Doctoral theses at NTNU, 2023:315

Abinet Tilahun Aweke

Essays on Environmental and Energy Economics

Doctoral thesis

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of
Philosophiae Doctor
Faculty of Economics and Management
Department of Economics

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Trondheim, October 2023

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ISBN 978-82-326-7330-8 (printed ver.)
ISBN 978-82-326-7329-2 (electronic ver.)
ISSN 1503-8181 (printed ver.)
ISSN 2703-8084 (online ver.)

Doctoral theses at NTNU, 2023:315

Printed by NTNU Grafisk senter

Acknowledgments

Several people have helped me in the process of writing this thesis, and I feel privileged to thank all whose help made this Ph.D. thesis a success.

I thank my supervisor, Associate Professor Anne Borge Johannesen, for always being there when I needed support and guidance. I am very grateful for her consistent guidance, scientific contributions, and practical support. I also want to thank my co-supervisor, Professor Jon Olaf Olaussen, for his input and constructive comments.

I would like to thank Professor Ståle Navrud for a successful collaboration on one of the articles, as well as for all the inspiring and encouraging discussions we have had and his constant guidance throughout this journey. Similar thanks are due to professor Kåre Johansen for his detailed feedback. Thank you both for taking your precious time to read the work and give valuable suggestions.

Professor Mari Rege gave useful insights during the midway seminar, which significantly improved the quality of the work presented in the thesis. I would like to thank the anonymous reviewers for their time, comments, and suggestions on the first essay. I am also grateful for the constructive comments from the evaluation committee.

Regarding practicalities at work, Anne Larsen could always be trusted and has saved me from a lot of unnecessary stress and frustration. Thank you for always being welcoming and helpful during my stay in Trondheim.

My extended gratitude goes to all members of staff at the Department of Economics. I specifically owe gratitude to Professor Anders Skonhoft for his guidance, which I learned a lot from in the first year of my Ph.D. I also give my gratitude to all of my fellow Ph.D. students and postdocs in the department. Special thanks to David Sørli Nielsen and Gonzalo Dona for continually reading my work and offering great suggestions.

Finally, I want to thank my husband, Abel, and all my family members who supported me throughout this journey with their positive words and prayers. I became a mother to Abiah, making this period the most memorable time of my life. Thank you, Abiah, for all the joy you brought during this period. Above all, I thank my Lord Jesus, for He has been my help and my

strength. Due to space limitations, not all acknowledgments can be made. If you have helped me, I am incredibly grateful. Thank you!

Abstract of the Thesis

The use of stated preference (SP) methods to measure preferences in various fields of study has become increasingly popular in recent decades. This thesis uses SP methods in topics within energy and environmental economics. First, we estimate welfare loss from electricity blackouts in the northern part of Ethiopia to help inform investment decision makings. In particular, we elicit households' willingness to pay (WTP) to avoid blackouts. We then proceed to explore and discuss how different factors including respondents' recollection of government promises to improve electricity supply play a role in respondents' willingness to pay to avoid electricity blackouts. We also propose that quantified welfare losses from power outages be used as a measure of energy poverty in developing countries, along with other existing measures of energy poverty, such as: the energy expenditure measure. Second, the thesis estimates WTP for organic meat in Norway using SP method and examines whether there is a gap between the reported willingness to pay for organic meat and the reported actual organic meat purchases. Factors that reduce or increase this gap between intention and behavior are also examined. Understanding factors that may prevent the translation of intentions into actions is very helpful in interpreting and using SP studies to inform policy decisions or for other purposes. Third, using survey data collected in Norway, the thesis investigates attitude towards carnivore-livestock management and their political votes for two different hypothetical carnivore-livestock policy programs; one favoring grazing sheep and the other favoring increase in number of large carnivores. In addition, we looked at the role of sociodemographic variables in both attitudes and respondents' choice of the carnivore-livestock management programs.

List of Papers

This thesis contains the following papers:

Paper I: Valuing Energy Poverty Costs: Household Welfare Loss from Electricity Blackouts in Developing Countries

Authors: Abinet Tilahun Aweke and Ståle Navrud

Published in *Energy Economics*

Paper II: Mind the Gap: Understanding the Gap between Consumers' Willingness to Pay and Purchasing Behavior

Authors: Abinet Tilahun Aweke

Paper III: The Different Sides of the Fence: Household Land-Use Preference in the Case of Livestock–Carnivore Conflict

Authors: Abinet Tilahun Aweke, Anne Borge Johannesen, and Jon Olaf Olaussen

Contents

Introduction and Summary

The introduction consists of three sections. In Section 1, I describe the stated preference (SP) methods and their applications; in Section 2, I summarize the papers; in Section 3, I present the contribution of the thesis to the SP literature, and finally I would like to make some reflections on the first essay of the dissertation.

1. Applying SP Methods in Environmental and Energy Economics

SP methods measure people's preferences for alternatives in hypothetical choice scenarios. These methods are applied to elicit preferences for goods and services where market prices do not exist or when it is impossible to measure them through revealed preference methods. Some examples where SP methods are widely applied include valuing ecosystem services, new products/services, biodiversity, landscape aesthetics, environmental-related health impacts, and externalities from energy and electric transmission lines. Public decisions often require cost-benefit comparisons of alternative projects to maximize the net benefit for the public; thus, SP methods can capture the benefits and costs with no market value.

Hicksian Welfare Theory

Hicksian welfare theory is based on two central concepts, compensatory variation and equivalent variation, which reflect willingness to pay (WTP) and willingness to accept (WTA) and are often measured empirically using WTP or WTP questions (Kim et al., 2015).

The equivalent variation is the amount of money an individual would accept having the same utility they are entitled to in the absence of an improvement in the environment (Kim et al., 2015).

$$V(P, Q_0, Y + E(Y) = V(P, Q_1, Y),$$

where $V(P, Q_1, Y)$ is the indirect utility as a function of price P, new quality of the environment Q_1— to which the individual is entitled—and income Y. $V(P, Q_0, Y + E(Y)$ is the indirect utility where Q_0 is the current environmental quality, and E is the equivalent variation or the minimum WTA in the absence of environmental improvement.

If the individual is entitled to the current environmental quality Q_0 instead of the improved environmental quality Q_1, then the measure is the compensation variation, C, and we will then measure the maximum WTP to obtain the improvement for the environment.

$$V(P, Q_0, Y) == V(P, Q_1, Y - C)$$

Which of the compensatory and equivalent variations or which of the WTP and WTA measures is appropriate for measuring welfare depends on two main factors: (i) whether the environmental good/service to be valued is an improvement or a deterioration in quality/quantity, and (ii) whether the individual/respondent is entitled to property right to improved or degraded environment (Perman et al., 2003; Kim et al., 2015). Table 1 places the appropriate welfare measures based on these two factors.

Table 1

WTP and WTP Welfare Measures Based on Property Rights and Goods to be Valued[1]

The Environmental Good or Service to be Valued	**Respondent State of Entitled Property Right**	
	Entitled to an improved environment	Entitled to a degraded environment
Improvement in quantity/quality	WTA compensation for not having an improved quality/quantity	WTP to have an improved quality/quantity
Deterioration in quality/quantity	WTA compensation for environnemental degradation	WTP to avoid the deterioration

Other than these two reasons, studies have shown that WTA studies are accompanied by many protest responses, and therefore WTPs are more desirable and widely applied (Kim et al., 2015). Johnston et al. (2017) also recommend basing the choice between WTP and WTA on a theoretical and empirical foundation.

Contingent Valuation Method

The most widely applied SP methods are contingent valuation (CV) and choice experiment (CE). The choice of which one to apply depends mainly on the good to be valued and the objective of the study. CE is based on Lancaster's consumer theory (Lancaster, 1966; Bergmann et al., 2006). The concept behind Lancaster's theory is that utility is driven by the

[1] The table is adopted from Perman et al. (2003) and Kim et al. (2015).

characteristics of the good rather than from its consumption, i.e., a good possesses several characteristics that give rise to utility (Lancaster, 1966), and therefore the value of the good as a whole is the combination of the value of each attribute or characteristic (Navrud & Grønvik Bråten, 2007). CE is applied when we are interested in valuing the attributes of the good (a service); however, if the objective is only to value a specified change in the good as a whole, CV suffices. The CV method uses a direct question about the maximum amount they would be willing to pay for a proposed change in the environmental good or service valued.

2. Summary of the Thesis

The thesis consists of three independent papers that apply survey data and environmental valuation techniques to two different topics. This thesis contributes to the SP literature by addressing the gap between attitudes, stated WTP, and stated buying behavior (SBB) and in terms of empirical best-practice applications. The analysis utilized two survey datasets. The first was collected in 2018 in Northern Ethiopia, and the second in Norway in 2021. Both surveys were CV surveys designed in accordance with the latest guidance for SP studies developed by Johnston et al. (2017). This thesis applies these best-practice recommendations for SP studies to identify important determinants for the validity and reliability of SP studies designed to inform decision-making.

Paper I uses the survey data collected in Ethiopia through face-to-face interviews to estimate energy poverty costs from electricity blackouts. We estimated households' WTP for a clearly specified improvement in energy reliability in terms of a reduced number of blackouts. The results showed that households' annual WTP eliminated electricity blackouts to, on average, 1% of their annual income. Households' WTP to avoid blackouts increases significantly with income, both in terms of their stated annual income and their annual expenditures, which can be considered a proxy for income. Their WTP also increased significantly with the annual number of experienced blackouts, the average length of these blackouts, and the number of damage categories experienced. The respondents' recollection of the government's promises to improve the electricity supply significantly reduces both the probability of being willing to pay something and the amount that households are willing to pay. The results in this study were as expected and support the validity and reliability of the SP survey to assess household welfare loss from this type of energy poverty in a developing country. These welfare estimates of increased energy security contribute to the development of a multidimensional energy poverty measure to develop a more holistic energy poverty measure in developing countries.

An important recommendation from these studies for the design of best-practice CV studies to increase the reliability of predicting actual behavior is to include more targeted auxiliary questions in SP questionnaires. This recommendation is supported by Johnston et al. (2017), and more specifically refers to including questions that help isolate the most unrealistic answers and protest responses (e.g., questions about respondents' behavior in the recent past, price importance, motives behind the WTP, and reasons for not having a WTP). In some cases, it is possible to isolate the most likely unrealistic WTPs (e.g., responses that may have word-deed gaps) and use the rest to perform benefit transfers, perform a cost-benefit analysis, or inform decision-making.

Paper II uses the survey data collected in Norway to examine what drives WTP for organic meat in Norway and SBB, and examines the gap between intended and stated actual behavior for organic meat. A major criticism of SP studies is the hypothetical nature of the questions, and the hypothetical bias this might create, and thus respondents' WTP and actual buying behavior might diverge. Thus, this paper sheds light on how to construct SP studies such that intentions are translated into actions by identifying what hinders the translation of WTP into SBB. The results showed that respondents' WTP was influenced by socio-demographic variables (education, gender, and ruralness index), stated price importance, and attitudes that organic is healthy and beneficial to the environment. However, only price importance, product availability, and the attitude that organic is healthy influenced SBB. This intention–behavior gap was bridged by product availability and health concerns but was impeded by price sensitivity. The results indicate that WTP estimates in this context should be interpreted with care, taking into account the factors hindering the translation of WTPs into actual purchase behaviors.

Paper III uses the same survey data as the second paper to explore households' attitudes and preferences for land use in the presence of the livestock–carnivore conflict in Norway. The scenario described in the survey provided two new management programs, in addition to the status quo. In one program, the number of large carnivores was reduced, and the number of free-range grazing sheep increased, while the other program involved an increased number of large carnivores and fewer free-range grazing sheep. The survey design lets respondents make a tradeoff between conflicting interests and therefore links two strands of literature: (i) attitudinal studies on carnivore management and (ii) attitudinal on semi-natural lands and landscape types emphasizing livestock presence and livestock free range grazing. We found that both rurality/residence and socio-demographic composition influenced the respondents'

choice of alternative programs. The results showed that age had a significant, negative effect on the likelihood of voting for the "more-carnivore" option, and positive attitudes toward conserving large predators. Conversely, age had a significant positive effect on the likelihood of favoring the "more-sheep" program and positive attitudes toward free-range grazing sheep and government support for free-range grazing sheep (in terms of compensation for lost lambs and ewes). However, the results also indicated that attitudes do not necessarily translate into a choice for a certain policy program when respondents had to make a tradeoff between competing interests; that is, a positive attitude toward free-range grazing does not necessarily lead to a preference or a vote for livestock-friendly management policy in regards to the livestock carnivore conflict. Furthermore, individuals with higher education tend to have a significant positive attitude towards both conserving carnivores and free-range grazing sheep. However, they are more likely to choose the "more carnivore" program and less likely to choose the "more sheep" program. The results imply that attitudes do not necessarily translate into a specific program/policy choice when faced with competing land-use interests. Therefore, attitudinal studies should be used with caution for informing decision-making.

3. Contributions

Role of SP studies in Constructing Energy Poverty Measures

Energy poverty is defined as the lack of access to adequate, affordable, reliable, high-quality, safe, and environmentally benign energy services (Reddy et al., 2000) and has been measured using different energy measures. The energy poverty measures commonly applied in the literature are the income-expenditure approach (economic threshold), the low-income-high-cost approach, the technology threshold, the physical threshold approach, subjective measures, and multidimensional measures. Thus far, energy insecurity has not been part of the energy poverty measure, but it can be a useful indicator of energy poverty in areas where electricity blackouts are widely reported. Thus, together with the abovementioned measures, energy insecurity can be accounted for and included where possible. Failure to include any measure of energy insecurity will bias the results and potentially misclassify households. For instance, in the income-expenditure approach, power outages will reduce energy costs, and potentially put households artificially below the threshold of energy poverty. In the technology threshold approach, households will be counted as energy poor only if they are not connected to the grid, and the effects of unreliable connections will not be accounted for.

In addition to being an input for cost-benefit analysis and justification for more investment in the power sector, the WTP estimates from Paper I of this thesis can easily be incorporated into the multidimensional measures. Below, I discuss how the energy insecurity index can be incorporated into a multidimensional measure of energy poverty.

The traditional multidimensional poverty index (MPDI) usually incorporates the subjective and energy expenditure (ENEX) measures (Awaworyi Churchill & Smyth, 2020; Munyanyi et al., 2021), where equal weights are assigned to each measure. A household energy deprivation score ranges between 1 and 0, and a score exceeding 0.5 indicates energy poverty. For sensitivity checks, different cut-off points—both below and above the 0.5 threshold—were also applied.

The household energy deprivation score in the MPDI is specified as follows:

$HED = w_1E + w_2S,$

$E = 1\ if\ X > 0.1Y$ *and E=0 if X < 0.1Y,*

$$S = 1\ if\ household\ reported\ they\ feel\ energy\ deprived;\ 0\ otherwise,$$

where HED denotes the household deprivation score for household i, and E and S represent the indicators known as expenditure measures and subjective measures, respectively. Each indicator equal to 1 is a household that is deprived, and 0 otherwise. w_1 and w_1 are the weighted attached to the first and second indicators. The sum of the weights should equal 1. X is the household's ENEX. When the income-expenditure measure is used alone, the ENEX threshold is set at 10% of household income (Hills, 2012). Households spending more than the 10% mark are considered energy poor. When incorporated into MDPI, the expenditure indicator E is set to equal 1 if ENEX is above 10% of household income.

One simple way of including energy insecurity is by setting a binary electricity blackout welfare cost indicator (B), where B is 1 if households were willing to pay to avoid blackouts and 0 otherwise. Using WTP estimates instead of the number of blackouts is better because the WTP represents the cost of energy insecurity to the households (and shows what it is worth for the respondent to avoid those blackouts). The mathematical formulation will then be as follows:

$HED = w_1E + w_2S + w_3B,$

$E = 1$ if $\mathrm{X} > 0.1\mathrm{Y}$ *and E=0 if X < 0.1Y,*

$S = 1\ if\ household\ reported\ they\ feel\ energy\ deprived;\ 0\ otherwise,$

$B = 1\ if\ WTP > 1\ and\ B = 0\ if\ WTP = 0,$

where w_3 denotes the weight attached to the blackout indicator, B. $w_1 + w_2 + w_3 = 1$. An equal weight of 0.33 or varying weights can be assigned for each indicator, and a household exceeding a certain HED score can be classified as energy poor according to this specific multidimensional energy poverty index.

Another way to go about it is having B represent the WTP to personal income ratio, where, for example, B is set to 1 if respondents were willing to pay higher than 0.5% of their average and zero if lower. Setting up this threshold can be guided by further research and case studies. Instead of binary values, B can also be a value ranging between zero and 1, but that will be complicated in terms of deciding B as a nonlinear function of the WTP-income ratio.

$HED = w_1E + w_2S + w_3B,$

$E = 1$ if $\mathrm{X} > 0.1\mathrm{Y}$ *and E=0 if X < 0.1Y,*

$S = 1\ if\ household\ reported\ they\ feel\ energy\ deprived;\ 0\ otherwise,$

$B = 1\ if\ WTP > 0.005Y\ and\ B = 0\ if\ WTP < 0.005Y.$

Just like the existing multidimensional measures, this energy insecurity inclusive multidimensional measure has limitations. The results will be sensitive to the weights assigned to each energy poverty indicator. The cut-off household deprivation score also influenced the results.

Targeted Auxiliary Questions in SP Surveys

The major criticisms of SP surveys are the hypothetical nature of the questions and the hypothetical bias that may arise. For example, a respondent may overstate their WTP value if they feel they do not have to pay for real. These issues are well discussed in the literature and can be minimized by following the proposed SP survey guidelines (Johnston et al., 2017; Mariel et al., 2021; Haghani et al., 2021). Studies, however, show that there is still a gap between state WTP and actual payment behaviors (Talwar et al., 2021; Paper II of this thesis).

Although more research is needed, factors that have been found to be significantly associated with having intention-behavior gaps in organic meat consumption are price importance, perceived product un/availability, and egoistic (own health concern) vs. altruistic (concern for

animal health and welfare) motives of WTP. Thus, including more targeted supportive and auxiliary questions will help identify responses that are unlikely to be transferred into actual payments. More specifically, the results from Paper II suggest including questions in SP surveys that help isolate answers that are most likely to be unrealistic and protest responses (e.g., questions about respondents' behavior in the recent past, price importance, motives behind the WTP, and reasons for not having a WTP). However, the transferability and generalizability of our results should be tested by conducting similar studies incorporating revealed preference-assisted estimations.

4. Reflections on Essay I: "Valuing energy poverty costs: Household welfare loss from electricity blackouts in developing countries".

This section presents some reflections and limitations on essay one that were not included in the published paper[2].

The title of the paper says "Valuing energy poverty costs", but the readers may find it hard to connect this concept with the main objective of the paper, which is eliciting WTP to avoid blackouts. A better fitting title is "Willingness to pay for elimination of blackouts in Ethiopia". However, the paper was submitted to the special issue "Energy poverty: trends and perspectives"; and during the review we were asked to revise the paper to place it better in the context of energy poverty.

Sample and data

The sample consists of households from areas in the northern region of Ethiopia, in terms of a small rural village and a limited part of a city. We do not have the appropriate data to check the geographical and infrastructural representativeness of our study sites. Most likely they are not representative of every rural and urban areas in Ethiopia, but we still think the study areas resembles many cities and villages in the country and can indicate the main differences in preferences between cities and villages in at least this part of Ethiopia. This should of course be tested further in a larger, representative sample of rural and urban areas in Ethiopia.

As can be seen in the descriptive statistics (table 5) of essay I, there is considerable variation in the number and duration of experienced blackouts. The number of blackouts the respondents report varies from 14 to 1080 per year, and the average duration from 0.05 to 24 hours. The higher numbers may seem to be outliers. However, such wide variations in the number and

[2] I thank the Evaluation Committee for their valuable comments, which form the basis of this section.

duration of blackouts are also reported by other studies. A survey conducted in Addis Ababa in 2016 found a wide variation in the total hours of blackouts per month. The average monthly duration was 53 hours with a standard deviation of 43 hours and an interdecile of 106 hours. This is after dropping outliers, i.e., power outages over 244 hours (Meles, 2020). When we calculate the average monthly duration for our sample, we also get 53.3 hours[3]. A World Bank enterprise survey also found that in a typical month, Ethiopia experienced 8.2 power outages, each with an average duration of 5.8 hours (World Bank, n.d).

Most power outages are due to insufficient power generation in developing countries, but other causes also play a role, such as sudden equipment failures and poor wiring at the point of use. Other outages are caused by delay in completing required maintenance or a utility employee seeking bribes etc (Gertler et al., 2017). Therefore, we can suspect that some power outages may have very long durations because of the cause of the blackout (for example maintenance taking so long).

Valuation question and payment vehicle

The valuation question was phrased to ask how much households would be willing to pay on top of their electricity bill for a complete elimination of blackouts. It is tricky to use the results from this in a cost-benefit analysis because complete elimination of blackouts is impossible; especially when taking into account the development status of the country. However, in the long run it may be technically possible to eliminate all unplanned blackouts. Further, the respondents seem to believe that this is possible, as there were very few protest zeros - only 3.3 % of those that reported zero WTP said they had zero WTP because there were aspects of the contingent valuation (CV) scenario they did not believe in. Asking households for how much they would be willing to pay for a reduced number of blackouts is better in terms of easily utilizing the results for cost benefit analysis. However, the reason why we chose to phrase the question this way is because it is easier for respondents to relate to and therefor give valid answers. As the number of blackouts varied widely between respondents; asking them for a avoiding a specific number might not suit all respondents and feel even more hypothetical and random than asking them to pay to avoid all the blackouts they experience. Second, we know exactly what the respondents are valuing - the welfare loss from elimination of the blackouts they reported that they experienced.

[3] Average number of blackouts 160 per year = 13.33 blackouts per month; average duration of each blackout = 4 h; average monthly duration = 13.33 x 4 h = 53.3 hours

The payment vehicle that is used is a payment card where respondents can choose from values ranging from zero to 3600 birr. In addition, the respondent has an option to state any "Other value" which should have been named "higher than 3600 birr". However, we believe that in practice it signaled a higher amount than the highest on the card as this option was located just after the highest amount on the payment card.

Regarding the payment card, there is also the issue on how to interpret a "0 birr" response. Some zeros are real zeros and some zeros are protest zeros, and some who stated 0 may have a positive WTP of <5 birr (which is the next amount on the payment card). In the paper "0 birr" responses are interpreted as zero WTP, whereas choices above "0" are interpreted as WTP being between the stated amount and the next amount on the payment card. Consequently, the interpretation is inconsistent between the zero responses and the rest of the responses. However, interpreting the "0" bid as a zero response and asking the follow-up question "Why zero WTP?" allows us to distinguish between real and protest zeros where we delete the latter group as they might have WTP>0 (and thus including them would underestimate WTP). For consistency we could have included the real zeros as the midpoint between 0 and 5 birr, which would have increased the mean WTP slightly.

Further in the results section the use of the Tobit model was not clarified. When applying the Tobit model, we did not used the two-part model but a truncated data, where the "0" choices were dropped, and the model was run only for positive WTP amounts.

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Essay I

Energy Economics 109 (2022) 105943

Contents lists available at ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneeco

Valuing energy poverty costs: Household welfare loss from electricity blackouts in developing countries

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ARTICLE INFO

JEL classification:
Q 41
Q 49
Q 51

Keywords:
Energy poverty
Electricity blackouts
Contingent valuation
Stated preference
Developing countries
Households
Welfare loss

ABSTRACT

Supply of electricity is not keeping up with the rapidly increasing demand due to industrialization as well as electrification of rural areas in many developing countries. This study adds to the scarce literature on valuing the welfare loss to households in developing countries from energy poverty in terms of access only to intermittent or unreliable electricity networks. We conducted a Contingent Valuation (CV) survey of households in both urban (city of Mekelle) and rural areas (village of Ashegoda) in Northern Ethiopia to estimate households' willingness-to-pay (WTP) to avoid electricity blackouts. On average, the households experienced 160 blackouts per year with an average duration of four hours; and were on average willing to pay 499 Ethiopian birr (18 USD) per household per year. This corresponds to a 34% increase in their annual electricity bill and represents 1% of their mean annual income. Thus, this type of energy poverty represents significant welfare losses in developing countries. The households' WTP to avoid blackouts increases significantly both with annual income and expenditure as a proxy for income; and with the annual number of experienced blackouts, the average length of these blackouts, and the number of damage categories experienced. These results are all as expected and support the validity and reliability of CV surveys to assess household welfare loss from this type of energy poverty in a developing country context.

1. Introduction

Energy poverty is defined as the inability of households to have access to adequate, affordable, reliable, high-quality, safe and environmentally benign energy services (Reddy et al., 2000). There is a general agreement that electrification is fundamental to economic growth and social welfare. There are numerous studies showing the positive effects of electricity on income, education, employment, and indoor air quality (Chakravorty et al., 2014; Khandker et al., 2013; Dinkelman, 2011; Barron and Torero, 2017). In developing countries like Ethiopia only 45% of the population had electricity in 2018, meaning that 60 million people have no electricity connection (IEA, 2019). The Ethiopian government continues to set goals to increase access to electricity and have launched a national electrification program aiming for universal access by 2025 (IEA, 2019). Increased use of decision support tools like cost-benefit (CBA) analysis to assess the profitability of energy investments, increase the need to document the full economic benefits of these investments, which includes reductions in energy poverty among households. This paper provides an example of how welfare effects of reducing energy poverty to households in Northern Ethiopia can be valued in monetary terms using state-of-the art Stated Preference (SP)[1] methods to map their willingness-to-pay (WTP) to avoid black-outs.

Higher quality of electricity i.e., less blackouts and brownouts, is just as important as access to electricity. Fewer power outages have a positive effect on income (Chakravorty et al., 2014; Dang and La, 2019), land and investment decisions (Dang and La, 2019), women empowerment (Sedai et al., 2020), consumption expenditures (Sedai et al., 2021) and ownership of basic appliances (Bajo-Buenestado, 2021). Poor quality of electricity has a significant negative impact on the production and income of companies (Fisher-Vanden et al., 2015; Allcott et al., 2016). Blackouts and brownouts are linked to slower economic growth. In 2010, power shortage caused a 3.1% loss in Gross Domestic Product (GDP) in Ethiopia (Engida et al., 2011). Since GDP does not include household welfare losses, it is essential to document the welfare losses due to poor electricity quality.

Many SP studies in the developed world have estimated households'

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[1] Stated Preference (SP) methods include Contingent Valuation (CV) and Choice Experiments (CE).

https://doi.org/10.1016/j.eneco.2022.105943
Received 30 January 2021; Received in revised form 26 February 2022; Accepted 1 March 2022
Available online 10 March 2022

willingness-to-pay (WTP) for power reliability (Hensher et al., 2014; Woo et al., 2014; Kim et al., 2015; Blass et al., 2010; Cohen et al., 2016; Cohen et al., 2018; Layton and Moeltner, 2005; Carlsson and Martinsson, 2007; Carlsson and Martinsson, 2008; Reichl et al., 2013; Morrissey et al., 2018; Bliem, 2009; Amador et al., 2013; Pepermans, 2011; Ozbafli and Jenkins, 2016; London Economics, 2013; Accent., 2008; Merk et al., 2019; Motz, 2021). However, in developing countries, and Africa in particular, there are still relatively few SP studies of households' welfare loss from unreliable electricity supply (Abdullah and Mariel, 2010; Oseni, 2017; Meles, 2020; Zemo et al., 2019; Alastaire, 2015; Nkosi and Dikgang, 2018; Twerefou, 2014; Amoah et al., 2017;) although power insecurity is very widespread.

Our study adds to this scarce literature in developing countries and complements Meles (2020) and Zemo et al. (2019) by providing a new case study in Northern Ethiopia. Meles (2020) used both defensive (averting) costs and Contingent Valuation (CV) to estimate households' welfare loss from power outages in the Ethiopian capital of Addis Ababa. Zemo et al. (2019) studied the determinants of households' WTP to reduce power outages using a sample of urban households from Mekelle, Ethiopia. A main contribution of our paper in this respect is that we perform an urban-rural analysis in order to identify any spatial variation in households' welfare loss from electricity blackouts and try to determine what socio-economic characteristics and other factors that can explain such variation.

The main aim of this paper is to apply the best practice guidance in SP methods (Johnston et al., 2017) to design a CV survey to get a valid and reliable estimate of households' WTP for eliminating electricity blackouts in Northern Ethiopia and determine the factors affecting their WTP. This study adds to the scarce developing country context literature on this topic in terms of: i) a clearly specified change in energy reliability, ii) covering both urban and rural households, and iii) extending the set of explanatory variables from socio-economic variables to also include households' possession of alternative energy sources and their recall of the government's unfulfilled promises with regards to energy supply.

The remainder of this paper is structured as follows. Section 2 provides a literature review of energy poverty and SP studies valuing household welfare losses from power outages Section 3 describes the methods and data, while section 4 presents and discusses the results, and section 5 concludes.

2. Literature review

Definitions of energy poverty (and fuel poverty) in the literature are centered around access to modern energy service, energy consumption levels, and affordability of energy for basic utilities (Boardman, 2010; Buzar, 2007; Li et al., 2014; Thomson et al., 2016). On the other hand, Reddy et al. (2000) cover multiple aspects by defining energy poverty as "the absence of sufficient choice in accessing adequate, affordable, reliable, high-quality, safe and environmentally benign energy services to support economic and human development". This is a more inclusive definition which corresponds better with the actual experience of households, especially in developing countries.

There are different approaches to measuring energy poverty. Below we summarize the most prominent ones. The most applied measure of energy poverty is the *Income-expenditure approach*; also known as the *Economic threshold* (Awaworyi Churchill and Smyth, 2020; Awaworyi Churchill and Smyth, 2021; Kahouli, 2020). It is based on income and energy-related household expenditures where the share of energy spending is higher for energy-poor households (Herrero, 2017; González-Eguino, 2015; Boardman, 2010). An example of the Economic threshold can be found in the UK fuel poverty official statistics, where the Energy expenditure (ENEX) threshold is set at 10% of household income (Hills, 2012). Households spending more than the 10% mark are considered energy poor. One problem with this approach is that it is challenging to compare countries because of its relative nature (González-Eguino, 2015). There is also no emphasis given to the type or quality of energy service households have. Therefore, this approach may underestimate the extent of energy poverty in developing countries in which some households spend a share of their income on traditional energy sources (Ismail and Khembo, 2015).

The *Low income-high cost (LIHC) approach* uses the income threshold and energy expenditure threshold. Households with a residual income (after deducting energy expenditures) lower than 60% of the median income, and with a higher energy expenditure than the median expenditure are considered energy poor (Hills, 2012). In both the Economic threshold and LIHC approaches the actual threshold chosen will influence the number of households categorized as energy poor (Rafi et al., 2021). Another potential problem is that these measures are based on actual energy expenditures, which can be lower than the desired expenditure because of costs (Awaworyi Churchill and Smyth, 2020), or because of frequent power outages.

The *Technology threshold approach* originates from the energy poverty definition stating that there is a lack of access to modern energy services. Energy poverty is measured by counting the number of people with no access to modern energy services such as electricity (González-Eguino, 2015). This measure is widely used in the context of developing countries and is easy to compute and compare, but it does not capture the affordability dimension of energy poverty. Some households have access to energy but are not able to afford it (Ye and Koch, 2021; Winkler et al., 2011). It also does not consider the degree of energy insecurity, which is a very common scenario in developing countries.

The *Physical threshold approach* measures energy poverty through the minimum energy consumption associated with basic necessities. Any household below the minimum threshold is categorized as energy poor, but the number of people categorized as energy poor is sensitive to the choice of threshold, and the definition of basic necessities. (González-Eguino, 2015; Herrero, 2017).

Subjective measures use households' feelings and perceptions of their energy use (González-Eguino, 2015). The most used subjective measure is households' self-assessment of the inability to afford adequate warmth (IAAW) in their homes (Thomson et al., 2017; Awaworyi Churchill and Smyth, 2020). The subjective measures are criticized for their lack of consistency across respondents and that the responses are influenced by respondents' cultural, geographical, and demographic characteristics (Thomson et al., 2017). For instance, Deller et al. (2021) found that household heads aged 65 or more are less likely to report IAAW while they are at a higher risk of being declared as energy poor according to the expenditure based indicators (i.e., ENEX and LIHC). The IAAW is a widely applied subjective measure but fails to include other energy demands such as cooling (Thomson et al., 2017). In addition, households may be unwilling or unable to identify themselves as energy poor (Deller et al., 2021).

Despite the shortcomings, subjective measures are proposed and widely used in the energy poverty literature, either independently or coupled with other measures (e.g., Awaworyi Churchill and Smyth, 2020; Thomson and Snell, 2013; Thomson et al., 2017; Price et al., 2012). One of the reasons behind this popularity is that these measures captures the lived experience and the feeling of being energy deprived (Thomson et al., 2017).

Deller et al. (2021) describes significant variation between the subjective and objective measures. The limited overlap between the subjective and objective measures is persistent through time, and not temporary. One of the suggested reasons is that households may not consider the threshold of the expenditure-based approaches as unaffordable. The households may also not feel comfortable declaring that they are energy poor. There could also be a degree of household heterogeneity affecting their responses due to differences in demographics, geographical and cultural conditions. Finally, households may report IAAW but spend much less of their income on energy to restrict their energy consumption for affordability reasons (Deller et al., 2021).

Multidimensional measures use a set of different indicators to capture

multiple dimensions of energy poverty. These measures have become widely used in the literature. For example, Awaworyi Churchill and Smyth (2020) and Munyanyi et al. (2021) used a composite index of energy poverty (households' energy deprivation score), combining the subjective and expenditure measures. In their study, equal weights (0.5 each) were assigned to the subjective and expenditure indicators. A household with a household energy deprivation score of 0.5 or more is considered energy poor.

The results of the multidimensional indices are sensitive to how they are designed. The assigned weights and the type of indices chosen to be included may significantly influence the results (Ye and Koch, 2021). Nussbaumer et al. (2012) introduce the multidimensional energy poverty index (MEPI), which comprehensively frames energy poverty in terms of household energy deprivation in different areas, as opposed to access only. The inclusion of services contingent upon electricity access broadens the measurement to include the affordability of energy, and not just the access. The reliability of the power grid is not included, but the cooking method is included, and can in some way be said to capture a bit of the variation in grid reliability.

Energy insecurity is directly related to the measures mentioned above. Together with the above measures, energy insecurity should be accounted for, in relation to energy poverty, and included where possible. In the income-expenditure approach, power outages will reduce the energy costs, and potentially put households artificially below the threshold of energy poverty. In the technology threshold approach, households will be counted as energy poor only if they are not connected to the grid, and effects of unreliable connections will not be accounted for. In the physical threshold approach, a blackout-related reduction in energy consumption increases the number of energy poor households counted as energy poor. In the subjective measures, households may feel deprived of basic energy services due to unplanned frequent blackouts and brownouts. This makes them more likely to self-report as energy poor, depending on how the energy poverty questions are framed. Lastly, in the multidimensional approaches, the frequency and duration of blackouts can easily be included in the framework and should be included if data is available. Failure to include any measure of energy insecurity will bias the results, and potentially misclassify households with regards to energy poverty.

Consistent electricity supply should be given equal attention to ensuring just access to electricity. Lack of regular access to electricity in developing countries has various negative impacts on households, small businesses, manufacturers, and public services. It interferes with day-to-day activities and hinders productivity, which limits growth and development. It also increases the households' use of kerosene, charcoal, and firewood causing increased indoor air pollution and associated health risks in terms of respiratory diseases, especially for those spending much time at home. Women, small children, and the elderly are the most vulnerable (WHO, 2018).

In addition to direct monetary costs, households face non-monetary costs due to interrupted electricity supply. Such welfare losses were estimated in a cross-country study by Cohen et al. (2016). They examined households' WTP to avoid blackouts in 15 EU countries.

They reported that the average household in Romania, Bulgaria, Greece, Hungary, Poland, Finland, Slovenia, Spain, Estonia, Sweden, Denmark, Ireland, Netherlands and Germany was willing to pay between €1.035 and €3.994 to avoid a 1-h power outage in winter, and between €0.088 and €1.100 to avoid a 4 h power outage in the summer. For France, the WTP was €0.364 to avoid a 1-h blackout in the winter season and a negative estimate for the summer outages, which indicated the general aversion of additional cost related to power service in the French household sample. WTP was generally high for the wealthiest nations (Finland, Denmark and Germany) and for the lowest power reliability tier (Romania, Bulgaria, Hungary and Poland) in their sample. Another cross-country CV study by Cohen et al. (2018) reported that households had an average WTP of €1.40 (Belgium), €1.47 (UK), €1.72 (Sweden), €1.96 (Netherlands), €2.31 (Austria), €2.83 (Luxembourg), €4.02 (Ireland) and €4.10 (Denmark) to avoid a 1-h loss of front door electricity in winter.

According to Blass et al. (2010), households in Israel had a mean WTP of 0.98 USD for a one-minute reduction in the duration of a blackout when there was only one such event per season, and 0.36 USD when there were five outages per season. They also found that households' valuation of power outages vary with how the reduction in power outage time is obtained. Households were willing to pay only 0.42 USD for a one-minute reduction achieved by reducing the frequency of blackouts when the blackouts have a 1-h duration.

In Canberra, Australia, Hensher et al. (2014) found that households' average WTP was 60 AUD (45.52 USD) to avoid an 8-h long power

Table 1
Review of Stated Preference surveys (Contingent Valuation, CV and Choice Experiment, CE) in Africa of households' willingness-to-pay (WTP) for improved energy security.

Authors	Valuation Method[2]	Country	Data collection Year	Households' willingness-to-pay (WTP)[1] for improved energy security
Abdullah and Mariel, 2010	CE	Kenya	NA	WTP KES 51.79 (0.68 USD) per month for improved electricity service
Oseni, 2017	CV	Nigeria	2011	WTP between NGN 956.60 (6.16 USD) and NGN 1160.72 (7.48 USD) per month to reduce blackout to half of the level they were experiencing.
Meles, 2020	CV	Ethiopia	2016	WTP 31 ETB (USD 1.3) per month for improved electricity service
Zemo et al., 2019	CE	Ethiopia	NA	The marginal WTP to reduce the frequency of outage by one is 1.857 ETB (0.07 USD) and 6.191 ETB (0.22 USD) per month when the outage happens ten times in a month and three times in a month, respectively
Alastaire, 2015	CV	Benin	2010	Weekend 800 FCFA (1.76 USD); Weekdays 400 FCFA (0.88 USD); Night 831 FCFA (1.83 USD); Day 381 FCFA (0.84 USD); Weekday 1 h 109 FCFA (0.24 USD); Weekend 1 h 642 FCFA (1.41 USD)
Nkosi and Dikgang, 2018	CV	South Africa	2015	WTP ranges from ZAR 69.53 (5.79 USD) to ZAR 106.68 (8.89 USD) to avoid a 5-h long blackout
Amoah et al., 2017	CV	Ghana	2015	Those who trust the government were willing to pay GHS 66.78 (20.77USD) per month and those who do not trust the government were willing to pay GHS 69.76 (21.7USD) per month for improved electricity
Twerefou, 2014	CV	Ghana	2013	WTP ¢0.2734 for a kilowatt-hour

Remarks: 1. Converted from national currencies to US dollar (USD) using exchange rates in the year of the study (and publication year if study year not available (NA)). 2. Stated Preference methods: CV = Contingent Valuation and CE = Choice Experiment.

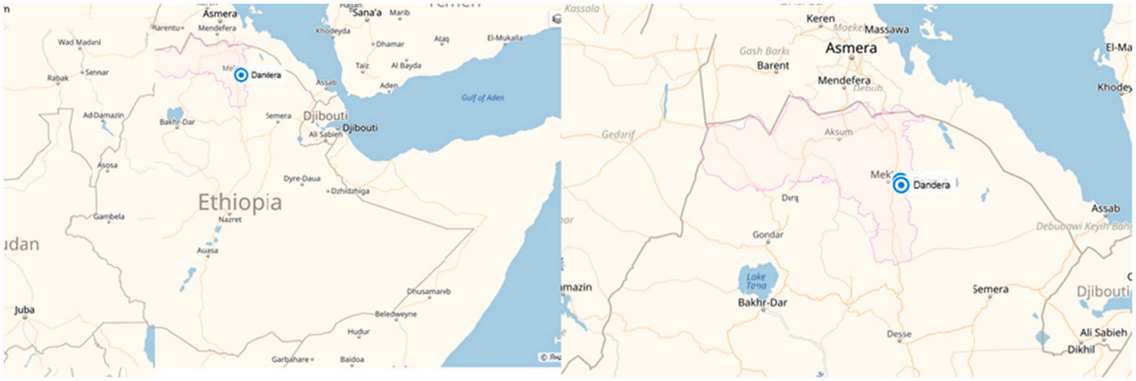

Fig. 1. Map of Mekelle and Ashegoda (Dandera village) in Northern Ethiopia (Map of Ashegoda – GeoLocated Ethiopia, 2021)

outage when it occurred once a year and 9 AUD (6.83 USD) to avoid a flicker in the electric current. Woo et al. (2014) estimated that, the average household cost in Hong Kong for a 1-h power outage was 350 HKD (45 USD). A recent Choice Experiment (CE) study in Switzerland by Motz (2021) mapped households' preferences with regards to frequencies and duration of blackouts and the primary energy sources used for generation. The willingness-to-accept (WTA) compensation estimates for having blackouts had a wider range from slightly negative values to more than 10 times the average price of electricity.[2]

Other studies in developed countries estimating the welfare loss of power outages using SP methods include: Kim et al., 2015; Carlsson and Martinsson, 2007; Carlsson and Martinsson, 2008; Reichl et al., 2013; Morrissey et al., 2018; Bliem, 2009; Amador et al., 2013; Pepermans, 2011; Ozbafli and Jenkins, 2016; London Economics, 2013; Merk et al., 2019. For a review of these papers and their results, see (Motz 2021)). Motz (2021) concluded from her literature review that the large variably of the WTP/WTA estimates observed in the literature is due to the differences in scenario descriptions in SP studies, and the different structure of the electricity sector and consumption habits in different countries. However, it could also arise from consumer reactions in different contexts and structural taste variability.

Table 1 provides an overview of eight SP studies in Africa estimating households' WTP for improved energy security.

These studies also provide interesting results with regards to what factors determine households' WTP, and the relative size of their WTP compared to their current electricity bill. Some examples are provided below, and are also discussed in relation to the results from our study in section 4.

Abdullah and Mariel (2010) used a CE to estimate households' WTP to avoid power outages in Kisumu, Kenya. They show that those who are unemployed, own a bank account, and are engaged in a farming activity were willing to pay on average KES 28.30 (0.26 USD), 90.96 (0.84 USD) and 74.95 (0.70 USD), respectively. Mean WTP for the rest of the sample was KES 51.79 (0.48 USD).

Oseni (2017) investigated the relationship between engagement in self-generation to mitigate impacts of poor electricity service and WTP for electricity service reliability in Nigerian households; and found that self-generation is positively correlated with their WTP.

Meles (2020) used both defensive (averting) costs and CV to estimate households' welfare loss from power outages in the Ethiopian capital of Addis Ababa. On average households were willing to pay 31 ETB (1.30 USD) per month for improved electricity supply, which is 23% of their average monthly electricity bill. His analysis shows that monthly household income, distance from the utility head office, education, and belief in future service improvement increased households' WTP for improved electricity supply; while WTP decreased with age.

3. Methods and data

3.1. Survey design and data collection procedure

The survey design and the implementation of this CV study was based on the contemporary guidance for stated preference studies (Johnston et al. (2017) in order to increase the validity and reliability of the survey results. Validity refers to maximizing accuracy in estimation while reliability refers to minimizing variability, and a credible CV study incorporates both attributes (Bishop and Boyle, 2017).

An eight-page long questionnaire was developed (see Appendix A). It was originally in English and then translated to Tigrigna.[3] The questionnaire starts by asking respondents to assess public services and goods, including electricity security (i.e. avoidance of blackouts); and then goes on to ask about their energy saving and environmental behavior[4]; see appendix C (Tables 29 and 30, respectively). These questions aim at helping respondents to put electricity blackouts in a broader perspective.

The second part of the questionnaire contains the CV scenario and willingness-to-pay (WTP) questions. The respondents were presented with a hypothetical scenario where the government plans to eliminate blackouts by upgrading hydropower dams, building new wind farms and new transmission lines. They were told that the project cost will be covered by the government, international donors, companies, and households collectively; and that the project will be implemented if these parties are able to cover the cost of the project. Then respondents were asked the most they would certainly be willing to pay annually, on the top of their electricity bill, to eliminate blackouts. The payment card showed different amounts ranging from zero to 3600 Ethiopian birr[5] per year.

Questions on respondents' socio-demographics and a question about respondents' perception of the survey constituted the last part of the questionnaire. To avoid any disruptions of the survey, income related questions which were judged to be the most sensitive, were placed at the very end of the questionnaire.

[2] The average electricity price was about 0.21CHF/kWh (0.22 USD/kWh).

[3] Tigrigna is a language spoken by inhabitants of Mekelle and Ashegoda.

[4] Recommendation 12 for Stated Preference (SP) surveys: SP studies should contain supporting questions to enhance validity (Johnston et al., 2017).

[5] 1 US dollar (USD) = 27.28 Ethiopian Birr (EB) at the time of the survey (2018).

3.2. Sampling procedure

A sample of 150 respondents were drawn using cluster sampling and simple random sampling in Mekelle, and a similar procedure was used to sample 51 respondents in Ashegoda. Mekele is a big city and Dandera is a small village in rural Ashegoda (see Fig. 1). Although larger sample sizes are preferred, we were not able to exceed 201 because of financial constraints. The generalizability of our results should therefore be tested in further surveys with a larger sample size in developing countries.

The clustered sampling involved selecting one out of a total of seven 7 sub-cities in Mekelle, for simple random sampling of households. In the selected sub-city Hadenet there are five weredas. Out of the five weredas three were selected randomly. Finally, respondents were selected randomly from the selected weredas. For the Ashegoda sample, respondents were randomly drawn from the village Dandera.

3.3. Scenario description

In the CV scenario the status quo, the proposed change, the mechanism of change and payment vehicle should be described in a clear and understandable manner to help respondents figure out their expected gain or loss from the proposed change (here: elimination of electricity blackouts). A survey design procedure that ensures respondents' understanding of the questions is also required (Johnston et al., 2017).

The following valuation question format was used to elicit respondents' WTP to avoid blackouts:

"The Government is now considering implementing a program to reduce the number of blackouts from the current level to eliminate the blackouts. The program includes upgrading old and building new electricity production plants and new transmission lines. The costs of this program will be covered by international donors, government, companies and the households. If the government sees that these interest groups are willing to pay more to avoid the blackouts than what it costs, they will implement the program, which will eliminate blackouts. Think about what it is worth to you to fully avoid the negative impacts you have experienced from blackouts the last 12 months. What is the most, if anything, your household certainly is willing to pay per year for 10 years on the top of your annual electricity bill (or on the top of your house rent, if you are not paying the electricity bill by yourself) to fully avoid blackouts? Remember that this payment will reduce your spending on other goods and services". Here, the baseline scenario is clearly stated as the current level of blackouts the household is experiencing, and which they had reported prior to the WTP-question in terms of the annual number of blackouts. Further, the proposed change is to *eliminate* blackouts.[6] Thus, it is clearly specified what change in the provision of the good (electricity security) the households are asked to state their WTP for, as opposed to Meles (2020) that used a dichotomous choice CV question to elicit respondents' WTP for "improving the electricity supply".[7] Meles (2020) specified a project and listed measures to improve the electricity supply, but did not specify the change in energy security the respondents were asked to value. We avoided listing the measures in order not to divert respondents' attention from the benefits they had from avoiding blackouts, and instead asked them specifically to tell us what it was worth to them to avoid the negative impacts they had experienced from the blackouts.

The last pilot survey we conducted verified that respondents understood the information provided.

To increase the credibility, realism, and acceptability of the CV scenario, we told our respondents that international donors, the government, companies, and households would cover the cost of the proposed program. It was important to mention that international donors and companies would contribute for two main reasons. First, to increase its acceptability, as respondents might not trust the government to implement the measures needed on their own; given the political unrest in the country. Second, it is consistent with the current practice in the country; i.e. international donors and companies participate in similar development projects.

A binding and realistic decision rule is important in SP surveys (Johnston et al., 2017).[8] Hence targeting the truth-telling behavior of respondents, we made it clear that the program will be implemented given that the interest groups are willing to pay more to avoid blackouts than what it costs to eliminate them. This will increase the likelihood of obtaining true WTP values from subjects. If a respondent state a higher WTP amount than what it is really worth to him/her to fully avoid the negative impacts, there is a higher probability that the program will be implemented and therefore the respondent will end up paying more than their true WTP. On the other hand, if a respondent states a lower WTP amount than what it is really worth to them to fully avoid the negative impacts for them, then there is a lower probability that the program will be implemented and therefore they might not get the desired change. A rational respondent will then provide his/her true WTP value.[9]

We clearly informed about the payment type and process of the proposed change. We used a payment card approach in which respondents were asked to choose an amount (from a list of amounts; including a "Don't know" option), which reflects what their household certainly is willing to pay per year for 10 years on the top of their annual electricity bill to fully avoid blackouts. A different payment vehicle, housing rent, was used for those who do not directly pay the electricity bill themselves.[10] Using an electricity bill as a payment vehicle for such respondents would be absurd and may even stand as an excuse for respondents' payment-rejection.[11]

3.4. Survey pretesting

While designing the questionnaire for this study, consecutive pilot tests were conducted with the intent of developing an understandable and credible questionnaire for the respondents. There are two types of pretesting, qualitative and quantitative pretesting. Though time and budget limitation allow us to conduct only qualitative and quantitative pretesting, conducting post surveys was also favorable. As for Johnston et al. (2017) an ideal survey process includes both types of pretests and post-survey tests.[12]

We conducted the first pilot test in July 2017, where 10 people were interviewed. The interview constituted open-ended questions including the valuation questions. In addition to helping us frame the auxiliary questions, the responses also helped us determine what range of amounts to put on the payment card for the WTP-question.

The second pilot was conducted in September 2017. Questionnaires were sent to 20 respondents by e-mail. Nine of them replied. The responses were helpful in re-designing and simplifying questions in order to make them easier to understand and avoid misunderstandings.

Just before the main survey, the third pilot was conducted in January 2018. There were no major changes in the questions after this last pilot

[6] Based on our findings the average number of blackouts is 160 times per year. Note that we do not have a uniform baseline for all the respondents as different households experience and recall different number of blackouts.

[7] *"Do you support the project, if every household in Addis Ababa including your household has to pay ____birr monthly for improving the electricity supply?" (*Meles, 2020*; p.3)*

[8] Recommendation 10

[9] Recommendation 13: Design of an incentive compatible and consequential valuation questions are important for credibility of the study (Johnston et al., 2017).

[10] This is the case where households rent a house and do not pay electricity bill directly.

[11] Recommendation 11: a realistic, credible and binding payment vehicle must be used (Johnston et al., 2017).

[12] Recommendation 2

survey, but it helped us to see the potential biases enumerators could introduce if they are not sufficiently trained. Therefore, the enumerators were trained[13] for the second time to ensure the quality of the survey.

3.5. Experimental design

Many researchers, as cited by Johnston et al. (2017), advise that effective designs for CV questions should ensure monetary amounts which are credible to respondents and can give unbiased and consistent estimates.[14] Our CV design attempts to adhere to this guidance, as the proposed change to be valued, previous studies and insights learned through pretesting influence the decision in experimental designs (Johnston et al., 2017).

3.6. Valuation question response formats

There are multiple response formats in CV, each with their own advantages and disadvantage. Binary or dichotomous choice, iterative bidding, open-ended elicitation and payment card are among the common response formats. Dichotomous choice format is known to be the most incentive compatible format under certain conditions. Nonetheless, the responses from such elicitation format provide limited information about the respondent's preferences (Carson and Groves, 2007). Like iterative bidding, it is subject to yea-saying and starting bid bias. The payment card approach and open-ended elicitation, on the other hand, suffer from range bias and unrealistically high or zero responses, respectively. The advantage of the payment card approach is that the range bias can be minimized using pilot tests. As mentioned earlier the payment card approach was used for this study, and it seems to provide a relatively unbiased and effective way of eliciting respondents' preferences.[15] Amounts on the payment card were ranging from zero to 3600 birr per year. "Other" and "don't know" reply options were included in order not to constrain respondents to the amounts listed. Even though Johnston et al. (2017) points out that SP studies need not necessarily include "don't know" or "no-answer" options, it is important to include them for CV studies to increase the validity of the WTP amounts elicited (Groothuis and Whitehead, 2002).[16] CV studies and valuation questions as such are not familiar to respondents, and therefore some respondents may struggle in realizing their WTP for the good to be valued. In cases where there is no "Don't know" option, they are forced to give a pseudo-WTP amount.

3.7. Best practice in Stated Preference surveys

This CV survey tried to adhere to the recent best practices recommendations for SP studies as described by Johnston et al. (2017). Table 2 summarizes these recommendations and how they were adapted in the design and implementation of our CV survey.

3.8. Statistical models

Using the payment approach in our CV design, we do not get the real maximum WTP amount, as opposed to an open-ended WTP question. Respondents' reported amount on a payment card is a minimum

[13] Enumerators were trained to familiarize themselves with reading the questions and do it in unbiased manners. For example if respondents did not understand the questions, the enumerators should just reread the questions and should not attempt to further explain the question or interpret it in their own way, as that might introduce another bias. Enumerators were also tested by the supervisors who have extensive experience in data collection.

[14] Recommendation 4

[15] Recommendation 8: reasonable response format should be applied (Johnston et al., 2017)

[16] Recommendation 9: "No answer" option

Table 2
Summary of best practice guidance for Stated Preference (SP) survey design and implementation from Johnston et al. (2017), and how they were implemented in our Contingent Valuation (CV) survey.

No.	Recommendations for SP survey design and implementation from Johnston et al. (2017)	Our CV survey
1.	Scenario presentation: Clear presentation of baseline scenario, the proposed change to be valued, the mechanism of change and the payment vehicle	The status quo, the proposed change, the mechanism of change and the payment vehicles were clearly described for respondents for both valuation questions
	Scenario presentation: Evidence that respondents' perception of the information provided	According to the last pretesting conducted, all respondents seem to understand the information provided by the interviewers.
2	Survey pretesting: Qualitative pretesting	Consecutive qualitative pretests were conducted
	Survey pretesting: Quantitative pretesting	A quantitative pretesting was conducted prior to the main survey
3	Attribute versus non-attribute approaches: Decision, whether to use CV or CE, should base on the objective of the study, the complexity of valuation scenario and respondents' perception towards the good	The choice of CV for this study was based on a number of considerations i.e. objectives of the study, respondents' perception towards the goods and the simplicity of the CV method (as opposed to CE) for respondents.
4	Experimental design: CV questions should ensure credible monetary amounts that can give unbiased and consistent estimates.	Valuation questions and auxiliary questions were carefully designed based on pretesting and the SP literature.
5	Ethical considerations: Survey procedure should avoid significant negative effects for respondents. Neither should it influence the validity of the study adversely.	Standard procedures for data collection were applied.
6	Survey mode: survey mode should be context specific	Face-to-face (f2f) interviews in the field was the most appropriate survey mode for our respondents, as internet and mail services are unreliable/have limited coverage.
	Sampling: random sampling from the population	Respondents were randomly selected from the population.
7	WTA (willingness-to-accept) compensation versus WTP: The decision between WTA and WTP should be based on empirical and theoretical considerations.	WTP was considered, both theoretically and empirically, to be most suitable for truthfully revealing respondents' welfare loss. However, note that as WTP is limited by income it also depends on the current income distribution, which may be deemed unjust. Distributional weights can be assigned to the stated amounts to adjust for this.
8	Valuation question response format: reasonable response format should be applied	A payment card approach was used for its relative efficiency
9	"No answer" options	"Don't know" options in the payment cards were provided to increase the validity of the responses.
10	Decision rule: a binding and credible decision rule should be selected	If the parties collectively paying for the program, including households, stated benefits exceeding the program, the program to eliminate blackouts will be implemented (and households have to pay increased electricity bills). This is both a credible, binding decision rule.
11	Payment vehicle: a realistic, credible and binding payment vehicle must be used.	The payment vehicle was an annual addition to households' electricity bills for those who pay electricity bills. For those not paying their electricity bill directly, the payment vehicle was increased house rent. Paying for electricity stability, directly or indirectly, over the

(continued on next page)

Table 2 (*continued*)

No.	Recommendations for SP survey design and implementation from Johnston et al. (2017)	Our CV survey
		electricity bill is both a realistic and credible payment vehicle, as well as involuntary /binding.
12	Auxiliary questions: SP studies should contain supporting questions to enhance validity.	The questionnaire includes supporting questions to check the understanding and acceptability of the WTP-question as well as to collect data on socio-economics and other determinants of WTP.
13	Design of an incentive compatible and consequential valuation questions are important for credibility of the study.	Valuation questions were designed in a way that enhances both payment consequentiality (by using an addition to the electricity bills they are used to pay) and decision consequentiality (by stating that foreign donors, government companies and households will collectively pay the costs). Payment card amounts and their range was based on careful pretesting and framed to enhance incentive compatibility and truthful responses.

indicator of the true maximum WTP as stated by Voltaire (2015). It is assumed that the true WTP lies between the observed amount and the next, higher amount in the payment card (Cameron and Huppert, 1989). Thus, we can take the average between the observed value and the next, higher amount. This average value or mid-point is an approximation of the true unobserved WTP. It can be used in estimating an OLS regression. Alternatively, we can use an interval regression without calculating the mid points. In this case, the respondents' real maximum WTP lies in-between a lower boundary, equal to the amount the respondent picked, and an upper boundary which is less than the next, higher amount. Moreover, a logit model is used to explain what factors affect the decision to pay or not, in order to see whether the same factors that affect the decision to pay or not also affects *how much* they like to pay. In the logit model the dependent variable is a binary variable taking the value 0 and 1, denoting willing to pay nothing and willing to pay some positive amount, respectively.[17]

In this study, models are specified for WTP to eliminate blackouts.

$$WTP_{bo} = \beta_0 + \beta_1 income + \beta_2 bo\_damages + \beta_3 number\_bo + \beta_4 length\_longest\_bo + \beta_5 avg\_length\_bo + \beta_6 recall\_gov\_promise + \beta_7 age + \beta_8 age^2 + \beta_9 sex + \beta_{10} number\_ppl\_in\_hh + \beta_{11} alternative\_energy\_sources + e$$

where, WTP_{bo} is WTP to avoid blackouts.

3.9. Survey mode

The survey mode for this study was face-to-face (f2f) interview. F2f Interviews are the most appropriate survey mode for a developing country like Ethiopia.[18] Other survey modes like telephone surveys and internet survey adversely affect the representativeness of the sample respondents in countries with low internet coverage. Nevertheless, f2f interviews have their own disadvantages e.g. interviewer bias. Therefore, to minimize unintended interviewer bias, we trained our enumerators and tested their performance prior to the data collection.

Table 3
Age distribution of the sample and population in Mekelle.

Age range	Mekelle sample (in percent)	Mekelle population aged between 20 and 74 (in percent)[a]
20–29	33.8	34.8
30–39	23.4	25.8
40–49	19.3	15.2
50–59	12.4	12
60–74	11	11.9

[a] The calculation is based on the census conducted in 1994 by central statistical agency. Note that the percentage we provided are for the population aged between 20 and 74 in order to be able to compare it with the sample data (which ranges between 20 and 73)AGENCY, C. S. *Census 1994 Report* [Online]. Available: http://www.csa.gov.et/census-report/complete-report/census-1994?start=20 [Accessed 2018].

Table 4
Duration and frequency of blackouts in rural (Ashegoda) and urban (Mekele) areas. Number of observations in parenthesis.

	Rural	Urban
Mean number of blackouts	167.4 (36)	157.68 (140)
Mean average length of blackout (hours)	5.8 (33)	3.4 (137)
Mean length of the longest blackout (hours)	342.5 (38)	22.6 (143)

4. Results and discussion

4.1. Sample representativeness[19]

In Mekelle city, the female and male population accounted for 52% and 48% of the total population in 2009, respectively (Mekelle Population Data - Millennium Cities Initiative, 2021). For the Mekelle sample 55% of the respondents were females which is quite representative of the population. However, in the Ashegoda sample the female population was slightly overrepresented. In Dandera village 64% of the inhabitants are female, but in the sample we have 84% female respondents. A possible explanation for this overrepresentation is the relativly higher availablity of females for an interview during the day. possible limitation that stem from having more women is that the WTP may be biased upward since women benefit more from less blackouts.

In terms of age, the Mekelle sample represents the population well as shown in Table 3. We are not able to compare the Ashegoda age distribution with its sample due to lack of population statistics.

[17] Recommendation 14: Econometric estimator selection should base on the data type, the hypothesis to be tested and how the results will be used(Johnston et al., 2017).

[18] Recommendation 6: survey mode should be context specific (Johnston et al., 2017).

[19] Recommendation 20: the generalizability and the sample representativeness of an SP study should be documented (Johnston et al., 2017).

Table 5
Descriptive statistics.

Variables	Mean	Std. Dev.	Min.	Max.	N
Age; in years	38.63	13.77	18	73	196
Number of household members	3.97	2.13	1	11	200
Electricity bill per month; birr	128.3	111.55	1	550	140
Household expenditures per month; birr	3406.47	2323.24	100	10,000	132
Net income per month; birr	3699.33	3438.48	0	25,000	82
Number of blackouts per year	159.67	107.16	14	1080	176
Length of the longest blackout per year; in hours	89	232.44	1	2160	181
Average length of blackouts per year; in hours	3.87	3.95	0.05	24	170
Gender; male = 0, female = 1	0.62	0.49	0	1	201
Recall unfulfilled government promise; 1 = yes, 0 = otherwise	0.36	0.48	0	1	198
Damage of blackouts[a] 0 = less than 4 damage categories; 1 = 4 or more	0.43	0.50	0	1	200
Alternative energy sources; 0 = less than 3 alternative energy sources, 1 = 3 or more	0.22	0.41	0	1	192

Note: 1 US dollar = 27.28 = Ethiopian birr at the time of the survey, 2018.
[a] Damages from blackouts for the households includes the following unable to cook with electric appliances, unable to refrigerate food, unable to use bank services and ATM, negative entertainment effects, vulnerable to robbers in a dark night, not able to read or study and so on.

4.2. Descriptive statistics

The raw data is a set of continuous, categorical and binary variables. Some variables were transformed to dummy variables. The variables transformed to dummies are: if respondents recall previous unfulfilled government promises about eliminating blackouts, damage of blackouts, and what other energy sources than electricity they have.

A total of 201 households were interviewed. Among the respondents, 62% were female. For the combined sample, the average age was 38. Half of the respondents were between the age of 22 and 38, 5% were under the age of 22, 26% were between 38 and 50, the rest of the respondents were distributed above 50 and the maximum is 73 (see Table 5).

Respondents were asked the highest attained education. 26% of the respondents had no schooling. 2% can only read and write. Those who attained vocational training, primary or secondary school constituted about 39.5% of the sample respondents. The remaining 32.5% had attained a diploma, bachelor or a master degree.

54.5% of the respondents had either a full time or part-time jobs. However, in the Ashegoda sample more than half were females and most of them were housewives. Around 54% of the respondents were married, 27% were single. The remaining were divorced and widowed. The average household size was approximately 4, and the average number of children in the household is 2. The largest family in the sample had 11 household members.

Almost half of the respondents live in a rented house. Out of these respondents, 36% does not pay electricity in a rented house. Therefore, those people were asked how much they would be willing to pay for the proposed program on the top of their monthly rent in the WTP part of the questionnaire. However, for other respondents, they were asked how much they would be willing to pay on the top of their electricity bill. Average electricity bill was 128 birr per month for those who are paying electricity bills. The average rent was 848 birr per month for those who do not pay electricity.

The average household income was 3700 birr per month but more than half of the respondents were not willing to reveal their income, therefore in the estimated models expenditure was used as a proxy variable for income. The average household expenditure was 3406 birr per month.

The average number of blackouts per year was 160 times with an average length of 3.9 h (see Table 4). Respondents were asked to report the longest blackout they experienced in the last year. The mean length of the longest blackout is the average of the longest blackout each household reported. The mean length of the longest blackout per year was 89 h. Dropping those who reported power outage of more than 7 consecutive days, the mean length of the longest blackouts becomes 26.5 h.

Damages of blackouts for the household includes the inability to cook, light, bake, iron, refrigerate, do laundry and other household chores. The overall frequency of different damage categories experienced by households is provided in the descriptive statistics in Table 18 in appendix C. For the regression modelling these data were converted into a dummy, where 0 denotes less than four types of damages and 1 denotes four or more types of damages experienced by the household. 56.5% of the respondents experienced less than four types of damages whereas the remaining respondents suffer from four or more damages.

The majority, 78% of households, use less than three alternative energy sources other than electricity for home making whereas 22% had three or more alternative energy sources. The alternative energy sources include coal, gas, woodfire, dung and others. The frequency distribution of this variable is provided in the descriptive statistics in appendix C. For the analysis, this variable was converted to a dummy variable.

Two respondents did not answer the question regarding government promises. Out of the 198 who responded, only 35.9% of them recall the government's previous promises of eliminating blackouts, the remaining either don't remember or don't know.

4.3. Mean willingness-to-pay (WTP) and determinants of WTP

The mean WTP to avoid the blackouts is positive. On average respondents were willing to pay 366.5 birr every year for ten consecutive years; based on the stated amounts on the payment card (PC). Using the mid point betweeen the stated amoiunt and the next amount on the PC, the mean WTP grows to 499 birr per year, with the median being 210. The maximum WTP amount was 3600 birr whereas zero is the minimum. 19% of the respondents had zero willingness to pay and 8% answered "don't know". Out of all the zero responses, 17.4% were considered as protest zeros. Mean WTP was calculated with and without protest zeros. The mean WTPs calculated without and with the protest zeros are provided in Tables 6 and 7, respectively. The main reason for excluding protest zeros from any calculations is that those zeros are not true zeros. These respondents could have positive WTP for the elimination of blackouts, but we cannot observe it as they are answering zero to protest one or more aspects of the CV scenario. Thus, all respondents stating zero WTP were asked why they were not willing to pay anything in order to identify the protest zeros. Reasons classified as protest responses include: i) they do not think the program would be effective, ii) they do not think they should pay for the proposed program, iii) they do

Table 6
Willingness to pay (WTP) to avoid blackouts without protest zeros; WTP/household/year (in Ethiopian birr); selected amount on the payment card, and midpoint between selected amount and the next, higher amount on the payment card (but zero and highest amount coded as stated).

WTP to avoid blackouts	Mean	Median	Standard deviation	Minimum	Maximum	Number of observations
Selected amount	366.55	120	496.64	0	3600	174
Midpoint interval	499.14	210	578.68	0	3600	174

Table 7
Willingness to pay (WTP) to avoid blackouts with protest zeros; WTP/household/year (in Ethiopian birr); selected amount on the payment card, and midpoint between selected amount and the next, higher amount on the payment card (but zero and the highest amount stated explicitly are coded as the amount stated).

WTP to avoid blackouts	Mean	Median	Standard deviation	Minimum	Maximum	Number of observations
Selected amount	350.44	120	491.35	0	3600	182
Midpoint interval	477.20	210	574.98	0	3600	182

Table 8
WTP/household/year (for 10 years) to eliminate blackouts for the Ashegoda rural and Mekelle urban samples (without protest zeros), based on the stated payment card (PC) amount and the mid-point to the next, higher amount on the PC; in Ethiopian birr.

Location		Mean	Median	Std. dev.	Mini-mum	Maxi-mum	Number of obs. (N)
Ashegoda (Rural sample)	Stated PC amount	230.27	120	299.50	0	1200	37
	Mid-point	321.89	210	392.79	0	1500	37
Mekelle (Urban sample)	Stated PC amount	403.36	120	532.53	0	3600	137
	Mid- point	547.01	210	611.78	0	3600	137

Table 9
Regression models for WTP to eliminate blackouts; OLS and Interval regressions.

	(OLS 1)	(OLS 2)	(Interval regression 1)	(interval regression 2
Household expenditures	0.148***		0.151***	
	(0.0000)		(0.0000)	
Damage of blackouts	221.3	290.3*	203.1	273.9**
	(0.1086)	(0.0118)	(0.1026)	(0.0100)
Number of blackouts	1.405**	1.554***	1.333**	1.486***
	(0.0032)	(0.0006)	(0.0020)	(0.0004)
The longest blackout	−0.0123	−0.233	−0.0411	−0.236
	(0.9790)	(0.6064)	(0.9226)	(0.5748)
Average length of blackouts	43.58**	23.20^{+}	42.75**	21.89^{+}
	(0.0099)	(0.0852)	(0.0051)	(0.0806)
Alternative enrgy sources	396.6	232.2	394.3	198.7
	(0.2343)	(0.4413)	(0.2001)	(0.4839)
Recall unfullfilled government promises	−148.8^{+}	−131.9^{+}	−135.6^{+}	−122.0^{+}
	(0.0639)	(0.0679)	(0.0604)	(0.0688)
Age	−3.757	−1.553	−2.826	−0.713
	(0.8958)	(0.9508)	(0.9145)	(0.9760)
Age-squared	−0.0173	0.0190	−0.0310	0.0103
	(0.9567)	(0.9482)	(0.9158)	(0.9703)
Rural	−301.2	−405.1	−265.1	−355.3
	(0.4321)	(0.2113)	(0.4524)	(0.2420)
Female	−417.6**	−241.2*	−414.8***	−236.8*
	(0.0020)	(0.0250)	(0.0005)	(0.0177)
Household members	41.15	53.86*	44.06	52.40*
	(0.2617)	(0.0482)	(0.1875)	(0.0381)
_cons	27.60	238.1	−4.642	228.5
	(0.9661)	(0.6433)	(0.9938)	(0.6357)
lnsigma				
_cons			6.136***	6.234***
			(0.0000)	(0.0000)
N	90	131	90	131
adj. R^2	0.4246	0.1958		

p-values in parentheses.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

not support new government programs, and iv) they don't trust the government.

Table 8 shows the mean WTP (without protest zeros) to eliminate blackouts in the two different locations. From the mid-point WTP estimates we see that the rural (Ashegoda) respondents are willing to pay on average 322 birr per year for the next 10 years, whereas the urban (Mekelle) respondents are willing to pay 70% more (547 birr). Although mean WTP varies between the samples, the median is the same. Thus, the WTP distribution is more skewed towards higher amount in the urban sample, with the highest stated WTP amount in Mekelle being three times higher than the one in Ashegoda.

The overall mean WTP (without protest zeros, and based on the midpoint; see Table 6) of 499 Ethiopian birr was 1.1% of mean annual net income, 1.2% of mean annual household expenditure and 32.4% of mean annual electricity bill. Households being willing to pay an additional one third of their electricity bill shows the extent of the blackout problem. The respondents could be paying lower electricity bill because of frequent blackouts and not using electricity as much, or respondents could be willing to pay this much because they desperately want to avoid blackouts.

The results in Table 9 shows that household expenditures (as a proxy for income) is positively associated with WTP. This is in line with the economic theory that a higher household income will result in a higher WTP. Previous studies (e.g Meles, 2020; Twerefou, 2014; Carlsson and Martinsson, 2007) also reported that income is important in determining the amount households would be willing to pay to avoid blackouts. In our regressions, the expenditure variable reduces the number of observations. Therefore, we run regressions without the expenditure variable. In addition to the previously significant variables, damages of blackouts and household size were significant and positively associated with WTP. These results are as expected and confirm the results from previous studies: e.g. Abdullah and Mariel (2010) demonstrated that household with 10 members had a higher mean WTP than those with 6 household members. The adjusted R-square, and thus the explanatory power, of the model with the expenditure variable is much higher than the regression model without it.

In the estimated models, the number of blackouts has a significant positive effect on households' WTP to eliminate blackouts. Average length of the blackout also appears to significantly increase WTP. This is consistent with previous studies (e.g., Nkosi and Dikgang, 2018; Alastaire, 2015; Carlsson and Martinsson, 2007) that also find that the duration of blackouts significantly affects WTP amounts. Zemo et al., (2019) on the other hand found a contrasting result that marginal WTP decreases with the frequency and length of power outages.

In line with the findings of Twerefou (2014) and Nkosi and Dikgang (2018), male respondents are willing to pay significantly more than females. Carlsson and Martinsson (2007) also show that male respondents have higher WTP than females. This could be because men are more in control of the household finances.

Recalling unfulfilled government promises significantly reduces the willingness to pay to avoid blackouts. Fulfilled political promises and historical practices are very important in shaping citizens' trust in government (Amoah et al., 2017). Previous studies (e.g. Oh and Hong, 2012) have shown that trust in government influences WTP for other projects. Amoah et al. (2017) looked at if trust in government had an influence on Ghanaian households' WTP for improved electricity

Table 10
Logit model for WTP to eliminate blackouts.

	(Logit 1)	(Logit 2)
Household expenditures	0.00663	
	(0.1033)	
Damage of blackouts	−2.965	1.973**
	(0.2420)	(0.0066)
Number of blackouts	0.0998^{+}	0.00618
	(0.0811)	(0.1066)
The longest blackout	−0.00934	−0.000304
	(0.1908)	(0.8953)
Average length of blackouts	−0.641	0.0434
	(0.1290)	(0.5211)
Alternative energy sources	30.82	3.924
	(0.9915)	(0.2804)
Recall unfullfilled government promises	−14.97^{+}	−1.068*
	(0.0903)	(0.0129)
Age	−2.049^{+}	−0.187
	(0.0554)	(0.2205)
Age-squared	0.0189^{+}	0.00188
	(0.0620)	(0.2806)
Rural	−33.52	−4.720
	(0.9907)	(0.1969)
Female	−21.21^{+}	−0.894
	(0.0990)	(0.1638)
Household members	4.797^{+}	0.515**
	(0.0892)	(0.0062)
_cons	47.74^{+}	4.319
	(0.0565)	(0.1495)
N	96	140
pseudo R^2	0.7394	0.2919

p-values in parentheses.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 11
Tobit models for respondents with positive WTP to eliminate blackouts.

	Tobit 1	Tobit 2
Household expenditures	0.210***	
	(0.0000)	
Damage of blackouts	560.5*	394.0^{+}
	(0.0207)	(0.0605)
Number of blackouts	1.835**	2.107**
	(0.0100)	(0.0048)
The longest blackout	−0.325	−0.528
	(0.7512)	(0.5756)
Average length of blackouts	95.72**	38.53
	(0.0011)	(0.1062)
Alternative energy sources	312.9	151.4
	(0.5580)	(0.7829)
Recall unfullfilled government promises	−273.4^{+}	−130.2
	(0.0687)	(0.3306)
Age	−6.308	1.878
	(0.8945)	(0.9649)
Age-squared	0.0473	0.0532
	(0.9265)	(0.9128)
Female	−541.5*	−391.7*
	(0.0111)	(0.0386)
Household members	7.275	31.57
	(0.9014)	(0.5246)
Rural	−393.6	−396.6
	(0.5423)	(0.5211)
_cons	−560.3	−148.1
	(0.6175)	(0.8734)
N	76	108
pseudo R^2	0.0566	0.0214

p-values in parentheses.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

services, and unexpectedly found a negative relationship between trust and WTP. Oseni (2017) pointed out that consumers who have confidence in future service improvements were willing to pay more for power reliability.

Length of the longest blackout, age, household size and number of

Table 12
Principal component analysis (PCA).

	(OLS1)		(OLS_PCA)	
Household expenditures	0.148***	(0.0000)	0.139***	(0.0001)
Damage of blackouts	221.3	(0.1086)		
Number of blackouts	1.405**	(0.0032)	1.117*	(0.0184)
The longest blackout	−0.0123	(0.9790)	0.163	(0.7303)
Average length of blackouts	43.58**	(0.0099)	38.12*	(0.0249)
Alternative energy sources	396.6	(0.2343)		
Recall unfullfilled government promises	−148.8^{+}	(0.0639)	−159.3^{+}	(0.0631)
Age	−3.757	(0.8958)	17.99	(0.5476)
Age-squared	−0.0173	(0.9567)	−0.255	(0.4394)
Rural	−301.2	(0.4321)	621.6	(0.1312)
Female	−417.6**	(0.0020)	−406.5**	(0.0027)
Household members	41.15	(0.2617)	52.78	(0.1668)
Unable to use appliances and services			71.81	(0.2884)
Unable to do basic activities			−95.69	(0.2097)
Vulnarablity to robbers in a dark night			−22.45	(0.7467)
Use of woodfire and dung			−141.5	(0.1561)
Use of coal			209.6^{+}	(0.0644)
Use of gas			134.6^{+}	(0.0693)
_cons	27.60	(0.9661)	−398.2	(0.5661)
N	90		90	
adj. R^2	0.4246		0.4204	

p-values in parentheses.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

alternative energy sources were insignificant in these models and thus they do not contribute to explaining the variation in households' WTP to avoid blackouts. A reduced model was formulated to test the stability of the results, as the reduced model has a higher number of observation than the full model. The same variables (expenditure, number of blackouts, average length of blackout, recalling government unfulfilled promise and gender) were also significant with the same signs in the reduced model as well as in regression models including protest zero observations (see appendix B). In addition to this, the F-test shows that these variables were jointly significant. A variance inflation factor (VIF) test was conducted to detect multicollinearity. The test result shows no evidence of multicollinearity. For robustness purposes, Table 14 in appendix B presents set of regression results where we delete one control variable at a time. The results seem quite consistent across the regressions.

To explore what factors affect respondents' decision to pay something or not, we estimated logit models (see Table 10). The significant variables with regards to WTP were, number of blackouts, recalling unfulfilled government promises, age, gender and number of household members. Male respondents are more likely to be willing to pay than females. Increased number of blackouts increases the probability of being willing to pay something to avoid blackouts. Thus, The average length of blackouts does not affect the decision of whether to pay or not. However, if the respondent has decided to pay something, the average length of the blackout significantly increase their WTP.

Age and respondent's recollection of government's unfulfilled promises to improve electricity supply has a significant negative effect in one of the logit models, whereas the possession of alternative energy sources does not have a significant effect on WTP. The number of people in the household significantly increases the likelihood of paying something.

Tobit models were run only for the respondents stating positive WTP to see whether the same factors determine the decision to pay compared to the decision on how much to pay when you have a positive WTP (see Table 11). The tobit models show that household expenditures (as a proxy for income), damages from blackouts, the number of blackouts, and the average length of blackouts all significantly increase WTP to eliminate blackouts. Males pay significantly more than females. Recalling government unfulfilled promises significantly decreases WTP

(See Table 11.)

To better identify which category of damages from blackouts (i.e. being unable to cook with electric appliances, refrigerate food, to use bank services, to read, have negative entertainment effects, vulnerable to robbers in a dark night, etc.) are important determinants of WTP, we conducted a principal component analysis and identified three components which we named: i) unable to use appliances and services (unable to use refrigerator, unable to use tv/radio for entertainment and unable to use bank services), ii) unable to do basic activities (reading and cooking) and iii) vulnerability to robbers in a dark night. Similarly, we found three components for alternative energy sources: i) use of woodfire and dung, ii) use of coal and iii) use of gas. Out of these predictor variables only use of coal and use of gas were significant and positively influencing WTP (see Table 12). This means that households which use coal and gas as alternative energy sources were willing to pay more to avoid electricity blackouts. This could be due to those using coal and gas having higher income than those who use woodfire and dung. It could also be due to the fact that coal and gas cost more than woodfire and dung.

5. Conclusion and policy implications

Electricity blackouts are among the major problems in Ethiopia, and thus it is important to study households' willingness to pay to avoid blackouts to assess the welfare loss from one aspect of energy poverty. Reducing this aspect of energy poverty should also be viewed as a contribution to the fulfillment of the UN Sustainable Development Goal no. 1 of eliminating poverty.

On average, households face 160 blackouts annually, each with an average length of four hours. In this study, the contingent valuation (CV) method was employed to an urban and a rural sample to estimate households´willingness-to-pay (WTP) to eliminate blackouts in Northern Ethiopia. Results show that households are willing to pay an additional 32% of their annual electricity bill to eliminate blackouts. This could justify larger investments by the government (particularly the Ethiopian electric power corporation (EEPCo)) to reduce blackouts. Households' WTP to eliminate blackouts increase significantly with increasing income, number of blackouts experienced the last twelve months, average length of blackouts and the number of damage categories experienced. Male respondents have significantly higher WTP. Respondents' recollection of government's promises to improve electricity supply significantly reduces the probability of being willing to pay something to eliminate blackouts and the amount households are willing to pay.

This study looks at households' WTP to eliminate blackouts, providing that they have access to electricity. Hence, future research should take a closer look at other external costs of blackouts, and other aspects of energy poverty including brownouts and the lack of access to electricity. Further, the transferability and generalizability of our results should be tested by conducting similar surveys in other developing countries.

The significant WTP among households to avoid blackouts does, however, indicate that this type of energy poverty could represent a significant welfare loss in developing countries. The results can be used to justify larger investments in electricity production and networks in developing countries to reduce the high number and long duration of unplanned power outages that many of these countries experience.

Appendix A. Questionnaire

A1. External cost of wind farms in Ethiopia: Assessment and valuation

Dear respondent, this is a survey on people's experience and attitudes towards energy use. It is conducted in partial fulfillment of master's degree program. I would be most grateful if you could take about 30 min of your time to complete this interview. There are no right or wrong answers. We would just like you to answer this as best as you can. Responses are confidential, so feel free to give your honest opinion.

Thank you in advance for your cooperation

Name of interviewer_____

Date ____

Time interview started _____

Time interview ended _____

Subcity_____

Tabia _____

A2. Part I: perception and attitude towards different energy sources

1. How many years has your household lived where you live now? _____years
2. Resources and budgets are limited and hence a country cannot provide the highest level of all services to its citizens. Some goods and services are more important than other goods and services. In your opinion, how important is it to improve the amount or quality of the following goods and services

For interviewer: Rotate the order of the public goods and services for each respondent

	0.Very Important	1.Somewhat Important	2.Moderately Important	3.Slightly Important	4.Not Important	5.don't know
Primary and secondary schools						
Clinics and hospitals						
Hydro-power development						
Wind-power development						
Roads						
Energy security (avoid blackouts)						
Clean water supply						

3. Please indicate whether you agree or disagree with each of the following statements

	0.Strongly agree	1. agree	2. neutral	3. disagree	4.Strongly disagree	5.Don't know	6.Not applicable
I use energy saving light bulbs							
I turn off the lights when I am not using them							
I keep my home and my car smoke-free							
I plant trees and native plants							
I reduce my use of chemicals							
I dispose waste properly							
I buy bonds in order to support the development of renewable resources							
I recycle							
I volunteer, give time or some cash to environmental activities							
I use water sparsely							
I teach the young the importance of treating our environment with care							
I do like to see more diesel power generation plants built in my country							

A3. Part II: Willingness to pay questions.

4. For which of the following purposes do you use electricity

☐0. Cooking.
☐ 1. Light.
☐ 2. Baking.
☐ 3. Ironing.
☐4. Refrigerating.
☐5. Laundry.
☐ 6. Other (please specify)_____.
☐ 7. I do not use electricity.

5. What other energy sources do you use for heating, light, and cooking?

☐ 0. Coal
☐ 1. Gas
☐ 2. Wood fire
☐ 3. Dung
☐ 4. Other, please specify:_____
☐ 5. I do not use any other sources

6. Approximately how many blackouts approximately did your household experience the last 12 months?_____blackouts
7. Approximately how long did the longest blackout last that your household experienced the last 12 months?_

Reply in number of _____hours OR_____days

8. What is the average length of most blackouts you have experienced during the last year?_____hours
9. What kind of negative impacts does blackouts have on you and your household?

☐0.Unable to cook with electric appliances.
☐1.Unable to refrigerate food.
☐2. Unable to use bank services and ATM.
☐3. Negative entertainment effects (i.e television and radio do not function).
☐4. Vulnerable to robbers in a dark night.
☐5. Not able to read or study.
☐6. others please specify _____

10. The government is now considering implementing a program to reduce the number of blackouts from the current level to eliminate the blackouts. The program includes upgrading old and building new electricity production plants and new transmission lines. The costs of this program will be covered by international donors, government, companies and the households. If the government sees that these interest groups are willing to pay more to avoid the blackouts than what it costs, they will implement the program, which will eliminate blackouts. Think about what it is worth to you to fully avoid the negative impacts you have experienced from blackouts the last 12 months. What is the most, if anything, your household certainly is willing to pay per year for 10 years on the top of your annual electricity bill (or on the top of your house

rent, if you are not paying the electricity bill by yourself) to fully avoid blackouts? Remember that this payment will reduce your spending on other goods and services

0birr per month (0 birr per year) For 10 years	10 birr per month (120 birr per year) For 10 years	25 birr per month (300 birr per year) For 10 years	50birr per month (600 birr per year) For 10 years	100birr per month (1200 birr per year) For 10 years	150birr per month (1800 birr per year) For 10 years	200birr per month (2400 birr per year) For 10 years	250birr per month (3000 birr per year) For 10 years	300birr per month (3600 birr per year) For 10 years	Other; please specify: ____	Don't know

If your answer to #10 was zero or don't know, please respond to question #11; otherwise, skip #11and answer #12

11. Why are you not willing to pay anything for the program which will eliminate blackouts, or don't know what you are willing to pay? Please choose the **one** most important reason

☐ 0. I do not experience any blackouts.
☐ 1. I cannot afford to pay.
☐ 2. I do not think that this program would be effective.
☐ 3. I do not think that I should pay for this program.
☐ 4. I do not support any new government programs.
☐ 5. I do not trust the government.
☐ 6. This program is not important to me.
☐ 7. Other, please specify: _____.

12. What is the most important reason for you being willing to pay something to eliminate blackouts?

_____

13. Which form of payment do you then prefer?

☐0. Voluntary payment.
☐ 1. Increased Income tax.
☐ 2.Increase in electricity bill.
☐ 3.Indifferent.

14. Do you remember the government making a promise to diminish blackouts?

☐ 0. no.
☐ 1.yes.
☐ 2. Don't know.

15. Do you get electricity? 0. No___1. Yes___

A5. Part IV: Socio-demographic Characteristics

32. Age ___
33. Sex ☐ male ☐ female
34. Which is the highest level of education that you have completed?

☐0.No schooling ☐1.reading and writing only(keshi or medrsa)
☐2.primary school ☐3.high school.
☐4.Vocational training ☐5.diploma ☐6.bachelor's degree.
☐7. Masters degree ☐8.doctorate degree ☐9.Other (please specify)____

35. Employment status ☐0.full-time job ☐1.part-time job ☐2.unemployed
☐3.pensioner ☐ 4.student ☐ 5.farmer ☐6.Housewife ☐7.Other (please specify)____.
36. marital statuses ☐ 0. married ☐ 1. unmarried ☐2. divorced

☐3.widowed

37. Number of children (if any):___
38. Number of people in your household (including yourself):_____
39. Type of home ownership ☐ 0. own house ☐1. rent ☐2.other(please specify)_____

40. If you rent the house you are currently living in, do you pay electricity yourself? 0. No 1.Yes If no, skip question #41
41. How much does your household pay approximately per month in electricity bill?____birr per month
42. How much do you pay for rent?____birr per month
43. Approximately how much money does your household spend per month on average for goods and services?_____birr per month
44. How much is your monthly net household income (after taxes) ____birr per month
45. Do you have any comments on this survey? Feel free to state anything which could help us improve the questionnaire. _____

Thank you for your time and help!

Appendix B. Other models

Table 13
Results for the reduced model for households willingness-to-pay (WTP) to avoid blackouts. OLS and Interval regression models.

	(OLS)	(Interval regression)
Expenditure	0.152***	0.152***
	(0.0000)	(0.0000)
Number of blackouts	1.211**	1.169**
	(0.0081)	(0.0077)
Average length of blackouts	35.16*	34.92*
	(0.0276)	(0.0218)
Recall unfullfilled government promise	−139.4+	−129.1+
	(0.0517)	(0.0563)
Female	−360.9**	−345.9**
	(0.0014)	(0.0010)
_cons	148.0	132.6
	(0.4056)	(0.4370)
lnsigma		
_cons		6.185***
		(0.0000)
N	99	99
adj. R^2	0.3941	

p-values in parentheses.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 14
OLS regression results (one control variable deleted at a time).

	(1)	(2)	(3)	(4)	(5)
Expenditure	0.152***	0.159***	0.155***	0.140***	0.139***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Number of blackouts	1.211**	1.425**	1.342**	1.341**	
	(0.0081)	(0.0029)	(0.0048)	(0.0051)	
Average length of blackouts	35.16*	36.50*	38.06*		
	(0.0276)	(0.0295)	(0.0239)		
Recall unfullfilled government promise	−139.4+	−108.5			
	(0.0517)	(0.1444)			
Female	−360.9**				
	(0.0014)				
_cons	148.0	−167.1	−262.9+	−76.73	107.1
	(0.4056)	(0.2889)	(0.0699)	(0.5380)	(0.2671)
N	99	99	99	103	117
adj. R^2	0.3941	0.3305	0.3223	0.2868	0.2268

p-values in parentheses.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 15
OLS and Interval regression results when including protest zeros.

	(OLS)	(OLS)	(Interval regression)	(Interval regression)
Expenditure	0.148***		0.151***	
	(0.0000)		(0.0000)	
Damage of blackouts	222.4	289.5*	204.5+	272.0**
	(0.1036)	(0.0114)	(0.0972)	(0.0098)
Number of blackouts	1.406**	1.518***	1.335**	1.453***
	(0.0030)	(0.0008)	(0.0018)	(0.0006)
The longest blackout	−0.0207	−0.192	−0.0533	−0.203
	(0.9640)	(0.6660)	(0.8975)	(0.6240)
Average length of blackouts	43.69**	22.32+	42.89**	21.07+
	(0.0092)	(0.0982)	(0.0046)	(0.0927)
Alternative energy sources	397.3	73.05	395.2	54.88
	(0.2305)	(0.7882)	(0.1965)	(0.8293)
Recall unfullfilled government promise	−147.1+	−125.4+	−133.1+	−116.2+
	(0.0589)	(0.0766)	(0.0573)	(0.0764)
Age	−4.123	−1.960	−3.437	−1.205
	(0.8840)	(0.9367)	(0.8944)	(0.9584)
Age-squared	−0.0109	0.0185	−0.0208	0.0112
	(0.9718)	(0.9481)	(0.9418)	(0.9666)
Rural	−295.0	−270.0	−255.9	−232.3
	(0.4322)	(0.3601)	(0.4595)	(0.3987)
Female	−416.5**	−227.9*	−413.3***	−224.1*
	(0.0018)	(0.0341)	(0.0005)	(0.0246)
Household members	40.77	53.60*	43.49	52.44*
	(0.2603)	(0.0441)	(0.1879)	(0.0333)
_cons	29.79	238.1	−0.211	230.4
	(0.9632)	(0.6417)	(0.9997)	(0.6304)
lnsigma				
_cons			6.130***	6.236***
			(0.0000)	(0.0000)
N	91	134	91	134
adj. R^2	0.4312	0.1858		

p-values in parentheses.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix C. Descriptive statistics. Summary tables for categorical variables

Table 16
purposes of electricity for the household.

Purpose of electricity for the household	Freq.	Percent	Cum.
0 cooking	10	4.98	4.98
1 lighting	15	7.46	12.44
2 baking	33	16.42	28.86
3 ironing	63	31.34	60.20
4 refrigerating	50	24.88	85.07
5 laundry	13	6.47	91.54
6 other	12	5.97	97.51
7 do not use electricity	4	1.99	99.50
.	1	0.50	100.00
Total	201	100.00	

Table 17
alternative energy sources.

Number of other energy sources the household use	Freq.	Percent	Cum.
0 coal	10	4.98	4.98
1 gas	85	42.29	47.26
2 wood fire	55	27.36	74.63
3 dung	35	17.41	92.04
4 other	7	3.48	95.52
.	9	4.48	100.00
Total	201	100.00	

Table 18
damages of blackouts for the households.

Number of categories of damages the household face due to the power outage	Freq.	Percent	Cum.
0 unable to cook with electric appliances	20	9.95	9.95
1 unable to refrigerate food	19	9.45	19.40
2 unable to use bank services and ATM	28	13.93	33.33
3 negative entertainment effects	46	22.89	56.22
4 vulnerable to robbers in a dark night	41	20.40	76.62
5 not able to read or study	33	16.42	93.03
6 others	13	6.47	99.50
.	1	0.50	100.00
Total	201	100.00	

Table 19
reason for not willing to pay to avoid blackouts.

Main reason for not willing to pay for sustainable energy:	Freq.	Percent	Cum.
0 do not experience BOs	1	0.50	0.50
1 cannot afford to pay	32	15.92	16.42
3 I do not think I should pay for the program	7	3.48	19.90
4 do not support any new government programs	1	0.50	20.40
5 I do not trust the government	3	1.49	21.89
6 this program is not important to me	2	1.00	22.89
7 other	8	3.98	26.87
.	147	73.13	100.00
Total	201	100.00	

Table 20
reason for being willing to pay something to avoid blackouts.

Main reason for willing to pay something for sustainable energy	Freq.	Percent	Cum.
0 because it's my responsibility as a citizen	4	1.99	1.99
1 because I believe that this matter is important	12	5.97	7.96
2 because it is important for development	19	9.45	17.41
3 because I believe that I (and my household) will be the beneficiary	70	34.83	52.24
4 to be able to receive a sustainable(and full) service	12	5.97	58.21
5 because I would like to see the problem been solved	29	14.43	72.64
6 to save time, energy and money(the money spent for other sources)	2	1.00	73.63
.	53	26.37	100.00
Total	201	100.00	

Table 21
if respondents recall government promising to diminish blackouts.

If respondent can recall the government making promise to diminish blackouts	Freq.	Percent	Cum.
0 no	39	19.40	19.40
1 yes	71	35.32	54.73
2 don't know	88	43.78	98.51
.	3	1.49	100.00
Total	201	100.00	

Table 22
if respondents in Ashegoda get electricity.

Ashegoda: if they get electricity: no = 0 yes = 1 don't know = 2	Freq.	Percent	Cum.
0	10	4.98	4.98
1	41	20.40	25.37
.	150	74.63	100.00
Total	201	100.00	

Table 23
Gender.

Male = 0 female = 1	Freq.	Percent	Cum.
0	76	37.81	37.81
1	125	62.19	100.00
Total	201	100.00	

Table 24
Education.

No schooling = 0 read and write only(keshi or merdsa) = 1 primary = 2 high = 3 vocational training 4 = diploma 5 = bachelor's degree 6 = master's degree 7 = doctorate degree 9 = other	Freq.	Percent	Cum.
0	52	25.87	25.87
1	4	1.99	27.86
2	38	18.91	46.77
3	36	17.91	64.68
4	5	2.49	67.16
5	34	16.92	84.08
6	26	12.94	97.01
7	5	2.49	99.50
.	1	0.50	100.00
Total	201	100.00	

Table 25
Employment.

Full time = 0 part time = 1 unemployed = 2 pensioner = 3 student = 4 farmer = 5 housewife = 6	Freq.	Percent	Cum.
0	73	36.32	36.32
1	36	17.91	54.23
2	10	4.98	59.20
3	5	2.49	61.69
4	7	3.48	65.17
5	7	3.48	68.66
6	46	22.89	91.54
7	16	7.96	99.50
.	1	0.50	100.00
Total	201	100.00	

Table 26
Marital status.

Marital status	Freq.	Percent	Cum.
Married	107	53.23	53.23
Unmarried	55	27.36	80.60
Divorced	10	4.98	85.57
Widowed	26	12.94	98.51
No response	3	1.49	100.00
Total	201	100.00	

Table 27
Home ownership.

Type of home ownership: own house = 0 rent = 1 government housing =2	Freq.	Percent	Cum.
0	99	49.25	49.25
1	95	47.26	96.52
2	6	2.99	99.50
No response	1	0.50	100.00
Total	201	100.00	

Table 28
If respondents pay electricity in a rented house.

if they pay electricity bill (for those living in a rented house): no = 0 yes = 1	Freq.	Percent	Cum.
0	34	16.92	16.92
1	61	30.35	47.26
.	106	52.74	100.00
Total	201	100.00	

Table 29
Percentage distribution: Respondents' opinion of the importance of different public goods and services.

	0.Very Important	1.Important	2.Moderately Important	3.Slightly Important	4.Not Important	5.don't know
Primary and secondary schools	78.11	16.42	2.49	0.00	0.00	2.99
Clinics and hospitals	91.04	7.96	0.50	0.50	0.00	0.00
Hydro-power development	76.62	13.93	1.99	0.50	5.47	1.49
Wind-power development	67.16	15.92	5.97	1.00	1.00	1.49
Roads	91.54	7.46	0.50	0.50	0.00	0.00
Energy security (avoid blackouts)	86.5	6.50	1.00	1.50	4.00	0.50
Clean water supply	96.02	3.48	0.50	0.00	0.00	0.00

Table 30
Respondents' environmental behavior; in percent.

	0. Strongly agree	1. Agree	2. Neutral	3. Disagree	4. Strongly disagree	5. Don't know	6. Not applic-able
I use energy saving light bulbs	40.8	21.89	4.98	20.40	4.48	2.99	4.48
I turn off the lights when I am not using them	59.7	25.87	5.97	1.99	1.99	0.00	4.48
I keep my home and my car smoke-free	39.3	6.97	7.96	3.48	9.45	2.99	29.85
I plant trees and native plants	33.33	23.38	19.90	15.42	5.97	1.00	1.00
I reduce my use of chemicals	40.20	3.52	2.01	2.01	3.02	32.6	16.18
I dispose waste properly	77.39	12.56	5.03	3.52	1.01	0.00	0.50
I buy bonds in order to support the development of renewable resources	23.28	7.96	15.92	24.88	6.97	14.43	6.47
I recycle	23.88	8.46	9.45	29.85	17.41	6.97	3.98
I volunteer, give time or some cash to environmental activities	46.23	22.61	8.04	16.58	3.02	1.01	2.51
I use water sparsely	83.00	9.00	4.50	1.00	2.00	0.00	0.50
I teach the young the importance of treating our environment with care	47.49	23.46	8.94	5.59	0.00	1.12	86.59
I do like to see more diesel power generation plants built in my country	28.00	18.00	11.00	11.50	10.50	17.00	4.00

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Essay II

Mind the Gap: Understanding the Gap between Consumers' Willingness to Pay and Purchase Behavior

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ABSTRACT

This study examined willingness to pay (WTP), stated buying behavior (SBB), and the gap between intention and buying behavior among potential consumers of organic meat in Norway. In a survey of 1,021 respondents, over 45% were willing to pay a positive price premium, while only 7.2% said they had actually purchased organic meat in the week prior to the survey. The results show that WTP was influenced by sociodemographic variables (education, gender, and rurality index), stated price importance, and attitudes supporting that organic food is healthy and beneficial to the environment. However, only rurality index, stated price importance, product availability, and attitude supporting that organic is healthy influenced SBB. The intention-behavior gap was reduced by product availability and own health concerns but widened by price importance. Environmental concerns and animal welfare attitudes did not contribute to translating intention into purchase behavior. The main finding of this study is that own health concerns (primary concerns) close the gap more effectively than environmental concerns (secondary concerns). Understanding how intentions are misaligned/aligned with buying behavior makes stated preference (SP) studies more applicable and suggests that future SP survey designs include targeted survey questions to identify responses that are likely to have gaps between intention and behavior.

Keywords: Intention-behavior gap**;** Organic meat; WTP; Stated buying behavior; Health concerns; Environmental concern; Price; Product availability

JEL Classification: D12, D19, Q18, Q59

1. Introduction

In Europe, interest is growing in food that is produced in an environmentally friendly manner and with wider benefits for society, such as biodiversity, sustainability, a small carbon footprint, improved animal welfare, local food production, and the like (Dudinskaya et al., 2021; European Commission, 2019; Koistinen et al., 2013).

Consumers may consider numerous extrinsic and intrinsic qualities when selecting meat to purchase. Extrinsic qualities include origin, organic production, pasture feeding, carbon footprint, animal welfare, traceability, quality labels and certifications, health claims, and readiness to cook, while fat content, type and cut of meat, animal age and type, and size (family portion/single) can be classified as intrinsic qualities (Bernués et al., 2012). The organic attribute, which is of focus in this paper, in particular is attracting more and more attention from consumers (Kushwah et al., 2019).

In Europe, the overall system of organic production combines several goals, such as the application of the best environmental and climate-protection practices, the achievement of a high level of biodiversity and animal welfare standards, the conservation of natural resources, and the use of materials and processes that are as natural as possible (Council of the European Union, 2018).

The regulations for certifying organic products in Norway are based on the EU legislation for organic food. The overarching goal of Norwegian organic farming is to ensure that the demand for organic food is met to the greatest possible extent by Norwegian production, and the National Organic Farming Strategy explicitly states that the development of organic agricultural production must be based on the market and on willingness to pay (WTP) for organic products (Ministry of Agriculture and Food, 2018). Despite the need for knowledge in this area, few studies have addressed consumer preferences for organic products in Norway. Storstad & Bjørkhaug (2003) and Aitken & Utsola (2020) explored attitudes and preferences towards organic and locally produced food in Norway, and the present study can complement and expand the knowledge these studies provide. Schjøll (2017) examined whether Norwegian consumers regard a foreign food with an identical organic seal as equivalent to the domestic counterpart. The focus of the present study is on locally produced organic meat and the first task of the analysis is to examine how much consumers value local organic meat compared to local conventional meat and to explain the factors behind WTP.

An additional indicator of consumer behavior toward organic meat is a stated purchase behavior[1] that indicates the recent past purchase behavior of the respondent and can be a good proxy for actual purchase behavior when such data is not available. Studies that have used the stated preference (SP) for organic meat include those of Argem-Armengol et al. (2019), Gaviglio and Pirani (2015), Picardie et al. (2020), Rutledge (2009), Torquati et al. (2018), and Van Loo et al. (2014), while studies that used actual purchase data to examine consumer behavior toward organic food include those of Chekima et al. (2017) and McFadden and Huffman (2017). To the author's knowledge, only Talwar et al. (2021) combined WTP and stated buying behavior (SBB) to examine consumer behavior toward organic food. The second task of the present study is to examine factors behind SBB, compare those with factors influencing WTP, and measure the gap between intention and purchase behavior.

The ethical consumption literature reveals a thriving ethical consumption movement (Carrington et al., 2014), but this intention is not always followed by action. The gap between intention and behavior has only recently been given attention (Ali et al., 2021; Wang et al., 2019; Li and Jaharuddin, 2021; Carrington et al., 2014; Testa et al., 2019; Zheng et al., 2021; Rahman and Noor, 2016; Weissmann and Hock, 2021; Nguyen et al., 2019; Qi et al., 2020). These studies focused on green products and organic foods in general. Although they were motivated to look for ways to close the gap, only Wang et al. (2019) quantitatively measured the intention-behavior gap as a dependent variable and examined the relationship between the gap and other factors (such as the gap between actual price and WTP, and trust in green products and brands). Factors that can influence the intention-behavior gap have not been researched enough in the literature and are still poorly understood. Therefore, additional studies are needed to better understand the key drivers of the intention-behavior gap, which is the third and main task of this present study.

This paper aims to elicit preference for organic meat and examine factors influencing the gap between intention and behavior using primary data from a sample of the Norwegian general population. The rest of the paper is organized as follows. Section 2 contains the literature review and theoretical framework. Section 3 covers the Survey design and the methods used. Section 4 presents the results in detail. Section 5 presents the discussion and implications of the results and Section 6 concludes.

[1] The terms “stated purchase behavior” and “stated buying behavior” are used interchangeably in this study.

2. Literature Review and Hypotheses Development

According to the Food and Agriculture Organization of the United Nations (FAO), organic farming is a system that relies on ecosystem management and that potentially reduces environmental and social impacts by eliminating the use of external agricultural inputs, such as pesticides, veterinary drugs, synthetic fertilizers, additives and preservatives, and genetically modified varieties and seeds (FAO, 2021).

Studies show that organic products are generally less polluting and more expensive than traditional products (e.g., Cobb et al., 1999). The price difference between the two represents the price premium.

The literature yields very few WTP studies on organic meat, as research has focused more on WTP and the consumption of other organic foods. The results of a literature review by Aertsens et al. (2009) reveal several motives for consuming organic food in general, including safety, health-related attitudes, universalism (environmental friendliness, animal welfare), benevolence (e.g., supporting the local community), attitude, personal norms, sociodemographic factors, region, and urban/rural status. Aertsens et al. (2009) also describe five prominent factors hindering the purchase of organic food: price, income, availability, lack of trust towards organic certification, and product appearance.

Regarding organic meat, WTP and the motivation behind the WTPs differ according to the type of meat/cut and the location of the study. In a cross-country study, Argemí-Armengol et al. (2019) examined WTP for diverse product scenarios, including various pig farm facilities and standards for organic pork. On the one hand, their study found that Spanish consumers' WTP for organic pork was mainly explained by concern about antibiotic residue in meat on a Spanish sample. On the other hand, such results were not observed in the Portuguese sample of the Argemí-Armengol et al. (2019)'s study. In the USA, Picardy et al. (2020) reported the preference for organic pork tenderloin was associated with preferences related to hormones, antibiotics, and genetically modified feed in animal husbandry. In Italy however, consumers were willing to pay a premium price for organic cured pork meat to ensure environmental and biodiversity protection in addition to their own health improvement, according to a study conducted by Gaviglio and Pirani (2015). Rutledge (2009) on the other hand indicated that the type of consumers may influence the premium amounts consumers are willing to pay in New Zealand. He identified three segments of organic lamb consumer: committed organic seekers,

convenience organic consumers, and incidental organic consumers, in which each segment have varying WTPs for organic attributes. Committed organic seekers and convenience organic customers were willing to pay premiums of 61% and 44%, respectively, for an organic lamb cutlet. Incidental organic consumers tolerated only a 26% price premium over standard lamb products in New Zealand.

The main aim and contribution of this study is to investigate of the intention-behavior gap (i.e., WTP-SBB gap) in the purchase of organic meat in Norway, a topic not addressed in the studies discussed above. Before describing the results, however, it is necessary to understand the intention to buy (WTP for) organic meat in Norway, which represents another contribution of this research, as there has previously been no such study in Norway. This will advance the understanding of organic meat purchase intent.

Intention is measured in a variety of ways in the intention-behavior gap literature, including reported statements of future plans to buy, willingness to pay for, willingness to switch to, and willingness to consider the product in question (Ali et al., 2021; Wang et al., 2019; Testa et al., 2019; Nguyen et al., 2019). The present study assumes that willingness to pay a positive premium for organic meat represents an intention to buy organic meat. Wang et al. (2019) also used WTP data as indicators of intentions, arguing that consumers have developed intentions once they are willing to pay the price premium for green products.

The theory of planned behavior and the theory of reasoned action are prominent frameworks in consumer studies literature. Both have challenged the belief that attitude translates directly into behavior, but they fail to recognize that intentions also do not necessarily translate into behavior (Hassen et al., 2016). A more holistic approach developed by Stern (2000)—the attitude-behavior-constraint (ABC) theory—posits that behavior is a function of an organism and its environment, i.e., behavior is a function of attitudinal variables and contextual (external) factors. Stern (2000) points out that behaviors that are not strongly favored and rewarded by context are less dependent on attitudinal factors and provides the example that more expensive or more time-consuming behaviors have a weaker dependence on attitudinal factors. Stern (2000) classifies the causal variables into four major types: (i) attitudinal factors (norms, beliefs, and values), (ii) contextual forces, (iii) personal capabilities, and (iv) habits or routines. Drawing upon previous findings, Stern (2000) notes that the impact and working of different types of causal variables depend on the particular behavior. For example, although attitudinal factors may create a predisposition to act, a more expensive behavior is more likely to be

influenced by monetary factors, while a difficult behavior (e.g., reduced use of automobiles) is more likely to be influenced by contextual factors (e.g., public policy support for alternative modes of transport), and so on (Stern 2000).

Researchers (e.g., Carrigan and Attala, 2001) claim that social desirability bias, which leads to an overestimation of intention, explains the discrepancy between intention and behavior. Carrington et al. (2010), however, argue that social desirability bias provides only a partial explanation of the intention-behavior gap of ethical consumers and that actual purchase is hampered by multiple barriers and competing demands. Adopting similar reasoning and drawing upon ABC theory, this paper examines the effect of selected attitudinal, habit/routine (price importance when purchasing products), and contextual/situational factors (product availability). It also considers the role of environmental, personal health, and animal welfare concerns.

i. Stated price importance

Ran and Zhang (2022) define *stated price sensitivity* as the level of consumer consciousness and response when noticing price differences in products. In the consumer behavior literature, price sensitivity has been shown to play a significant role in increasing the intention-behavior gap, particularly in regard to purchasing innovative products (Goldsmith et al., 2005) and recycling e-waste (Ran and Zhang, 2022).

H1: Price importance increases gap between intention and behavior toward buying organic meat

ii. Product availability

Product unavailability or perceived product unavailability can be a barrier to product purchase and, hence, a barrier to turning intentions into purchase behavior. Previous studies have found that consumers did not buy when a sustainable or green product was not available or when it was perceived as unavailable (Weissmann and Hock, 2021).

H2: Product availability reduces the intention-behavior gap in buying organic meat

This study will also investigate the effects of own health and environmental concerns associated with purchasing a livestock product.

iii. Personal health, environmental, and animal welfare concerns

Attitudes toward the attributes of organic food, for example, the perceived healthiness of organic food, environmental friendliness, and animal welfare friendliness, may all increase the intention to buy organic food. When it comes to the actual purchase, however, not all concerns are of equal salience. Concerns can be prioritized into primary and secondary based on the hierarchy of the consumer's needs (Carrington et al., 2014). Primary concerns may be more effective in reducing the gap between intention and behavior. Consumers may prioritize their own health over environmental and animal health motives. If that is the case, then concern for own health can be classified as primary and the latter two as secondary concerns/motives. We can expect both primary (concern for own health) and secondary concerns (concern for environment and animal welfare) to reduce the gap but concern for environment and animal welfare to reduce the gap less than health concerns.

H3: personal health concerns/motives reduce the intention-behavior gap for buying organic meat.

H4: Environmental concerns/motives reduces the intention-behavior gap for buying organic meat.

H5: The perceived animal welfare friendliness of organic production/ animal welfare concern reduces the intention-behavior gap for buying organic meat.

To test these hypotheses, we need data on the gap between intention to buy organic meat and actual purchase. Logically the most ideal way is to obtain a random sample data on the consumer's purchase intention and a follow-up data on actual purchase after the consumer has expressed/revealed his/her intention. However, to date, this type of data has not been used in any study, probably due to the difficulty in obtaining this data or other considerations. The closest to this was a data collected by Testa et al. (2019) where they monitored a non-random sample of 79 consumers over 30 months at UniCoop Tirreno stores in Italy and surveyed these consumers on the 26th month of the monitoring period.

In the literature, reported statements of future plans to buy, willingness to pay for, willingness to switch to, and willingness to consider the product in question are used to measure intention (Testa et al. 2019). Whereas for measuring purchase behavior, shopping expenditures

monitored for over a period of time, reported statements on purchase frequencies and reported statements on actual behaviors were used (Testa et al 2019; Ali et al 2021; Nguyen et al 2019).

This study uses reported willingness to pay for organic meat to measure intention to buy organic meat and reported recent purchases of organic meat to measure organic meat purchasing behavior. There are two limitations to the data I use. The first is that I only have reported data on organic meat purchases for the last one-week period. However, ideally, one could argue that organic meat purchase records over a longer period would be preferred. There are surely pros and cons for both asking for purchase history further back in time and the more snap-shot like last week period. It is believed that the accuracy is better for the latter choice, and given the relatively large number of respondents, most special circumstances potentially affecting the one week period should be averaged out. Second, one could also argue that observing the purchase of organic meat after respondents had expressed their intention to purchase organic meat may have provided more accurate information about the intention-behavior gap. On the other hand, it could also be argued that it could have introduced a bias in consumption due to the question raising consciousness of the issue. In this study I hence used past purchasing behavior data.

3. Methods and Data

3.1 Survey design and implementation

Based on a literature review of the SP methods used in several domains, Johnston et al. (2017) compiled contemporary best practice recommendations for SP studies with the aim of improving the quality of such studies for use in decision-making. In designing this survey, we followed the recommendations that apply to our research context. Data collection was carried out through an internet survey by a data collection agency, with an established panel of representatives from Norway. The survey was sent to 3,000 respondents in October 2021 and yielded 1,021 complete responses, with a gross response rate of 35.9% and a net response rate of 34 %. The small difference in gross and net response rate indicates that the survey was easy to understand and not lengthy. However, a drop-out that is too low can indicate self-selection bias in terms of those who are highly interested in the topic opening the survey in the first place. On a positive note, this was part of another survey looking at the issue of carnivore-livestock conflict, which is a hot and ongoing controversial topic in Norway, and the survey title may attract many to look into it.

Johnston et al. (2017) recommend that the baseline condition and the proposed change relative to the baseline be described in a way that is understandable and credible to the respondents. Thus, we provided a clear baseline (conventional meat) and described a proposed change (organic meat) to the respondents. A pilot study was conducted before the main data collection.

We posed the following valuation question:[2] *Think about what it is worth to you to obtain organic meat. What is the highest price premium, if any, your household is certainly willing to pay for 1 kilo of Norwegian organic meat above the conventional Norwegian meat price?*

0 %	5 %	10%	20 %	30 %	40%	50 %	75 %	100 %	Other: please specify__	Don't know
□	□	□	□	□	□	□	□	□	□	□

Figure 1. WTP amounts as a percentage of the conventional meat price

Formerly, the paper aimed to elicit WTP for organic lamb meat[3]. However, it was suspected that many Norwegian consumers may think that lamb produced in Norway is organic[4]. If this is the case, we may not get valid answers. That is, we can end up with several protest zeros if they thought the lamb meat produced in Norway is always organic. Therefore, Norwegian organic meat was chosen for the formulation of the WTP and the purchase behavior questions. But that also has a downside. People have different WTP for different meats and therefore may have difficulty choosing a single value on the payment card.

The elicitation mechanism used was a payment card approach (a payment table). There are also other alternative response formats such as open-ended and dichotomous choice. All types of response format have their own advantages and disadvantages. Dichotomous choice, although known to be the most incentive compatible, it is also subject to yea-saying and starting bid bias, therefor provide limited information about respondents' preferences. The open-ended

[2] Translated version (from the Norwegian)
[3] This was because essay three in this thesis (also a part of the same survey) was essentially about the conflict between carnivores and grazing sheep, and with that we may be able to tie the two papers together and answer some interesting questions such as whether those who vote for program B were willing to pay more for organic lamb.
[4] Since we suspected that many think Norwegian farmed lamb is organic, we included a question in the survey to check and for possible future use. About 37 percent (215 respondents) thought this was true, so valuing organic lamb meat could have been fine.

elicitation format may result in unrealistically high amounts or zero WTP responses (Johnston et al., 2017). The payment card approach is also not without its problems, it is prone to range bias, but this can be reduced to a certain extent through pilot testing. In addition, the payment card is easy for respondents to comprehend and fill out. It also is in line with a choice in a store therefore may feel more familiar.

3.2 Variable measurement

The variables used in this study were conceptualized and adapted from the existing literature (Britwum et al., 2021; Gil, 2000; Baiyegunhi et al., 2018; Sarma, 2017). Table 1a shows the main variables, how they were framed in the questionnaire, the scales, and the sources.

Table 1a: Variable measurement

Variable	Questionnaire item	Scale	Source
Stated price importance	How important is the following aspect when you purchase livestock products?: Price	5-point Likert scale (0=not important to 4=very important)[5]	Britwum et al., 2020
Perceived product availability	Please indicate whether you agree or disagree with the following statement: Organic foods are widely available in the market	5-point Likert scale (0=strongly disagree to 4=strongly agree)	Baiyegunhi et al., 2018
Own health concerns	How important is the following aspect when you purchase livestock products?: Healthiness	5-point Likert scale (0=not important to 4=very important)	Britwum et al., 2020
Environmental concern/motive	How important is the following aspect when you purchase livestock products?: Benefiting the environment	5-point Likert scale (0=not important to 4=very important)	Britwum et al., 2020
Attitude/ perception about organic food: perceived organic is healthier	Please indicate whether you agree or disagree with the following statement: Organic foods are healthier than their conventional counterparts	5-point Likert scale (0=strongly disagree to 4=strongly agree)	Sarma, 2017; Gil et al., 2000; Baiyeguhni et al., 2018

[5] In the questionnaire, this was coded 0=very important to 4=not important and 5=don't know/not applicable. This was recoded before the analysis for convenience in interpreting the result. This applies to all the scale variables in the questionnaire.

Attitude /perception about organic food: perceived organic is environmentally friendly	Please indicate whether you agree or disagree with the following statement: Organic products benefit the environment	5-point Likert scale (0=strongly disagree to 4=strongly agree)	Sarma, 2017; Baiyeguhni et al., 2018
Perceived animal welfare friendly	Which of the following attributes of sheep grazing are the most important in your opinion [select up to 3 options]	Dummy variable: value 1 assigned if "Enhance health and welfare of sheep" is selected; 0 otherwise	
Red meat consumption frequency	How often do you eat red meat?	Never, once a month or less, twice a month, once a week, at least three times a week, daily	Gil et al., 2000
Stated buying behavior	Approximately how many grams of organic meat have you bought in the past week?____grams	Open ended. Continuous variable but later changed to binary, 1 if organic meat bought and 0 if not.	-
Age	Background information[6]	Continuous	
Education	"	Categorical	
Female	"	Binary	
Household income before tax	"	Categorical	
Household size	"	Continuous	
Rurality index		Centrality index obtained from statistics Norway[7], municipalities are classed 1 (very central) to 6 (low centrality)	SSB

[6] Background information about the respondents (age, education, gender, household income and household size) collected in advance by the survey company from the year 2022 is used.

[7] SSB's centrality index is based on access to work places and service functions. The index runs from 0 (only theoretically possible) to 1000 (the most central). They have a class variable between 1 and 6. 1 denotes the centrality index 925-1000, 2 denotes 870-924; 3 represents 775-869 ; 4 means 670-774; 5 denotes 565-669 and 6 denotes 0-564.

Our independent variable "gap" is a binary variable showing whether there is a gap between intention and behavior. WTP and SBB variables are used to construct the dependent variable "gap". See the table 1b below to see how the gap variable is formulated.

Table 1b: variable measurement: Intention-behavior gap

		Stated intention (WTP)	
		If reported any positive WTP amount	If not willing to pay anything for organic meat[8]
Stated behavior (SBB)	If purchased organic meat/if positive grams of organic meat reported	gap = 0 (no gap observed)	dropped (because there is no intention of buying)
	If not purchased organic meat/if zero grams of organic meat reported	gap = 1 (observed gap between WTP and SBB)	dropped (because there is no intention of buying)

Three different types of gap variables are used later in the analysis, where instead of positive WTPs as intentions, WTPs of at least 10 percent, 20 percent, and 30 percent WTPs as intentions are used. No such threshold is used for stated buying behavior. Any positive amount of bought organic meat will imply that there is no gap between intention and behavior. This is because it is assumed that the fact they purchased the organic meat shows that their intention is translated to practice to a certain degree at least.

Table 1c: variable measurement: other Intention-behavior gap variables (Gap10, Gap20 and Gap30)

	Stated intention / WTP	
	If reported WTP amount is at least 10 %, 20 % and 30%	If not willing to pay lower than 10%, 20% and 30% [9]

[8] If respondents are not willing to pay, we assume they have no intention of buying organic meat. Different assumptions holds for variables in Table 1c (i.e No intention if WTP < 10 % , 20% and 30 % for variables Gap10, Gap20 and Gap30" respectively)

[9] Dropped because we assume these observations have no intention of purchasing organic meat. For constructing the intention-behavior variable gap we need the observations that have intention to buy.

Stated buying behavior (SBB)	If purchased organic meat/positive grams of organic meat	Gap10 = 0, Gap20=0 , and Gap30=0 (No gap observed)	Dropped
	If not purchased organic meat/reported zero grams of organic meat	Gap10 = 1, Gap20=1, and Gap30=1(Observed gap between WTP and SBB)	Dropped

3.3 Statistical models

When using a payment card approach instead of an open-ended WTP question, we do not observe the real maximum WTP amount but the minimum indicator of the true maximum WTP (Voltaire, 2015). The true maximum WTP lies between the observed WTP and the next higher amount on the payment card. Considering the data type we have we can use an interval regression model or an OLS. When we use the interval regression model, we assume that the WTP lies between a lower boundary (the observed amount) and an upper boundary (the next higher amount); when we use OLS, we can approximate the true maximum WTP by calculating the average between the observed WTP and the next higher amount on the payment card. In estimating the probability of being willing or not willing to pay any premium, buying or not buying, and having or not having a behavioral gap, we apply the logit model.

The statistical models applied here form their theoretical basis from the Hicksian measures of utility change. Individuals drive utility from consumption of goods and services, and they maximize their utility given their budget and commodity prices. Assume $V(P, Q_0, Y)$ is the indirect utility where Q_0 is the current commodity quality and income Y. $V(P, Q_1, Y - C)$ is the indirect utility as a function of price P, new quality of the commodity Q_1 and the compensation variation C.

If the individual is entitled to the current commodity/environmental quality Q_0 instead of the improved commodity/environmental quality Q_1, then we use the measure is the compensation

variation, C, and we will then measure the maximum WTP to obtain the improvement for the environment/commodity (Perman et al., 2003).

$$V(P, Q_0, Y) == V(P, Q_1, Y - C)$$

We can specify the individuals WTP as follows using an expenditure function[10].

$$wtp_i = e_i^0(P, Q_0, U_i|X) - e_i^1(P, Q_1, U_i|X)$$

where U_i is the utility level and X is a set of explanatory variables that vary across individuals.

3.3.1 OLS and instrumental variables consideration

Consider the following population model adapted from Wooldridge (2013) with a vector of dependent variables and a normally distributed error term[11]:

$$wtp = X_i\beta + u \quad i = 1,2,\dots n$$

Where wtp is the dependent variable assigned to the value of the interval midpoints, X_i is a vector of the explanatory variables and β denotes the corresponding vector of coefficients.

A basic assumption here is the average value of the error term in the population is zero.

$$E(u) = 0$$

Another is the error term is mean independent of the explanatory variables i.e the average value of the error term does not depend on the value of x.

$$Cov(u, X_i) = 0$$

$$E(u|X_i) = E(u)$$

Combining the above assumptions, we obtain the zero conditional mean assumption.

$$E(u|X_i) = 0$$

Under these assumptions we have the following population regression function:

$$E(wtp|x_1, x_2 \dots x_n) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n$$

[10] Adapted from Broberg and Brännlund (2008)
[11] Equations in this section are adapted from Wooldridge (2013).

3.3.2 Interval regression

When applying OLS model we use the interval midpoints for the dependent variable as an approximation for the true maximum WTP. Now let's consider a different model with the following population model:

$$wtp_i^* = X_i\beta + u_i$$

Where only the thresholds containing the latent variable wtp_i^* are observed. Therefore, what we observe in our survey is:

$$wtp = 0 \; if \; wtp^* \; < 5$$

$$wtp = 5 \; if \; 5 \leq wtp^* < 10$$

$$wtp = 10 \; if \; 10 \leq wtp^* < 20$$

$$\ldots and$$

$$wtp = 100 \; if \; \; wtp^* = 100$$

Let's denote the observed upper and lower thresholds of the latent variable wtp_i^* by U_i and L_i, respectively[12]. The conditional probability that wtp_i^* is in the interval (L_i, U_i) is given by

$$\Pr(L_i \leq wtp_i^* < U_i \,) = F(U_i; \beta, \theta | X_i) - F(L_i; \beta, \theta | X_i)$$

Where $F(.)$ denotes the cumulative conditional distribution of wtp_i^* and θ denotes a vector of distributional parameters. The log likelihood function for the interval regression model is then

$$l(\beta, \theta) = \sum_i ln[F(U_i; \beta, \theta | X_i) - F(L_i; \beta, \theta | X_i)]$$

3.3.4 Logit

While the OLS and Interval regression models possibly yield the same type of information the logit model will give us new information by looking at the probability of willing to pay anything at all, and hence complements the OLS and interval regression analysis. The dependent variable used here takes the value 0 if the respondent is not willing to pay anything

[12] Equations adopted from McDonald et al. (2018)

at all and 1 if the respondent ticks any positive amount form the payment card. The logit model is also estimated for when looking at SBB and the main interest in this study the intention-behavior gap. In case of analyzing the SBB the dependent variable takes the value 1 if the respondent have bought organic meat and 0 if not. While for the intention-behavior gap analysis the dependent variable takes the form 1 if the respondent is willing to pay for organic meat but have not bought organic meat, and 0 if the respondent is willing to pay and also have bought organic meat.

$$Y = \begin{cases} 1\ with\ probablity\ p \\ 0\ with\ probablity\ 1-p \end{cases}$$

the response probability of the binary outcome Y is

$$P = Pr[Y = 1|X_i] = G(X\beta) = \frac{exp\ (X\beta)}{1 + exp\ (X\beta)}$$

Where $G(X\beta)$ is the cumulative distribution function of the logistic distribution which is assumed to range between 0 and 1.

The loglikelihood for is

$$l(\beta) = \sum_{i=1}^{N} Y \log[G(X\beta)] + (1-Y)\log\left[1 - G(X\beta)\right])$$

4. Results

4.1 Descriptive statistics and sample representativeness

Table 2 presents a summary of demographic variables. The mean age in the sample was 51 years, and 48% of the respondents were male. Approximately 59% of the respondents had a college degree (bachelor's degree or higher). The average household size was 2.4 people. The sample is fairly representative in terms of gender and the region in which the participants lived. At the time of the survey, 59% of the respondents had completed college, while only 35.3% of the general population had completed college in 2020. Regarding the representativeness of the age distribution, the younger group (20–44 years) is slightly underrepresented, while the next age group (45–66 years) is overrepresented. The likelihood of replying to the email (to complete the survey) was significantly influenced by age, with the younger people being less likely to reply to the email within the given time frame. The regressions, including weighting,

are shown in the appendix. Note that weighting does not solve the entire problem and comes with a cost. For example, the young in the sample may not be representative of the young in the population, so giving them more weight does not guarantee representativeness.

Table 2. Descriptive statistics of the sample and population

		Sample (survey sent to 3000 participants)	Respondents (1021 completed the survey)	Population
Gender	Female	49.2%	52%	50.44%
	Male	50.8%	48%	49.56%
Age	Average age[13]	44.49 years	51.36 years	
	20–44	52.00%	33.95%	43.63%
	45–66	36.72%	45.14%	36.8%
	67–69	10.03%	18.65%	14.93%
	80–89	1.25%	2.26%	4.63%
Education	Higher education (bachelor or higher)		59%	35.3%
Household income[14]	Under 200 k NOK		3.13%	
	200 k–399 k NOK		9.40%	
	400 k–599 k NOK		16.14%	
	600 k–799 k NOK		15.66%	
	800 k–999 k NOK		17.95%	
	1,000,000–1,199,999 NOK		14.46%	
	1,200,000–1,399,999 NOK		9.40%	
	1,400,000 NOK or more		13.86%	
Household size	Average number of people in the household		2.38	2.13
Region	Eastern Norway	51.33%	51.03%	50.8%

[13] The sample did not include those under the age of 18.
[14] Income related variables had fewer observation (830) than other socio-demographic variables. Regarding missing values in general, the standard approach in microeconomic studies when dealing with missing values is listwise deletion, i.e., dropping observation with missing values (Cameroon and Trivedi, 2010).

	Southern and Western Norway	30.97%	30.07%	29.2%
	Trøndelag and Northern Norway	17.70%	18.90%	18.0%

4.2 WTP and purchase

More than 45% of the respondents were willing to pay a premium price for organic meat; 39.6% were not willing to pay any premium, while the rest (15%) responded that they did not know (see Table 3). The mean premium price stated was 9.86%. When we calculate the midpoint, the mean becomes 12.39%. Around 55% of the respondents said that they had bought meat in the week prior to the survey, but only 7.2% indicated that they had purchased organic meat. Since we observe only one week of purchase history, we control for meat consumption frequency in the analysis, because those who consume meat very rarely may be willing to pay and purchase as they intend, yet we may not observe the behavior because we have only one week of purchase observation.

Table 3. Willingness to pay (Percentage premium price per kg)

Percentage premium price per kg	Frequency	Percentage	Cumulative percentage
0	404	39.6	39.6
5	95	9.30	48.9
10	161	15.8	64.6
20	112	11.0	75.6
30	43	4.21	79.8
40	13	1.27	81.1
50	24	2.35	83.4
75	4	0.39	83.8
100	9	0.88	84.7
Don't know	156	15.3	100
Total	1,021	100	

The respondents were asked to indicate their reason for not being willing to pay a premium. Nearly 14% of those who were not willing to pay indicated that they could not afford it. Around 22% said that they were satisfied with the conventional product, and 38% indicated that it did not matter to them whether the food they bought was organic. Another 14% said either that they did not trust the claims for organic products or that they believed that all products should be organic, so they should not pay extra. The rest (12%) gave other reasons, did not consume meat, or stated that they did not know why. Based on the reasoning for not being willing to pay a premium, the zeros are seen and treated as real zeros, and not as protest zeros.

4.3 Estimation results

4.3.1 Willingness to pay

This section presents the estimated impacts of sociodemographic variables on WTP for organic meat. Table 4 presents the estimates from OLS (column 1), interval regression (column 2), and logit (column 3). Note that the dependent variable is constructed slightly differently in each column. In the interval regression model, the dependent variable is an interval of a lower boundary (the observed amount), and an upper boundary (an amount just lower than the next higher amount on the payment card). In the OLS model, the values of the dependent variables are approximations of the true maximum WTP, which was determined by calculating the average between the observed WTP and the next higher amount on the payment card. The results are similar and very consistent between the OLS and interval regression models. The different constructs of the dependent variables help to test the sensitivity of the model to the assumption we are making in the dependent variable that in OLS the mid-point is a good approximation of the true maximum WTP. The logit model indicates the probability of WTP or not, rather than the variation of WTP amounts across different values.

The results show that some sociodemographic variables significantly influence the variation in premium prices consumers are willing to pay. Females tend to be willing to pay a higher percentage over the price of conventional meat for an organic counterpart. A higher level of education is positively associated with the percentage premium price for organic meat. The rurality index[15] was negative and significant in column 1 and 2 but not in the logit model, indicating that living in a rural area does not significantly affect the likelihood of being willing

[15] The variable ruralness index comes from the Statistics Norway index for the measure of centrality. This centrality index is based on travel time to places of work and service functions from all inhabited districts and gives scores to municipalities on a scale from 0 to 1000 (Statistics Norway 2020)..

to pay at all, but a person living in a rural area is willing to pay less than a person living in urban. Age, household income, and household size were insignificant. The constant term in two of the models is the most significant of all, apart from education and takes the largest value. It is the intercept or the predicted value when all the other independent variables are zero. Even though we can't give the "constant" here a meaningful interpretation the fact that is the among the few significant variables and the too low R^2s indicate that these models have poor explanatory power.

Table 4. WTP baseline models

	OLS	Interval regression	Logit
Age	-0.0150	-0.0145	-0.0000132
	(0.0430)	(0.0403)	(0.00108)
Education	1.656***	1.526***	0.0357**
	(0.459)	(0.429)	(0.0112)
Female	3.018*	2.634*	0.159***
	(1.322)	(1.237)	(0.0320)
Annual household income before tax	-0.278	-0.272	-0.00459
	(0.394)	(0.368)	(0.00995)
Household size	0.502	0.432	0.0310+
	(0.658)	(0.616)	(0.0166)
Rural index	-0.865+	-0.778+	-0.00905
	(0.494)	(0.462)	(0.0123)
Constant	8.935*	9.830**	-0.536
	(3.605)	(3.371)	(0.394)
Log-likelihood	-3076.6	-1776.9	-534.1
Adjusted R^2	0.0282		
McFadden Pseudo R^2			0.0364
AIC	6167.2	3569.8	1082.3
BIC	6199.2	3606.4	1115.3
Observations	720	720	830

Standard errors in parentheses. The reported coefficients of the logit model are marginal effects

and their Standard errors. Significance code: $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

The baseline models (Table 4) do not include other important variables (e.g., price sensitivity, perception/attitude that organic meat is healthier, and attitude/perception that organic meat benefits the environment more than conventional meat), because they can be considered *bad control* variables[16]. These variables can be considered outcome variables and may be influenced by the sociodemographic variables in the model (see Appendix A2 for how they are influenced); thus, they are not included in the baseline model. These variables however are the main interest of this study therefore Column 2 of table 5 provides the estimation of the impact of stated price importance and attitudinal variables on WTP. The results show that stated price importance is associated with a lower WTP, while both attitudinal variables were associated positively with WTP; WTP increases with the belief that organic foods are healthier and with the belief that organic foods benefit the environment.

One more thing to note is that the explanatory power of the model with only the socio-demographic variables is very poor, and this improves when we use the other independent variables: stated price importance and attitudinal variables in column 2. The model presented in column 2 suffers from omitted variable bias causing endogeneity problem. A potential solution to these would be using instrumental variables. However, we do not have a valid instrument that has a casual effect on attitude but not have direct influence on WTP. Therefore, the results should be seen in light with these severe limitations. However, thinking that sociodemographic variables have a direct effect on WTP, and indirect effects that works through the attitude variables, the results in Table 5, first column can be interpreted as reduced for effects that pick up both the direct and the indirect effects.

Table 5. The influence of price sensitivity and attitude on WTP, OLS results

	With only socio-demographic variables	Model without socio-demographic variables
Age	-0.0150 (0.0430)	
Education	1.656^{***} (0.459)	

[16] A bad control variable is a control variable that is influenced by other independent variable/s and leads to misinterpretation of the model estimates (Angrist and Pischke, 2008)

Female	3.018*	
	(1.322)	
Annual household income before tax	-0.278	
	(0.394)	
Household size	0.502	
	(0.658)	
Rural index	-0.865+	
	(0.494)	
Stated price importance		-4.573***
		(0.613)
Perceived Healthier		4.408***
		(0.594)
Perceived Environmentally friendly		2.586***
		(0.635)
Constant	8.935*	11.74***
	(3.605)	(2.205)
Adjusted R^2	0.0282	0.249
AIC	6167.2	6157.6
BIC	6199.2	6176.0
Observations	720	740

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.3.2 Stated buying behavior

Table 6 presents a logistic baseline model for purchase behavior (SBB). Column 1 presents the estimated impacts of sociodemographic variables. Column 2 shows the same logistic regression but only for those who were willing to pay, and in column 3 is a model consisting only those who purchased meat in the previous week. None of the sociodemographic variables were significant except rurality.

Table 6. stated buying behavior, logit results

	Whole sample	The sample consists only of respondents with positive WTP	The sample consists only of respondents who reported having

			purchased meat
Age	0.000817	0.000966	0.00195
	(0.000863)	(0.00137)	(0.00126)
Education	0.00316	-0.00339	-0.00219
	(0.00926)	(0.0152)	(0.0132)
Female	0.0168	-0.0380	0.0485
	(0.0257)	(0.0412)	(0.0362)
Annual household income before tax	0.00592	0.00833	0.0118
	(0.00764)	(0.0119)	(0.0114)
Household size	0.0167	0.0184	0.0124
	(0.0125)	(0.0196)	(0.0184)
Rural index	-0.0171^{+}	-0.0168	-0.0324*
	(0.0102)	(0.0157)	(0.0154)
Constant	-2.950***	-1.970*	-2.715**
	(0.772)	(0.842)	(0.878)
Log-likelihood	-203.2	-152.6	-153.0
McFadden Pseudo R^2	0.0214	0.0174	0.0358
AIC	420.5	319.2	320.1
BIC	451.2	346.0	347.7
Observations	598	340	379

Reported coefficients are marginal effects. Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7 presents estimated effects of perception/attitudinal variables on SBB for different samples: the whole sample (column1), for those who having an intention to buy (column2) and for those who reported having purchased meat (coumn3). Price sensitivity and perceived availability were both significant. Being price sensitive reduce the probability that they buy organic meat. On the other hand product availability is associated with a higher chance of organic purchase. The perception that organic is healthy increases the likelihood of actually purchasing organic meat, whereas the perception that organic is environmentally friendly had no significant effect on the actual purchase. The magnitude of all the marginal effects is higher for the sample with a positive WTP (with an intention to buy) compared to the whole sample. Indicating stronger association of the variables to the organic purchase decision when the respondent has intention to buy.

Table 7. Influence of attitude variables on SBB, logit results

	Whole sample	The sample consists only of respondents with positive WTP	The sample consists only of respondents who reported having purchased meat
Stated price importance	-0.0523***	-0.0760**	-0.0675***
	(0.0147)	(0.0240)	(0.0190)
Perceived product availability	0.0323*	0.0568**	0.0332+
	(0.0138)	(0.0219)	(0.0181)
Perceived Healthier	0.0664***	0.0878***	0.0748***
	(0.0141)	(0.0224)	(0.0182)
Perceived Environmentally friendly	-0.000393	-0.0164	0.00353
	(0.0148)	(0.0246)	(0.0196)
Constant	-2.922***	-2.469**	-2.352***
	(0.623)	(0.760)	(0.698)
Log-likelihood	-181.9	-139.3	-141.2
McFadden Pseudo R^2	0.132	0.103	0.137
AIC	373.8	288.7	292.4
BIC	395.5	307.6	312.1
Observations	564	324	377

Reported coefficients are marginal effects. Standard errors in parentheses $^{+}\ p < 0.10$, $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

4.3.3 The intention-behavior gap

Table 8 presents the underlining influences of the intention-behavior gap and tests the hypotheses developed in section 2. Table 1b describes a description of how the dependent variable gap is constructed. Table 8 shows a logistic regression of stated price importance, product availability, own health concern, environmental concern, attitude toward animal welfare, and the control variable (red meat purchase frequency) on the dependent variable (intention-behavior gap).

Stated price importance is positive and significant, meaning that more price-sensitive consumers are more likely to show an intention-behavior gap, supporting H1: *Price importance leads to a gap between intention and behavior toward buying organic meat*

Product availability (perceived product availability) is negative and significant. Consumers who perceive that the product is widely available tend to purchase the product and, therefore, are less likely to show an intention-behavior gap, supporting H2: *Product availability reduces the intention-behavior gap in buying organic meat* .

The variable personal health concern is negative and significant. Consumers who are concerned for their health are more likely to actually purchase and, hence, less likely to show an intention-behavior gap, supporting H3: *Personal health concerns/motives reduce the intention-behavior gap for buying organic meat.*

The consumer's concern for the environment has no significant influence on the intention-behavior gap. Therefore, the analysis does not support H4: *Environmental concerns/motives reduces the intention-behavior gap for buying organic meat.* The variable "attitude toward animal welfare" is significant and positively influences the gap, therefore does not support H5: *The perceived animal welfare friendliness of organic reduces the intention-behavior gap for buying organic meat.* This may mean that the attitude positively influences intention but is not a strong motivation to translate the intention into purchase behavior.

Table 8. Intention-behavior gap, logit result.

	Gap
Stated Price importance	0.0976***
	(0.0256)
Perceived product availability	-0.0710**
	(0.0236)
Own health concern	-0.0553+
	(0.0302)
Environmental concern	0.0385
	(0.0273)
Perceived Animal welfare friendliness	0.123**
	(0.0438)

Red meat consumption frequency	-0.0518*
	(0.0202)
Constant	1.842+
	(1.037)
Log-likelihood	-131.7
McFadden pseudo R^2	0.112
AIC	277.4
BIC	303.1
Observations	292

Reported coefficients are marginal effects. Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Different gap variables are used in Table 9 and Table 10, where instead of positive WTPs as intentions (column1), we only consider WTPs of at least 10 percent (column 2), 20 percent (column 3), and 30 percent (column 4) WTPs as intentions. Table 1c presents a description of how these gap variables are constructed.

In table 10 we see that socio-demographic variables are insignificant except for when we use Gap30, when the intentions are set on WTP equal to or higher than 30 percent. We can expect the significance to get stronger if we use a higher cutoff than 30 percent, but the number of observations does not allow us to test for a higher cutoff point than thirty percent. Also note that in table 9 price, availability and health concerns become insignificant when we use Gap30. This suggests that the factors influencing intention-behavior gap depends on how we relate WTPs to intentions.

Table 9: Different gap variables, logit results: intentions are assumed to be formed at least 10, 20, and 30 percent WTP values-influence of price, availability and concerns related to own health, the environment and animal welfare.

	(Intention if WTP > 0) Gap	(Intention if WTP ≥ 10) Gap10	(Intention if WTP ≥ 20) Gap20	(Intention if WTP≥30) Gap30
Stated price importance	0.0976***	0.0935**	0.0974*	0.0405
	(0.0256)	(0.0308)	(0.0409)	(0.0632)
Perceived product availability	-0.0710**	-0.0844**	-0.0830*	-0.0135
	(0.0236)	(0.0273)	(0.0359)	(0.0620)

Own health concern	-0.0553^{+}	-0.0671^{+}	-0.0470	-0.0327
	(0.0302)	(0.0346)	(0.0461)	(0.0765)
Environmental concern	0.0385	0.0541^{+}	0.0698^{+}	0.0805
	(0.0273)	(0.0316)	(0.0414)	(0.0711)
Perceived Animal welfare friendliness	0.123**	0.117*	0.136^{+}	0.131
	(0.0438)	(0.0513)	(0.0701)	(0.130)
Red meat consumption frequency	-0.0518*	-0.0656**	-0.0890**	-0.118*
	(0.0202)	(0.0243)	(0.0316)	(0.0469)
Constant	1.842^{+}	2.179^{+}	1.486	0.838
	(1.037)	(1.137)	(1.432)	(2.071)
Log-likelihood	-131.7	-114.0	-69.68	-33.03
McFadden pseudo R^2	0.112	0.110	0.145	0.140
AIC	277.4	242.1	153.4	80.06
BIC	303.1	266.3	173.7	94.60
Observations	292	236	136	59

Reported coefficients are marginal effects. Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10: Different gap variables, logit results: intentions are assumed to be formed at at least 10, 20, and 30 percent WTP values-influence of socio-demographic variables.

	(Intention if WTP > 0) Gap	(Intention if WTP ≥ 10) Gap10	(Intention if WTP ≥ 20) Gap20	(Intention if WTP≥30) Gap30
Age	-0.00125	-0.00164	-0.00348	-0.00676^{+}
	(0.00168)	(0.00195)	(0.00257)	(0.00385)
Education	0.0137	0.0256	0.0317	0.115*
	(0.0183)	(0.0204)	(0.0289)	(0.0522)
Female	0.0398	0.0539	0.0879	0.197^{+}
	(0.0496)	(0.0577)	(0.0805)	(0.118)
Annual household income before tax	-0.00920	-0.00866	-0.00585	0.0228
	(0.0146)	(0.0173)	(0.0248)	(0.0391)

Household size	-0.0179	-0.0235	-0.0209	-0.0124
	(0.0237)	(0.0272)	(0.0381)	(0.0534)
Rural index	0.0157	0.0263	0.0358	0.0196
	(0.0187)	(0.0213)	(0.0307)	(0.0493)
Constant	1.580^{+}	1.087	0.822	-1.290
	(0.915)	(0.967)	(1.203)	(2.220)
Log likelihood	-136.4	-118.5	-73.36	-31.34
McFadden pseudo R2	0.0155	0.0264	0.0383	0.141
AIC	286.8	251.1	160.7	76.68
BIC	312.0	274.9	180.6	90.85
Observations	273	221	126	56

Standard errors in parentheses. Reported coefficients are marginal effects
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Discussion and Implications

Almost half the respondents were willing to pay a premium for organically produced meat in Norway, which is in line with the overall sales growth in organic farming products. The Ministry of Agriculture and Food (2018) has found that this growth is occurring without a corresponding increase in Norwegian production, so it can be assumed that much of the sales growth is met by imported goods. Currently, import statistics do not distinguish between organic and conventionally farmed food, so it is impossible to know the exact amount of organic food traded.

Although we found that 45% of our respondents were willing to pay a significant premium for organic meat, only 7.2% had bought organic meat in the week prior to the survey. The difference between intention and action can be attributed to a number of factors, and the results show that price sensitivity and animal welfare attitudes are more likely to widen this specific gap between intention and behavior in the context of consuming organic meat, whereas perceived product availability and personal health concerns are likely to lessen the gap.

A number of barriers stand between intentions and behaviors, the first being limited availability in convenience and grocery stores Only 40% of our respondents agreed that organic food is widespread. When it comes to meat, in particular, the variety of products is limited in popular convenience and grocery stores. Perceived product availability was significant for both reported buying behavior and the gap between intention and behavior. Consumers were more likely to actually buy organic meat and less likely to show a gap between intention and behavior

when they believed organic food was widely available. This is consistent with the results of Qi et al. (2020) and Weissman and Hock (2022), who suggest that unavailability issues were among the factors contributing to the gap between green food intention and purchase.

Previous work generally agrees that price is one of the main barriers to buying organic food (Akaichi et al., 2019; Lee and Yun, 2015; Verain et al., 2012). Consistent with that research, our results show that households that described price as being very important when buying livestock products were less likely to actually buy and tended to show a gap between WTP and purchase behavior.

Additionally, nearly 80% of those reporting a positive WTP were willing to pay a price premium of only 5%–20% per kg. Although we can't say for sure, we can suspect that for some respondents this could mean the market price premium[17] could be higher than what they are willing to pay. Wang et al. (2019) discussed that the difference between the actual premium and the WTP is the biggest factor impeding green buying behavior in their study. Wang et al. (2019) also reported that at the time of the study, green product prices in the Chinese market were 20% to 30% higher than what consumers intended to pay, which was 5% for more than 70% of consumers. Twenty years ago consumer prices for organic beef in Norway were almost 50% higher than of conventional products (Schmid and Richter, 2000; Storstad & Bjrkhaug, 2003). However, we do not have updated or accurate data or estimates of the current market price premium and therefore cannot say with certainty whether the reported WTPs are higher or lower than the market premium.

Annual reports from the Norwegian Directorate of Agriculture show that, despite increasing growth in organic meat production, only a certain percentage of it is sold as organic. For example, it was reported that 2480 and 2530 ton of organic meat was produced in 2020 and 2021, respectively. However, in both 2020 and 2021 only 55% of the organic meat produced was sold as organic meat (Weie and Moe, 2022). One reason for this is the problem of logistics; when producers, slaughterhouses, and processors are not conveniently located, processing it organically is more expensive than bringing it into the conventional flow of goods (Weie, 2021). Policies and strategies aimed at facilitating the processing of organic products would be beneficial in this regard. From an economies of scale perspective, increased production would also reduce the problem of logistics and thus the problems of cost and availability.

[17] The market price premium here implies a price difference between a conventional meat and its organic counterpart.

Another point worth mentioning is cross-border shopping in Norway. It is common for many consumers in eastern Norway (particularly those living on the border with Sweden) to travel to neighboring Sweden to shop for cheaper food and drink. Meat, alcohol, and tobacco in particular are much more expensive in Norway than in Sweden. The value-added taxes on groceries is 15% in Norway and 12% in Sweden, and, generally, prices are lower in Sweden.

Additionally, there are different types of consumers, e.g., committed organic seekers vs. convenience organic consumers. It may be the case that some of our respondents are of the latter type and that their willingness to pay once does not necessarily mean they are willing to always buy organic meat. Rutledge (2009) discusses and differentiates groups of organic consumers. Committed organic consumers tend to eat organic food on a daily basis, actively seek to buy organic food, and do not believe that the availability of organic food is a barrier to buying organic food. By contrast, convenience and incidental organic consumers will buy organic food when it is available but will not buy it for everyday consumption. The data used in the present study consists of only one week of actual (reported) purchase data, which may mean that we are more likely to observe the purchase behavior of people who buy/consume meat frequently. Our analysis included the frequency of meat consumption to account for this. Meat consumption frequency had a significant negative effect on the intention-behavior gap, i.e., the more they consume meat, the less likely they are to show inconsistency between WTP and SBB.

Several studies (Akaichi et al., 2019; Gaviglio and Pirani, 2015; Qasim et al., 2019) have reported that environmental concerns and health consciousness are positively correlated with the WTP for organic food. The perceived environmental benefits of organic products are associated with a higher WTP in the present study but are insignificant for SBB. The results also show that environmental concerns had an insignificant impact on the intention-behavior gap. These results are consistent with those of Verhoef (2005), who, in examining SBB (i.e., the choice of organic meat and the frequency of buying organic meat), found that environmental concerns did not have a significant influence on the decision to buy organic meat. At the same time, the perceived health benefits of organic food positively influence both WTP and SBB, and health concerns negatively influence the intention-behavior gap, i.e., help eliminate the gap. In agreement with Ali et al. (2021), Birch et al. (2018), Chekima et al. (2017), and Talwar et al. (2021), the present study suggests that practitioners and marketers of organic products should give special emphasis to the health benefits of consuming organic meat to

broaden their consumer base and increase loyalty among current consumers. However, more research is needed to determine whether the same results apply to all other organic foods and organic products (e.g., cosmetics).

In line with the results of previous studies on consumer preference for organic food (e.g., Akaichi et al., 2019; Singh and Verma, 2017), gender and education are correlated with WTP. The rurality index was also significantly and negatively associated with WTP. Although there are many studies reporting a significant influence of income on the WTP for organic food, this study found no evidence that income significantly influences the variation in WTP, which may be due to the limited observation of income variables.

This study contributes to the existing literature in a number of ways. First, the study focused on both purchase intention (WTP) and purchase behavior (SBB) as opposed to only purchase intention for organic food/meat. Second, it examined the intention-behavior gap (including only consumers intending to buy meat) and identified the factors widening or lessening the gap. Studies that use intention as an endpoint are of little use without an understanding of how intentions are translated into action. Third, the hypothesis development was guided by Stern's (2000) ABC theory to account for environmentally relevant individual behavior.

6. Conclusion and Future Research

This study sheds some light on consumers' purchase intentions and behavior in regard to organic meat. It examined the factors behind consumer WTP, purchase behavior, and the gap between intention and behavior in relation to the consumption of organic meat. The effects of sociodemographic factors, price sensitivity, and attitudinal variables on WTP were examined. As previous studies have suggested that consumers' WTP does not necessarily lead to actual purchasing decisions, the study examined whether the same factors, in addition to product availability, influence SBB. The results show that education, gender, the rurality index, attitudinal variables, and price sensitivity significantly influenced WTP. However, only price sensitivity and product availability were significant in regard to the likelihood of a purchase decision.

The data reveal an intention to buy organic meat (45% of respondents were willing to pay a higher price). However, only 7% of the respondents said that they bought organic meat in the week prior to the survey, while 50% said they had bought meat in the same week. This study examined this specific gap between intention and behavior and found that product availability

and concern for one's health reduce the gap between purchase intent and behavior, whereas consumer price sensitivity was found to widen the gap, and environmental and animal welfare concerns were not found to be effective translators of purchase intention into behavior. In other words, primary concerns, such as concern for one's own health, can narrow the gap between intention and behavior more effectively than secondary concerns, such as environmental and animal welfare concerns.

The findings of this study indicate that social desirability bias is not solely responsible for the intention-behavior gap, which is also influenced by situational factors (such as how costly and available the organic product is), consumer attitudes, and priority of concern at the point of purchase (i.e., not all concerns are of equal importance when it comes to purchasing behavior; some concerns are stronger in translating intentions into actual behavior).

When considering the results of this study, the following limitations should be kept in mind: first, the study had a limited observation of the stated buying behavior, which may have influenced the analysis. Therefore, the transferability and generalizability of the results should be tested by conducting similar surveys. Second, the data were collected at a single point in time, so they do not capture actual purchase behavior over time; the SBB or reported purchase quantity of meat or organic meat in the week prior to the survey offers only a glimpse into a more complex organic consumption pattern. Third, self-reported data were used for the analysis. Although the survey was designed according to the latest SP survey guidelines, the responses could still be susceptible to certain survey biases. Future researchers should use a more objective measure of organic food buying and consumption behavior to gain a deeper understanding of buying behavior and obtain generalizable insights.

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Appendix

A1 Weighted regressions

Table 11: Weighted regression: WTP

	(unweighted)	(weighted)
Age	-0.0150	-0.00721
	(0.0430)	(0.0418)
Education	1.656***	1.662***
	(0.459)	(0.482)
Female	3.018*	2.999*
	(1.322)	(1.377)
Annual household income before tax	-0.278	-0.262
	(0.394)	(0.381)
Household size	0.502	0.747
	(0.658)	(0.702)
Rural index	-0.865+	-0.973+
	(0.494)	(0.503)
Constant	8.935*	8.195*
	(3.605)	(3.271)
Adjusted R^2	0.0282	0.0298
AIC	6167.2	6170.2
BIC	6199.2	6202.2
Observations	720	720

Standard errors in parentheses. Weighted to balance age, education and gender . The table presents the weighted and unweighted regressions to see if the difference between them is major The difference between the results are very minor. Significance code: $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: Weighed logistic regression: SBB

	(unweighted)	(weighted)
Age	0.000817	0.000803
	(0.000863)	(0.000918)
Education	0.00316	-0.000573
	(0.00926)	(0.0104)
Female	0.0168	0.0184
	(0.0257)	(0.0265)

Annual household income before tax	0.00592	0.00477
	(0.00764)	(0.00766)
Household size	0.0167	0.0208^{+}
	(0.0125)	(0.0124)
Rural index	-0.0171^{+}	-0.0166
	(0.0102)	(0.0112)
Constant	-2.950***	-2.846***
	(0.772)	(0.793)
Log-likelihood	-203.2	-200.9
McFadden R2	0.0214	0.0211
AIC	420.5	415.8
BIC	451.2	446.6
Observations	598	598

Standard errors in parentheses. Reported coefficients are marginal effects.

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13: Weighed logistic regression: Intention-behavior gap

	(unweighted)	(weighted)
Stated Price importance	0.0976***	0.103***
	(0.0256)	(0.0246)
Perceived product availability	-0.0710**	-0.0647*
	(0.0236)	(0.0253)
Own health concern	-0.0553^{+}	-0.0464
	(0.0302)	(0.0306)
Environmental concern	0.0385	0.0335
	(0.0273)	(0.0285)
Perceived Animal welfare friendliness	0.123**	0.135**
	(0.0438)	(0.0448)
Red meat consumption frequency	-0.0518*	-0.0552*
	(0.0202)	(0.0218)
Constant	1.842^{+}	1.554
	(1.037)	(1.002)
Log-likelihood	-131.7	-128.1
Adjusted R^2	0.112	0.118

AIC	277.4	270.2
BIC	303.1	295.9
Observations	292	292

Standard errors in parentheses. Reported coefficients are marginal effects.

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A2 Alternative regressions

Table 14: Left hand side variables: Perception that organic food is healthy(1), Perception related to organic food being environmentally friendly (2), own health concern (3) and environmental concern (4).

	(1) Perceived Healthier	(2) Perceived Environmentally friendly	(3) Own health concern	(4) Environmental concern
Age	0.00746**	0.00831**	0.00710***	0.00715**
	(0.00275)	(0.00259)	(0.00190)	(0.00236)
Education	0.00981	0.0149	0.0308	0.118***
	(0.0291)	(0.0279)	(0.0205)	(0.0253)
Female	0.162+	0.158*	0.224***	0.457***
	(0.0847)	(0.0799)	(0.0590)	(0.0729)
Annual household income before tax	-0.0361	-0.0316	0.00803	-0.00975
	(0.0252)	(0.0240)	(0.0176)	(0.0216)
Household size	0.0625	0.0284	-0.00370	0.0378
	(0.0413)	(0.0392)	(0.0289)	(0.0358)
Rural index	0.00598	-0.00202	0.0133	-0.00604
	(0.0307)	(0.0291)	(0.0216)	(0.0267)
Constant	1.292***	1.705***	2.304***	1.305***
	(0.227)	(0.214)	(0.158)	(0.196)
Adjusted R^2	0.00936	0.0131	0.0299	0.0759
AIC	2380.3	2176.3	1972.4	2312.2
BIC	2412.8	2208.4	2005.2	2345.0
N	763	734	803	803

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table15: Left hand side variable: Animal welfare

	(logit) Perceived Animal welfare friendly	
Animal welfare		
Age	-0.00130	(0.00483)
Education	0.0447	(0.0512)
Female	0.525***	(0.149)
Annual household income before tax	0.0111	(0.0440)
Household size	-0.0204	(0.0729)
Rural index	-0.0403	(0.0544)
Constant	0.377	(0.396)
McFadden pseudo R^2	0.0143	
AIC	1078.8	
BIC	1111.9	
N	830	

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A3 Survey

This section presents parts of the survey that are relevant to this paper.

Purchasing behaviour

1. How important are the following aspects when you purchase livestock products?

	0.Very important	1.important	2.Moderately important	3.Slightly important	4.Not important	5.Don't know/ Not applicable
taste						
freshness						
Food safety						
Healthiness						
Product appearance/packaging						
Price						

	0.Very important	1.important	2.Moderately important	3.Slightly important	4.Not important	5.Don't know/ Not applicable
Purchasing locally produced food						
Supporting Norwegian livestock production						
Benefiting the environment						
Meeting my spouse/children/household members expectations of organic food purchase						
Reducing gasoline consumption due to shorter transportation of food						

Attitude towards organic production

2. please indicate whether you agree or disagree with each of the following statements

	0.Strongly agree	1.agree	2.neutral	3.disagree	4.Strongly disagree	5.Don't know/not applicable
Organic foods have no harmful effects						
Organic foods are healthier than their conventional counterparts						
Organic foods are more attractive						
Organic foods have better quality than conventional foods						

The benefits of organic food are overrated						
Organic products benefit the environment						
Organic foods taste better than their conventional counterparts						
Conventional products are better than organic products						
Organic products are trending/in fashion						
Organic foods are widely available in the market						
Organic products are more expensive						
Norwegian lamb meats that are sold in Norway are organic						
I would feel guilty if I bought conventional food instead of organic foods						

Lifestyle questions

1. Are you vegetarian /vegan ? No Yes
2. How often do you

	Daily	at least 3 times	once a week	twice a month	once a month or less	Never	I don't know

		a week					
exercise / are you active							
eat fast food							
smoke							
eat red meat							
eat fruits							
eat vegetables							

WTP question

5. Approximately how many grams of meat have you bought in the past week?____grams

6. Think about what it is worth to you to obtain organic meat. What is the most price premium, if anything, your household certainly is willing to pay for 1 kilo of organic Norwegian meat on top of the conventional Norwegian meat price? Remember that this payment will reduce your spending on other goods and services.

0 %	5 %	10%	20 %	30 %	40%	50 %	75 %	100 %	Other: please specify__	Don't know

(If your answer to question number #6 was 0 or don't know, please respond to question #7; otherwise, skip #7 and answer #8.)

7. Why are you not willing to pay anything for the product or don't know what you are willing to pay? Please choose the one most important reason

I cannot afford to pay

I am happy with conventional meat

I do not trust that the organic claim truly holds

I do not eat meat/ I am vegetarian

It does not matter for me that the food I buy is organic

All productions should be organic and we should not be paying extra

Other; please specify_____

8. What is the most important reason for you being willing to pay something to obtain an organic meat? _____

9. Approximately how many grams of organic meat have you bought in the past week?____grams

Essay III

This paper is awaiting publication and is not included in NTNU Open

ISBN 978-82-326-7330-8 (printed ver.)
ISBN 978-82-326-7329-2 (electronic ver.)
ISSN 1503-8181 (printed ver.)
ISSN 2703-8084 (online ver.)

NTNU
Norwegian University of
Science and Technology