subject of academic inquiry. Although the provision of climate-friendly alternatives and access to cleaner energy sources are necessary preconditions for fuel switching, research has demonstrated that they are not sufficient (Akintan, Jewitt, and Clifford 2018; Jewitt, Atagher, and Clifford 2020; McCarron et al. 2020; Kapsalyamova et al. 2021). The transition away from polluting solid fuels in households also depends on environmental knowledge and awareness, individual behavior and decision-making, and the structure and composition of social networks. Information campaigns have proven useful in broadening public understanding of the dangers of solid fuel consumption and promoting energy conservation practices (Steg 2008; McCarron et al. 2020). Forging social acceptance and trust of new thermal and cooking technologies represents a vital enabling factor in promoting sustainable fuel choices and altering behavior (IEA 2022). Larger and more open social networks, in concert with peer effects, have also been shown to accelerate the diffusion of greener fuels in rural communities (Gu 2022; H. Li et al. 2024).

The central objective of this article is to analyze the relationship between gender and green prioritization in the context of the Fergana Valley, building on the results of an in-person survey conducted among 1,522 households in Kazakhstan, the Kyrgyz Republic, and Uzbekistan. Green prioritization is defined as the level to which a household adopts climate-friendly alternatives to polluting solid fuels, within their existing circumstances. This novel concept combines ideational factors and environmental awareness with the material constraints that a household faces in shifting towards greener options, such as practical availability, employment, household structure, and economic affordability. Green prioritization can be conceived as the midpoint between environmental awareness of the risks of solid fuels and a wholesale shift toward green energy consumption. This is designed to reflect the complexity of household fuel use, highlight that many households are in an intermediate stage in the green transition, illuminate the barriers households face in this process, and capture the interplay between the expressed intentions and the realized behaviors of households.

The respondents were “household heads”, defined as those with decision-making responsibilities over financial and domestic matters. The research explores three key hypotheses that compare the green prioritization practices of female and male household heads: that green prioritization is more likely among female household heads *in general* (Hypothesis 1), among female household heads who are in employment (Hypothesis 2), and among female household heads with children (Hypothesis 3), in each case compared to their male counterparts. We find that gender alone does not have a statistically significant impact on the probability of prioritizing the reduction of environmental and health harm from solid fuel use. However, female household heads in employment are more inclined towards green fuel practices than employed male heads. Finally, households with children are in general more likely to engage in green prioritization, regardless of the gender of the household head.

The study's contribution to the literature arises from both its methodology and its results. *First*, in contrast to many studies in this area that use education level as a proxy for environmental awareness, as well as those that focus only on the actual consumption of climate-friendly fuels, our research conceives and measures green prioritization directly. The questionnaire provided to respondents was explicitly designed to explore the perceptions and motivations that drive green behaviors, within the context of a "choice architecture" in which households face many competing considerations and material constraints. *Second*, despite a wealth of literature associating women with cleaner fuel use, the outcomes of our survey suggest that gender on its own is an insufficient indication for green prioritization. This study brings together interaction variables such as women's employment status and children to assess how these may affect the prioritization of green fuel sources. This illuminates the complex intersections between gender, employment, and children, and demonstrates that these work in combination rather than in isolation to affect green prioritization. More broadly, there is a general lack of academic attention to the specific and complex dynamics of fuel choice in the Fergana Valley, which is a compact geographical area spreading across three countries from Central Asia that is heavily dependent on fossil fuels. This research has transferable lessons to Central Asia and beyond. While there is substantial engagement with the structural issues of access, affordability, infrastructure, and energy poverty in driving fuel use, this paper addresses the comparatively overlooked dimension of green behavior and prioritization. The drivers and dynamics of climate change in Central Asia are critically underexplored. One study of 13,488 articles on the region in eight leading journals found that only 0.24% focused on climate-related topics (Vakulchuk et al. 2023).

The remainder of this paper is structured as follows. The second section provides a literature review on the role of gender in energy and fuel choice. The third section sets out the survey data and the methodology underpinning its collection. The fourth section outlines the results emerging from the study and discusses their drivers and implications.

2. LITERATURE REVIEW

There is a significant body of literature analyzing the relationship between gender and household energy use, including its underlying demographic and socioeconomic drivers, its interplay with family structure and the employment status of household heads, and its embeddedness within a range of specific geographic, climatic, and infrastructural contexts. However, the vast majority of this literature focuses *either* on energy consumption, without examining the underlying reasoning behind household decision-making, *or* environmental awareness, without reference to the material conditions and constraints framing households' choices. This is because most literature relies on national household surveys, which provide an account of actual consumption and expenditure as well as education levels. An emphasis on energy consumption generally excludes consideration of household perceptions, while a focus on education levels serves as an imperfect proxy for environmental awareness. This article aims to address this gap by assessing green prioritization directly and through primary data collection from households, combining the material and ideational factors of fuel use, and unpacking the interaction between gender, employment, and children.

The gender of the household head represents a crucial determinant of green prioritization, given the distribution of roles and responsibilities around residential energy consumption. In particular, women-led households have regularly been associated with greener fuel choices than male-led ones (Aryal et al. 2019; Choudhuri and Desai 2020; Gould and Urpelainen 2020; J. Chen, Liao, and Zhang 2024; Mishra et al. 2024). As women are disproportionately responsible for residential tasks and fuel collection, granting them more decision-making capacity and bargaining power within the household can accelerate the transition toward more climate-friendly options (Gould and Urpelainen 2020; J. Chen, Liao, and Zhang 2024; Mishra et al. 2024). Women's access to salaried income is shown to be a further enabling factor, as the income provides them with the necessary financial autonomy and control over household expenditure to drive a shift toward cleaner fuels in the home (Choudhuri and Desai 2020). The diversity of economic resources available to women is also key, with those in rural areas relying more on non-farm sources of income more likely to pivot away from solid fuels (Aryal et al. 2019). Higher education levels among women household heads have also been positively associated with cleaner energy consumption patterns, likely due to enhanced environmental awareness and greater consciousness of the risks posed by household air pollution to children and themselves (ibid).

The socioeconomic features of households have also received widespread attention as crucial drivers of household energy preferences. This is grounded in the conception of the “energy ladder”, whereby households move from solid fuels such as timber and coal, through to oil and gas, and eventually to renewables-powered electricity sources as income rises and accessibility broadens (Leach 1992). Indeed, higher incomes are often associated with cleaner fuel use, including in South, Central, and East Asia (Hasan and Mozumder 2017; Wei and Lin 2024). Despite its continued usefulness as a starting point for analysis and a baseline framework for policymaking, several more recent studies have raised questions and cast doubt on the “energy ladder”. These have focused on the phenomenon of “fuel stacking”. In the Central Asian context, for instance, previous studies have shown that solid fuels are increasingly used in conjunction with electricity sources (Gassmann and Tsukada 2014; Kim and Standal 2019; Sabyrbekov and Ukueva 2019). This serves, at least partly, as insurance against volatile prices and an inconsistent electricity supply in both Uzbekistan and the Kyrgyz Republic (Kim and Standal 2019; Koirala and Acharya 2022). Urbanization is also often associated with a transition away from environmentally harmful and unhealthy energy sources, but also with an increase in aggregate energy consumption (Pachauri and Jiang 2008; Zheng 2023; Bhattarai et al. 2024). The relative salience in each of these factors varies across settings, according to the pace of migration to cities and the speed of the green energy transition at the country level. However, in the context of Central Asia, researchers have found only small gaps between rural and urban energy consumption (Wang et al. 2020).

Employment status, particularly as it relates to household heads, is also closely associated with household fuel choice. The composition of labor markets and access to employment opportunities is a fundamental precondition for shifting away from polluting solid fuels (Twumasi et al. 2020; Adusah-Poku et al., 2023; Zheng 2023). It provides women with greater economic empowerment and decision-making capacity within the household, and limits the amount of time they can spend collecting biomass and tending to domestic activities that rely on these sources (Sehjpai et al. 2014; Rahut, Behera, and Ali 2016; Gould and Urpelainen 2018). The consistency and stability of employment is also a key factor in green prioritization, since it makes longer-term investments less risky and more feasible (Sharma and Dash 2022; Zheng 2023). The income generated by more widespread employment prospects, more regularized

and formal jobs, and less reliance on unstable and fluctuating agricultural sources of income also equips households with the ability to internalize the upfront costs of adopting climate-friendly fuel options (Ma, Zhou, and Renwick 2019; Sun, Yang, and Qiu 2022; Chang and Zhang 2024).

The existing literature has identified a diverse range of sociodemographic determinants and residential characteristics underpinning household energy consumption patterns. The overall size of the household has regularly been demonstrated to be associated with fuel use patterns, with larger families across a range of jurisdictions exhibiting a stronger tendency to use solid fuels (Gould and Urpelainen 2018; Koirala and Acharya 2022). This may be due to such households having more residents available for collecting fuel, lowering the opportunity costs associated with this activity and blunting some of the key drivers of the transition toward cleaner alternatives—in the form of the comparative accessibility, availability, and time savings they represent (Narasimha Rao and Reddy 2007; Ngui et al. 2011; Alem et al. 2016). However, some studies suggest that this relationship may be more complex and non-linear than is portrayed in the mainstream literature (Pandey and Chaubal 2011; Rahut, Behera, and Ali 2017). The age structure of households has also been linked to fuel use patterns. Younger families have shown greater flexibility and adaptability to climate-friendly options, while older households appear more wedded to traditional solid fuels and entrenched in behavioral patterns that are more difficult to dislodge (Çelik and Oktay 2019; Sabyrbekov and Ukueva 2019; Kapsalyamova et al. 2021).

Family structure and the presence and number of children are also closely associated with green prioritization (Brounen, Kok, and Quigley 2012; Çelik and Oktay 2019; Majumdar, Koley, and Chatterjee 2023). Several studies have found that households with children are more likely to use cleaner forms of energy for the performance of domestic tasks (Kishore and Spears 2014; Gould and Urpelainen 2020). This could reflect a heightened sensitivity to the adverse health outcomes of polluting solid fuels once children are involved in household considerations. In addition, acknowledging that household air pollution negatively affects women during pregnancy, a shift has even been noted in some cases before children are born (Majumdar, Koley, and Chatterjee 2023; UNICEF 2024). However, others have noted that, once the number of children exceeds a certain threshold, this relationship may move into reverse (Chang and Zhang 2024). This is likely a result of a shifting division of labor within the household, where enlisting children to collect fuel becomes progressively more practicable and less costly as the number of children grows. The number of children also corresponds with women's education and employment status, rural and urban divisions, and household income—which interact in important ways with fuel consumption patterns.

Education levels, social perceptions and environmental awareness also represent a strong indicator of green prioritization (Narasimha Rao and Reddy 2007; Pandey and Chaubal 2011; Mottaleb, Rahut, and Ali 2017; Rahut et al. 2017; Rahut et al. 2019; Pallegedara, Mottaleb, and Rahut 2021; Dongzagla and Adams 2022). The education of the household head is a key determinant of environmental awareness, with a greater knowledge of the impacts of indoor air pollution leading to a stronger inclination towards cleaner fuel sources (Alem et al. 2016; Gould and Urpelainen 2018; Gould et al. 2020; S. Chen, Oliva, and Zhang 2022). However, this effect could be subject to intervening factors that are closely related to education, including income and urbanization. More educated households tend to have higher income, which both increases the opportunity cost of solid fuel collection and lowers the affordability constraints that limit the uptake of cleaner energy sources (Alem et al. 2016). A higher level of education is also linked to greater mobility, which enables households to move from rural areas with infrastructural deficits to urban locations with more integrated

energy networks (J. Chen et al. 2017). This blunts the barrier of access to, and practical availability of, alternatives, a barrier that can contribute to a persistent reliance on solid fuels. Less tangible, measurable and predictable sociocultural factors can also influence the shift to clean fuels, such as an emphasis on traditional practices, path dependencies and a status quo bias toward inertia, the degree of community openness to globalized communications, and individual, household, and business cultures (Baiyegunhi and Hassan 2014; Zhang and Hassen 2017; Lin and Wei 2024).

The specific features of geography and climate, the structure and composition of energy markets, and the sociotechnical systems of Central Asia also play a strong role in shaping the choice architecture facing households and their tendency toward green prioritization. Households represent a significant proportion of overall energy use in Central Asia—household energy use is 45% of the overall total in Uzbekistan, for instance (Gassmann and Tsukada 2014). This partly arises from the type of energy available, the energy intensity of household appliances, poor insulation, and heating needs amid extreme temperatures (Gómez, Dopazo, and Fueyo 2015; Kapsalyamova et al. 2021). Infrastructural development is a central determinant in the provision and availability of cleaner energy sources for households, and, by extension, a vital pathway to promote their uptake (Koirala and Acharya 2022; Wei and Lin 2024). This is particularly evident in relation to access to gas for cooking and heating in Central Asia. However, ageing infrastructure based on the use of solid fuels, which is widespread within the building stock and energy networks of the region, can inhibit progress toward greener options (Kapsalyamova et al. 2021).

An emerging strand of the literature focuses on the behavioral factors and green prioritization practices shaping household fuel use. Behavioral change represents a relatively rapid and cost-effective way to shift and reduce household energy consumption patterns, but it is difficult to predict and is reliant on the “choice architecture” within which people operate—from the existing energy infrastructure to price and market structures (IEA 2022). Green prioritization can take a diversity of forms, and can be situated within an “avoid–shift–improve” framework. This encompasses avoiding the use of dirty fuels, shifting the composition of energy sources consumed, and improving the underlying energy systems within which behaviors are pursued (Alexander and Yacoumis 2018; Creutzig et al. 2018; Kola-Bezka and Leki 2024). The underlying motivations and ultimate purpose of these practices also vary; they include limiting the risk of household air pollution, enhancing environmental outcomes, and reducing household costs (ibid). However, several behavioral factors run counter to green prioritization and can be “sticky” and resistant to change. Reliance on traditional factors and path dependencies are widespread, and economic, environmental or social crises are often required for them to be meaningfully shifted (Sabyrbekov and Ukueva 2019; B. Acharya and Adhikari 2021; Kola-Bezka and Leki 2024).

Overall, this paper analyzes the relationship between gender and green prioritization in the Fergana Valley in Central Asia. The study is designed to combine ideational and motivational considerations, sociodemographic drivers, and material conditions underpinning household energy choices. First, noting that prior knowledge of the negative health and environmental impacts of polluting solid fuels represents an essential condition in shifting toward greener alternatives, the survey assesses the environmental awareness of households. In contrast to many studies that deploy education as a proxy for environmental knowledge, this survey gauges environmental awareness through direct questions to participants. Second, the presence of children sheds light on the demographic structure of the households under analysis and shapes their fuel use decisions, given that children are particularly vulnerable to indoor

air pollution. Third, women's employment illuminates the material conditions facing households, including pivotal aspects of green prioritization such as affordability, income and access to finance, the availability of various options and the opportunity costs of solid fuel collection, and intra-household bargaining power. Women's employment is deployed as a proxy for women's economic empowerment. By coupling these considerations with gender and green prioritization, this paper seeks to unpack the complexity of household energy decision-making, the multiplicity of its underlying drivers, and the relationship between these drivers.

3. DATA AND METHODOLOGY

3.1 Data and sampling

The household energy survey was carried out in person in the territory of the Fergana Valley, which is located in three countries of Central Asia: eastern Uzbekistan, "the southern Kyrgyz Republic, and northern Tajikistan. This provides an ideal setting for analyzing the similarities and differences between three distinct populations and national energy systems, within a relatively concentrated geographical area. The survey was designed jointly by the Central Asian Regional Cooperation (CAREC) Institute, the Asian Development Bank Institute (ADBI), and the Public Opinion Research Institute in Kazakhstan. The survey was conducted during July and August 2023 following pilot tests.

The survey was designed to gather sociodemographic data on household characteristics, energy use, and green prioritization practices. In particular, the questionnaire sought information on energy consumption, access to energy for heating, cooling, and cooking, the quality of the energy infrastructure, energy efficiency, and environmental education. The survey also gathered data on households' heating methods and energy use behaviors, and assessed their willingness to switch to more climate-friendly sources of energy.

The respondents were "household heads", defined as those with decision-making responsibilities over financial and domestic matters. The proportion of female and male household heads included within the scope of the survey was roughly evenly split. The majority of those surveyed were drawn from rural households, which accounted for 63% of the overall total. Overall, 1,522 household heads responded to the questionnaire, with an approximately even distribution across those from Tajikistan (500), the Kyrgyz Republic (522), and Uzbekistan (500). The socioeconomic features of the households included within the survey are outlined in Table 1. A more detailed explanation of the sample population is provided in previous work by Azhgaliyeva et al. (2023) and the CAREC Institute (2024).

Table 1: Sample Distribution

Country	Provinces in Fergana Valley	Sample Size	SEC1 (lowest income)	SEC2	SEC3	SEC4 (highest income)	Rural
Kyrgyz Republic	Jalal-Abad, Osh, Batken, Osh city	522	3%	4%	34%	58%	75%
Tajikistan	Sughd	500	28%	8%	19%	44%	73%
Uzbekistan	Fergana, Namangan, Andijan	500	17%	14%	16%	50%	42%
Total sample		1,522	16%	8%	23%	51%	63%

Note: SEC – socioeconomic class/income group (see Table 2).

Table 2: Household Income Groups

	Kyrgyz Republic, KGS	Tajikistan, TJS	Uzbekistan, UZS
SEC1 (lowest income)	< 6,000 (USD\$67)	< 800 (USD\$72)	< 1,200,000 (USD\$98)
SEC2	6,001–12,000 (USD\$67–135)	801–1,400 (USD\$72–126)	1,200,001–2,000,000 (USD\$98–164)
SEC3	12,001–20,000 (USD\$135–226)	1,401–2,400 (USD\$126–216)	2,000,001–3,200,000 (USD\$164–262)
SEC4 (highest income)	> 20,000 (>USD\$226)	> 2,400 (>USD\$216)	> 3,200,000 (>USD\$262)

Note: in local currency and USD, set at mid-September 2023 when the original survey was conducted. Source for exchange rates to USD: <https://www.oanda.com/currency-converter/en/>.

The survey found that environmental awareness is already widespread in the Fergana Valley, with the majority of household heads explicitly acknowledging that fossil fuels are harmful for the environment and/or the health of their families (80.5% in the Kyrgyz Republic, 80% in Tajikistan, and 65% in Uzbekistan) (Figure 1). Despite these high levels of environmental awareness, however, many households continue to use fossil fuels. For this reason, we do not focus on the perceptions and awareness of the damaging environmental and health impacts of polluting fuels. Rather, we focus on the multiple underlying, and sometimes competing, priorities driving energy choice. A household may continue to use fossil fuels despite knowledge of their negative effects because of the economic costs of various energy sources, fluctuating energy prices, the reliability and consistency of supply, the existing energy infrastructure, and the availability of alternatives. That is why in this paper we focus on green prioritization, to situate environmental awareness and household behavior in the context of material conditions.

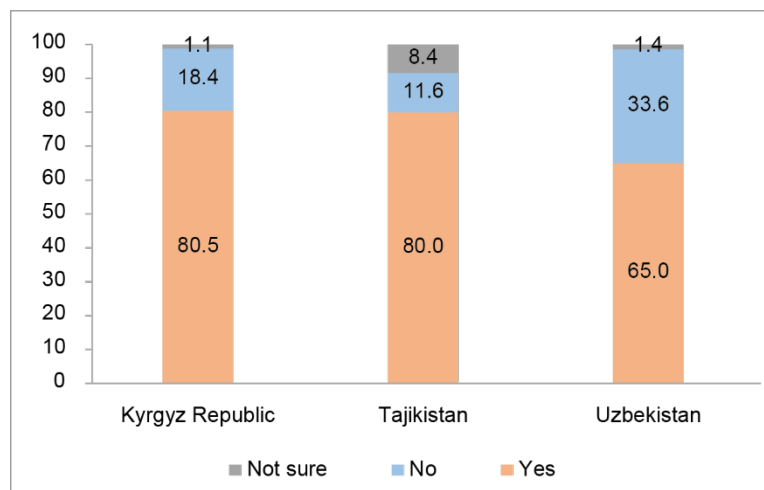
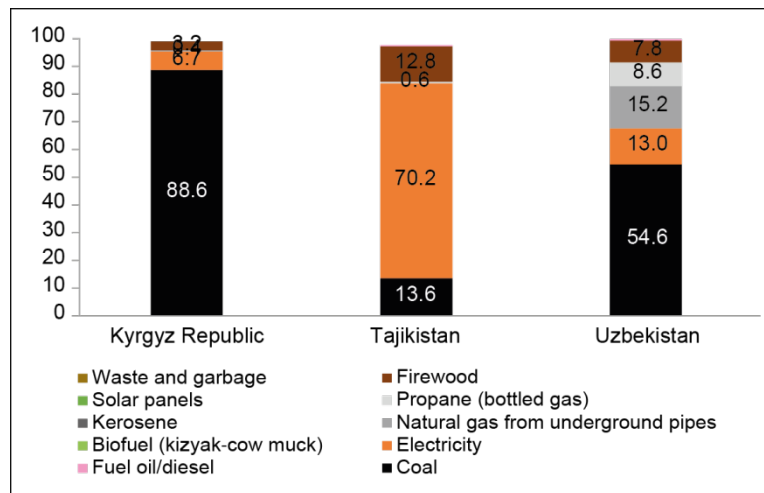
Figure 1: Awareness of the Damaging Impact of Fossil Fuel Combustion on Environment and Health

Figure 2: Main Fuel for Heating

3.2 Dependent Variable: Green Prioritization

Green prioritization is defined as the level to which the household adopts climate-friendly alternatives to polluting solid fuels, within its existing circumstances. This combines ideational factors and environmental awareness with the material constraints that the household faces in shifting towards greener options, such as practical availability, employment, household structure, and economic affordability. The majority of household heads explicitly acknowledge that fossil fuels are harmful for the environment and/or the health of their families. Nevertheless, the majority prioritize the financial cost, the reliability of the energy supply or their existing heating system in their fuel choice. The dependent variable—green prioritization—is a binary variable which equals one if the household head prioritizes reducing the environmental or health impact of heating, and zero if they make the choice of heating fuel based on the financial cost, the consistency and reliability of supply, and the legacy of their existing heating systems. In Central Asia, the choice of cooking fuel is generally driven by the choice of heating fuel (Azhgaliyeva et al. 2021).

Household heads who demonstrate higher environmental awareness of the negative effects of solid fuel use are more likely to adopt climate-friendly alternatives (Azhgaliyeva et al. 2021; Kapsalyamova et al. 2021). The existing literature often relies on the level of education as an indicator of environmental awareness (Alem et al. 2016; Gould and Urpelainen 2018; Rahut et al. 2019; Gould et al. 2020) (S. Chen, Oliva, and Zhang 2022). However, there are several reasons why this may provide an imperfect proxy. First, education interacts strongly with many variables that also drive fuel use, including employment, income, and urbanization. Second, education may have an indirect impact on household energy choices by raising the opportunity costs of fuel collection for household heads, rather than boosting their environmental awareness.

To address this limitation, our survey directly asked household heads what shapes their energy choices, in order to gain a stronger sense of the role and importance of green prioritization in their decision-making. Approximately one third of households surveyed suggested that their fuel selection practices were based on the most cost-effective option (32%), just over a quarter raised the continuity and stability of supply (26%), 12% grounded their choices in their existing heating systems and the upfront costs associated with switching to greener forms of energy, and 30% made decisions based on the fuels with the lowest environmental and health impact (Table 3).

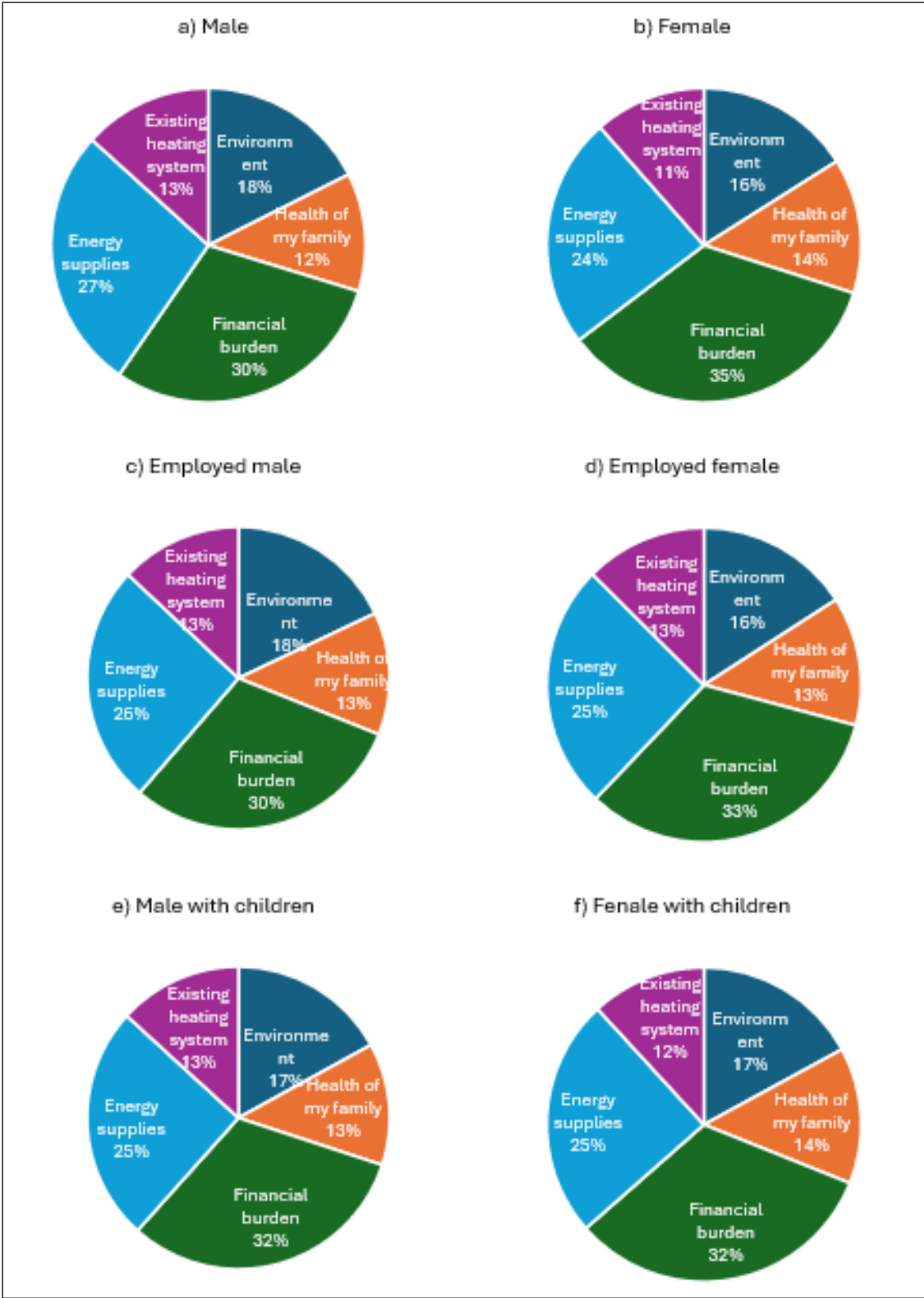
Table 3: Summary Statistics by Gender of Household Head

Variable	Female				Male			
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Green prioritization (=1 if prioritize environmental or health impact in the choice of heating fuel, zero otherwise)	0.50	0.50	0	1	0.51	0.50	0	1
Heating dirty (=1 if use dirty fuel for heating, zero otherwise)	0.56	0.50	0	1	0.62	0.49	0	1
Plan switch to clean (=1 if plan, zero otherwise)	0.13	0.33	0	1	0.16	0.37	0	1
Awareness (=1 if aware of environmental or health impacts from fossil fuel combustion, zero otherwise)	0.28	0.45	0	1	0.28	0.45	0	1
Marital status (=1 if married, zero otherwise)	1.68	0.60	0	2	1.67	0.70	0	2
Children (number)	1.48	1.47	0	7	1.46	1.50	0	9
Children (1-have children and 0-no children)								
Age	41.06	14.87	18	85	40.81	15.10	18	85
Education:								
• 9 classes	0.09	0.28	0	1	0.05	0.22	0	1
• 11 classes	0.41	0.49	0	1	0.38	0.49	0	1
• Secondary	0.28	0.45	0	1	0.27	0.44	0	1
• Higher education	0.23	0.42	0	1	0.30	0.46	0	1
SEC (income group):								
• SEC1 (lowest)	0.17	0.38	0	1	0.15	0.36	0	1
• SEC2	0.16	0.36	0	1	0.13	0.34	0	1
• SEC3	0.33	0.47	0	1	0.38	0.48	0	1
• SEC4 (highest)	0.34	0.48	0	1	0.35	0.48	0	1
Employed (1 if employed)	0.21	0.41	0	1	0.40	0.49	0	1
Energy poor (1 if energy poor)	0.65	0.48	0	1	0.68	0.47	0	1
Financial problem:								
• Major	0.05	0.23	0	1	0.07	0.26	0	1
• Some	0.19	0.39	0	1	0.18	0.39	0	1
• Minor	0.14	0.34	0	1	0.12	0.32	0	1
• No	0.62	0.48	0	1	0.62	0.48	0	1
Rural (1 if rural)	0.61	0.49	0	1	0.65	0.48	0	1
Country:								
• Kyrgyz Republic	0.34	0.47	0	1	0.34	0.48	0	1
• Tajikistan	0.34	0.47	0	1	0.32	0.47	0	1
• Uzbekistan	0.32	0.47	0	1	0.34	0.47	0	1

Note: Observations: 759 female headed households and 763 male headed households.

These results are largely consistent across genders, employment status, and household heads with children. Overall, around 30% of households prioritize the health and environmental impacts (green). In particular, 30% of male household heads and 30% of female household heads prioritize the environmental and health impact in their fuel choice (Figure 3). Once employment is taken into account, the share of employed males who prioritize green energy (31%) is slightly greater than that of employed females (29%). The shares of males with children who prioritize green energy (30%) and females with children who prioritize green energy (31%) are also similar.

Figure 3: Awareness/Prioritization Across Genders



3.3 Gender

The gender of the household head—the household member in charge of financial and energy use decisions—could affect green prioritization (Aryal et al. 2019; Choudhuri and Desai 2020; Gould and Urpelainen 2020; J. Chen, Liao, and Zhang 2024; Mishra et al. 2024). For women, solid fuel presents a number of specific challenges. In many societies, due to traditional gender roles, women and girls are responsible for gathering and managing household energy, meaning they must spend significant time and effort collecting solid fuels (Foell et al. 2011; Mishra et al. 2024). This not only limits their opportunities for education and economic activities but also exposes them to health risks from using unclean fuels (IEA 2021; WHO 2023). Therefore, strategies to address energy poverty need to pay special attention to women's needs and rights, including improving their access to energy, reducing their dependence on polluting fuels, and ensuring their voice is heard in energy decision-making processes (ADB 2012, 2023).

Hypothesis 1: Female household heads are more likely than male household heads to prioritize reducing environmental and health harm from fossil fuels (rejected).

3.4 Employment

During the design and implementation of the survey, we anticipated that the employment status of the household head would have a statistically significant impact on green prioritization if the household head was female. Employment of a female household head combines the domains of gender, employment, and household structure, accounts for their interaction, and serves as a proxy for women's empowerment. Employment for women means a greater opportunity cost for the time-consuming use of solid fuels (Sehgal et al. 2014; Rahut, Behera, and Ali 2016). If a female household head is employed, she has less time for gathering and consuming solid fuels. In addition, she is likely to have more income, improving the affordability of greener alternatives (Narasimha Rao and Reddy 2007; Hasan and Mozumder 2017; Wei and Lin 2024). If she is a household head, she is also likely to have more bargaining power and decision-making responsibility over how the income is spent (Gould and Urpelainen 2018). Employed women are not only more willing but might also feel more able to shift fuel consumption from dirty to clean fuel, because they bring additional income to the family and allow access to finance because of their employment (Malla and Timilsina 2014).

Hypothesis 2: Employed female household heads are more likely than unemployed female household heads to prioritize reducing environmental and health harm from fossil fuel (not rejected).

3.5 Children

Families with children are expected to demonstrate higher levels of green prioritization (Brounen, Kok, and Quigley 2012; Kishore and Spears 2014; Çelik and Oktay 2019; Gould and Urpelainen 2020; Majumdar, Koley, and Chatterjee 2023). Children are particularly vulnerable to air pollution, both because of their stage of physiological development and because of their tendency to spend more time indoors (WHO 2016, 2023). Across the globe, nearly 2,000 children die every day as a result of air pollution—which equates to 15% of the premature deaths of those under 5 (UNICEF 2024). As a result, it was anticipated that households with children would place a stronger emphasis on minimizing the environmental and health impacts of household air pollution than households without children (Kishore and Spears 2014; Gould and

Urpelainen 2020). Within the household, those responsible for caring for children—who are disproportionately women—will likely exhibit a greater appreciation of the lower environmental and health risks of more modern, climate-friendly energy sources, and a stronger tendency towards their adoption (ibid). In addition, women may be more likely to shift to greener fuels before, during, or after pregnancy, noting the elevated risks posed to children in the pre-natal, neonatal, and post-natal phases and the close relationship between the health of such children and maternal health (Majumdar, Koley, and Chatterjee 2023; UNICEF 2024).

Hypothesis 3: Female household heads with children are more likely than female household heads without children to prioritize reducing environmental and health harm from fossil fuel (rejected).

4. RESULTS

4.1 Main Results

The main results of the estimation on green prioritization are presented in Table 4 and summarized in Table 5.

Gender and Green Prioritization

Simply put, we find that gender does not have a statistically significant impact on the probability of prioritizing environmental and health impacts. Hypothesis 1, that female household heads are more likely than male ones to prioritize reducing environmental and health harm from fossil fuel, is rejected. This contrasts with the prevailing literature, which suggests that women are more likely to engage in green prioritization by virtue of their gender (Narasimha Rao and Reddy 2007; Aryal et al. 2019; Choudhuri and Desai 2020; Gould and Urpelainen 2020; J. Chen, Liao, and Zhang 2024; Mishra et al. 2024). It is true that women are generally the primary users of energy within the household, bear the greatest domestic responsibilities associated with fuel collection, cooking, and heating, and stand to benefit from the shift to more modern, climate-friendly sources (ibid). However, there are several countervailing social and economic factors that may influence their willingness and ability to prioritize green energy, including the consistency and reliability of supply, the affordability and availability of various alternatives, and access to finance, employment, and infrastructure (Gómez, Dopazo, and Fueyo 2015; Kim and Standal 2019; Sabyrbekov and Ukueva 2019; Kapsalyamova et al. 2021; Koirala and Acharya 2022). As a result, gender alone represents an insufficient explanation for green prioritization. This suggests that policies narrowly focused on gender and the green transition may be inadequate, and that they must take additional socioeconomic and sociodemographic factors into consideration in their design and implementation.

Employed Female Household Heads and Green Prioritization

The impact of gender on green prioritization is large and significant once employment is taken into account. Employed female household heads are more likely to prioritize environmental and health impacts from their fuel choice than those who are unemployed, according to our survey. Hypothesis 2, that employed female household heads are more likely than unemployed female household heads to prioritize reducing environmental and health harm from fossil fuels, is not rejected. The role of employment as a vehicle for women's empowerment is well-documented (ADB 2012; Hasan and Mozumder 2017; Wei and Lin 2024). Employment improves the relative

affordability of climate-friendly options and minimizes the up-front costs of fuel switching, raises the opportunity costs associated with the collection and consumption of solid fuels, enhances access to finance and income, and upgrades women's bargaining power and decision-making capacity within the household (Sehjpai et al. 2014; Rahut, Behera and Ali 2016; Hasan and Mozumder 2017; Gould and Urpelainen 2018; Wei and Lin 2024). This demonstrates that gender and employment work together to advance green prioritization, and that the economic empowerment of women can be a driver for accelerating and broadening the sustainability transition in household fuel use. The results suggest that government policies that expand and improve women's employment and raise their incomes may carry spillover benefits for green prioritization. However, the importance of employment also implies that overcoming financial barriers will be critical in advancing the uptake of cleaner energy sources in households. As a result, an approach that boosts women's economic empowerment could be coupled with the wider provision of more affordable and accessible climate-friendly alternatives to solid fuels.

Females with Children and Green Prioritization

Households with children (a binary variable) are more likely to prioritize the environmental and health impact from their fuel choice. However, the impact of having a female head of household with children on the prioritization of the environmental and health impacts is not statistically different from the impact of having a male head of household with children. Regardless of gender, household heads with children are more likely to prioritize the environment and health than those without children. Hypothesis 3, that female household heads with children are more likely than female household heads without children to prioritize reducing the environmental and health harms from fossil fuels, is rejected. This result is consistent with the existing literature on the relationship between the presence of children and greener fuel choice practices (Brounen, Kok, and Quigley 2012; Kishore and Spears 2014; Çelik and Oktay 2019; Gould and Urpelainen 2020; Majumdar, Koley, and Chatterjee 2023). However, we find a statistically significant difference between the green prioritization position of male household heads with children and male household heads without children (Column 5 of Table 4), and no statistically significant difference between female household heads with children and female household heads without children (Column 6).

In practice, this implies that men become more likely to prioritize environmental and health impacts after they have children, while female household heads' tendency toward green prioritization does not meaningfully shift if they have children. In other words, females with children do not prioritize environmental and health impacts more than males with children. However, male household heads place less priority on the environmental and health impacts of solid fuel use before having children than after having children. This could be due to females caring for their health even before having children, because they know that their health before and during pregnancy will affect the well-being of their future children (Majumdar, Koley, and Chatterjee 2023; UNICEF 2024). Indeed, there is a growing awareness of the importance for women of pre-conception health, which is the health of women during their reproductive years before they have children (ibid). Avoiding harmful exposure to household pollution and other health risks before and during pregnancy can reduce the chances of pregnancy complications and improve outcomes for both mother and child (Majumdar, Koley, and Chatterjee 2023; UNICEF 2024). While men's health can also impact fertility and the health of future offspring, the emphasis on preconception care is often more pronounced for women in societies and healthcare. Taken together, this implies that policies to promote green prioritization may gain greater traction if targeted households with children, as such households place greater emphasis on the environmental and

health risks of solid fuels and demonstrate a higher likelihood of adopting climate-friendly alternatives.

Table 4: Main Results on Green Prioritization

Variables	(1) Awareness	(2) Awareness	(3) Awareness	(4) Awareness	(5) Male	(6) Female	(7) Urban	(8) Rural
Female	−0.0130 (0.121)	−0.0764 (0.126)	0.122 (0.268)	−0.00978 (0.279)			−0.370 (0.466)	0.282 (0.358)
Have children	0.304** (0.141)	0.275* (0.148)	0.479** (0.197)	0.360* (0.205)	0.398* (0.208)	0.129 (0.213)	0.300 (0.325)	0.417 (0.270)
Female with children			−0.371 (0.277)	−0.184 (0.289)			−0.382 (0.461)	−0.0677 (0.383)
Employed	−0.133 (0.136)	−0.139 (0.143)	−0.453** (0.178)	−0.437** (0.187)	−0.445** (0.196)	0.253 (0.217)	−0.470 (0.318)	−0.351 (0.239)
Employed female			0.720*** (0.264)	0.673** (0.278)			1.364*** (0.459)	0.196 (0.360)
Married	−0.299* (0.156)	−0.150 (0.163)	−0.187 (0.236)	−0.0173 (0.244)	−0.0738 (0.253)	−0.196 (0.221)	0.0440 (0.405)	−0.0810 (0.317)
Married female			−0.143 (0.315)	−0.191 (0.328)			−0.175 (0.533)	−0.228 (0.431)
age	−0.00216 (0.00414)	0.00105 (0.00434)	−0.00407 (0.00427)	−0.000444 (0.00444)	0.00389 (0.00643)	−0.00435 (0.00619)	−0.00231 (0.00766)	0.00119 (0.00560)
Education (incomplete secondary reference)								
Secondary	−0.275 (0.244)	−0.0905 (0.256)	−0.290 (0.244)	−0.0925 (0.257)	0.266 (0.434)	−0.206 (0.325)	0.329 (0.547)	−0.121 (0.304)
Vocational	−0.0733 (0.251)	0.0260 (0.265)	−0.115 (0.252)	0.00209 (0.266)	0.605 (0.441)	−0.343 (0.347)	0.269 (0.554)	0.0394 (0.318)
Higher education	0.713*** (0.250)	0.712*** (0.263)	0.689*** (0.250)	0.706*** (0.264)	1.247*** (0.437)	0.384 (0.342)	0.966* (0.549)	0.712** (0.316)
Income (SEC1 poorest reference)								
SEC 2	−0.497** (0.239)	−0.429* (0.252)	−0.526** (0.239)	−0.458* (0.253)	−0.204 (0.358)	−0.593 (0.367)	−0.437 (0.413)	−0.399 (0.333)
SEC 3	−0.512*** (0.181)	−0.429** (0.190)	−0.518*** (0.182)	−0.434** (0.191)	−0.362 (0.277)	−0.431 (0.267)	−0.256 (0.340)	−0.531** (0.238)
SEC 4 (richest)	−0.747*** (0.160)	−0.717*** (0.169)	−0.770*** (0.161)	−0.737*** (0.170)	−0.866*** (0.243)	−0.607** (0.239)	−0.173 (0.283)	−1.075*** (0.220)
Rural	0.188 (0.125)	0.517*** (0.139)	0.177 (0.125)	0.503*** (0.140)	0.212 (0.197)	0.742*** (0.202)		
Heating_dirty		−1.282*** (0.138)		−1.276*** (0.139)	−1.268*** (0.190)	−1.221*** (0.190)	−0.718*** (0.223)	−1.507*** (0.166)
Energy_poor		0.0985 (0.138)		0.123 (0.139)				
Financial problem (no problem reference)								
Minor		0.438** (0.176)		0.450** (0.177)	0.551** (0.259)	0.417* (0.248)	0.317 (0.283)	0.588** (0.237)
Some		−0.507*** (0.187)		−0.502*** (0.188)	−0.501* (0.267)	−0.561** (0.269)	−0.472* (0.274)	−0.552** (0.267)
Big		−0.0967 (0.263)		−0.0861 (0.265)	−0.119 (0.353)	0.0698 (0.410)	−0.0155 (0.384)	−0.0797 (0.370)
Constant	−0.449 (0.355)	−0.349 (0.378)	−0.401 (0.370)	−0.322 (0.395)	−0.672 (0.552)	−0.0839 (0.505)	−0.800 (0.702)	0.371 (0.464)
Observations	1,522	1,522	1,522	1,522	763	759	557	965

***Significant at the 0.01 level, **Significant at the 0.05 level, *Significant at the 0.1 level.

Table 5: Summary of the Main Results

Factors	Impact on Females	Impact on Males
Gender alone	No impact	
Employment status	More likely to prioritize environmental and health impacts	No impact
Households with children	No impact	Likely to prioritize environmental and health impacts

4.2 A Blinder–Oaxaca Decomposition

The results from the Blinder–Oaxaca decomposition analysis are presented in Table A1 of Annex A. This decomposition technique, popularized by Blinder (1973) and Oaxaca (1973), is widely used to study mean outcome differences between groups (Jann 2008). The Blinder–Oaxaca technique is applied to divide the green prioritization gap between men and women into one part that is explained by differences in the determinants of green prioritization such as employment and children, and another part that cannot be explained by such differences. The results of the Blinder–Oaxaca decomposition analysis are consistent with the main results from the logit model presented in section 4.1.

The results indicate no significant difference in green prioritization between male and female heads of household (H1 is rejected). However, there are statistically significant differences in green prioritization (significant at 10%) between employed male heads and employed female heads (H2 is not rejected). The endowments reflect the mean increase in employed women's prioritization if they had the same characteristics as employed men. Although green prioritization has a statistically significant difference between households with children and households without children, green prioritization has no significant difference between female-headed households with children and female-headed households without children (H3 is rejected). However, green prioritization has a statistically significant difference between male-headed households with children and male-headed households without children. Also, green prioritization has no significant difference between female-headed households with children and male-headed households with children. It is most likely that the overall results of the impact of having children on green prioritization are driven by the household having a male head.

4.3 Robustness check: Regression

In order to test for the robustness of the results we use five alternative measures of explanatory variables (Table A2 of Annex A). The results of the robustness check are presented in Table 6. The main results are robust to the various model specifications.

Table 6: Robustness Check

Variables	(1) Awareness	(2) Awareness	(3) Awareness	(4) Awareness	(5) Male	(6) Female	(7) Urban	(8) Rural
De jure female	0.201 (0.269)	0.133 (0.276)	0.246 (0.443)	0.0547 (0.454)			0.306 (0.780)	0.149 (0.579)
De facto female	0.0678 (0.150)	-0.0119 (0.156)	-0.151 (0.257)	-0.143 (0.267)		0.307 (0.420)	-0.597 (0.441)	0.278 (0.351)
Children, number	0.00548 (0.0452)	0.0200 (0.0471)	0.0806 (0.0612)	0.0845 (0.0637)	0.113* (0.0660)	0.0437 (0.187)	0.0935 (0.112)	0.104 (0.0798)
De jure female#c.children			-0.0563 (0.190)	-0.0251 (0.196)			-0.522 (0.348)	0.462* (0.268)
De facto female#c.children			-0.148 (0.0931)	-0.141 (0.0961)		-0.113 (0.199)	-0.163 (0.183)	-0.182 (0.118)
Self-employed	0.310* (0.164)	0.272 (0.171)	-0.252 (0.218)	-0.167 (0.226)	-0.177 (0.243)	0.847* (0.462)	0.0456 (0.391)	-0.150 (0.290)
Public sector employment	0.395* (0.231)	0.191 (0.245)	-0.422 (0.320)	-0.512 (0.337)	-0.640* (0.356)	1.225* (0.726)	-0.754 (0.525)	-0.238 (0.459)
Private sector employment	0.0609 (0.180)	0.0707 (0.188)	-0.350 (0.258)	-0.286 (0.268)	-0.398 (0.288)	1.165** (0.480)	-0.436 (0.423)	-0.166 (0.362)
De jure gender#self-employed			1.439*** (0.481)	1.010** (0.499)			2.259** (0.927)	0.570 (0.650)
De jure female#public			1.843** (0.765)	1.714** (0.789)			3.121** (1.217)	1.089 (1.175)
De jure female#private			1.404*** (0.506)	1.328** (0.531)			2.661*** (0.886)	0.604 (0.724)
De facto female#self-employed			0.998*** (0.373)	0.794** (0.389)		-0.140 (0.551)	0.434 (0.615)	1.148** (0.540)
De facto female#public			1.653*** (0.521)	1.387** (0.550)		-0.407 (0.844)	1.991** (1.007)	0.938 (0.702)
De facto female#private			0.186 (0.381)	0.151 (0.394)		-1.246** (0.557)	1.048* (0.626)	-0.377 (0.525)
Divorced/widow	0.494 (0.308)	0.339 (0.317)	1.178*** (0.426)	0.810* (0.442)	0.705 (0.477)	-0.0278 (0.465)	0.772 (0.744)	0.792 (0.569)
Married	0.216 (0.273)	0.241 (0.287)	0.492 (0.319)	0.428 (0.331)	0.374 (0.359)		0.333 (0.557)	0.399 (0.423)
De jure female#divorced/widow			-1.331** (0.560)	-0.911 (0.578)			-2.106** (1.040)	-0.613 (0.749)
age	-0.00635 (0.00486)	-0.00208 (0.00504)	-0.00715 (0.00499)	-0.00289 (0.00514)	-0.00292 (0.00745)	-0.00253 (0.00719)	-0.000572 (0.00951)	-0.00298 (0.00643)
Education: Secondary	-0.309 (0.245)	-0.117 (0.257)	-0.346 (0.248)	-0.149 (0.259)	0.280 (0.438)	-0.297 (0.328)	0.230 (0.560)	-0.203 (0.309)
Vocational	-0.138 (0.254)	-0.0329 (0.267)	-0.153 (0.257)	-0.0346 (0.269)	0.648 (0.447)	-0.397 (0.352)	0.193 (0.565)	-0.0283 (0.327)
Higher education	0.623** (0.253)	0.635** (0.266)	0.599** (0.257)	0.627** (0.268)	1.268*** (0.443)	0.251 (0.348)	0.875 (0.562)	0.657** (0.325)
Income: SEC2	-0.468* (0.240)	-0.420* (0.253)	-0.435* (0.242)	-0.412 (0.254)	-0.109 (0.359)	-0.586 (0.371)	-0.355 (0.419)	-0.350 (0.339)
SEC3	-0.533*** (0.184)	-0.460** (0.193)	-0.474** (0.187)	-0.424** (0.195)	-0.316 (0.284)	-0.459* (0.273)	-0.304 (0.355)	-0.512** (0.245)
SEC4 (richest)	-0.759*** (0.164)	-0.731*** (0.173)	-0.736*** (0.167)	-0.719*** (0.174)	-0.808*** (0.250)	-0.639*** (0.245)	-0.110 (0.292)	-1.137*** (0.229)
rural	0.177 (0.126)	0.496*** (0.140)	0.194 (0.129)	0.482*** (0.142)	0.161 (0.200)	0.777*** (0.207)		
heating_dirty		-1.270*** (0.139)		-1.207*** (0.141)	-1.259*** (0.193)	-1.093*** (0.194)	-0.697*** (0.231)	-1.443*** (0.172)
energy_poor		0.133 (0.139)		0.166 (0.142)				
Financial problem: Minor		0.478*** (0.178)		0.479*** (0.180)	0.561** (0.259)	0.490* (0.256)	0.375 (0.295)	0.621*** (0.240)
Some		-0.471** (0.188)		-0.491*** (0.190)	-0.494* (0.270)	-0.533* (0.274)	-0.394 (0.281)	-0.590** (0.271)
Big		-0.0834 (0.265)		-0.0822 (0.267)	-0.131 (0.354)	0.111 (0.415)	0.0104 (0.391)	-0.0751 (0.371)
Constant	-0.708* (0.376)	-0.581 (0.403)	-0.687* (0.414)	-0.560 (0.438)	-0.739 (0.577)	-0.494 (0.562)	-1.090 (0.774)	0.208 (0.529)
Observations	1,518	1,518	1,518	1,518	760	758	556	962

***Significant at the 0.01 level, **Significant at the 0.05 level, *Significant at the 0.1 level.

5. CONCLUSION

The relationship between gender and green prioritization is complex, and shaped by both ideational considerations and material circumstances. This study suggests that neither gender nor environmental awareness is a sufficient condition for green prioritization. In contrast to the prevailing trend within the existing literature, we find no meaningful, statistically significant impact of gender on green prioritization when gender is analyzed in isolation. While environmental awareness is widespread across the Fergana Valley, women and households face several barriers to the adoption of clean energy. This paper was designed to unpack the dynamics of the socioeconomic and sociodemographic features of households by analyzing how women's employment and the presence of children drive fuel choice decisions in Central Asia. The empirical evidence of our survey suggests that women's empowerment through employment represents a key driver of green prioritization. In addition, women are more likely to engage in green prioritization because of the environmental and health impacts of solid fuels. While this tendency remains consistent for women before and after having children, men close the gender gap once children are born and demonstrate roughly the same levels of green prioritization as women. Taken together, this study provides evidence of the vital importance of women's empowerment through employment for promoting the green transition. However, it also illuminates pathways for further research, to assess the relationship between environmental awareness and green prioritization in greater depth, explore the non-financial challenges facing the uptake of climate-friendly options, and delve into additional intersections between women's empowerment and the green transition.

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ANNEX A

Table A1: Compiled Results from Blinder–Oaxaca Decomposition

Hypothesis	Groups	Difference	Endowments	Coefficients	Interactions
H1 is rejected	Male vs Female	0.003	0.003	0	0
H2 is not rejected	Unemployed female vs employed female	−0.083*	−0.043	−0.053	0.013
H3 is rejected	Female without vs. with children	−0.005	0.15***	0.005	−0.167***
	Male without vs. with children	−0.075**	−0.041	−0.78**	0.044

***Significant at the 0.01 level, **Significant at the 0.05 level, *Significant at the 0.1 level.

Table A2: Alternative Variables for Robustness Check

Variables	Main Results	Robustness Check
Children	Binary (1 if have children and 0 if no children)	Number of children
Marital status	Binary (1 if married and 0 if single)	Categorical (1 if single, 2 if divorced/widow, 3 if married)
Household head gender	Binary (1 if female and 0 if male)	Categorical (1 if male; 2 if de jure (divorced, widow or single) female and 3 if de facto (married) female)
Employment	Binary (1 if employed and 0 if unemployed)	0 “unemployed”, 1 “self-employed”, 2 “private sector” and 3 “public sector”
Financial problems	Binary (1 if big or some; 0 if no or minor)	Categorical (1 no, 2 minor, 3 moderate, 4 major)