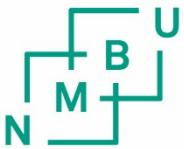

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Consumer Willingness to Pay for Renewable Energy: A Meta Analysis

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Master of Science in Economics

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ABSTRACT

The electricity generated from renewable source i.e. wind, solar, hydro and biomass are considered to be environmentally stable from the point of Co2 emission and resource depletion. According to International Panel of Climate Change (IPCC) the average temperature on earth is predicted to increase between 0.8 and 3.5 Degree Celsius by the year 2100 AD if the CO2 emission policies are not implemented urgently (IPCC Report, 2014). The electricity generated from renewable energy source are costlier than that of electricity generated from the non renewable source like that of fossil fuels. The consumers have to bear this cost either directly through additional cost on their electricity bill as premium or indirectly through green taxes. In the recent year's various studies has been published in order to study the willingness to pay (WTP) for renewable energy. The increase in the number of study has also made it quite difficult to recognize the real determinants for the consumer WTP, hence it is very important to find out the actual factor which really affect the consumer's willingness to pay and my study will try to fill the gap in this topic. This study will use both OLS and Meta Regression Model to capture the important factors that effect the consumer WTP. Both the stated preference technique i.e. Contingent Valuation and Choice Experiment (CE) has been used in the studies among which CE has predicted the high estimates. The findings of my study also shows that consumers have higher willingness to pay for the electricity produced from the generic source and the survey specific and methodological variables plays an important role to determine the consumer WTP. Further more this study also uses the meta analytic transfer to the policy sites and compare the results with the actual values and find out the transfer errors. In this study five different models have been used to compare the transfer errors i.e four are meta analytic and one is unit value transfer with income adjustment, among which unit benefit transfer with income adjustment has produced the low transfer error comparing to meta analytic transfer.

Keywords: Ordinary Least Square, Meta Regression, Contingent Valuation, Choice Experiment, Green Electricity, Renewable Energy, Benefit Transfer.

SAMMENDRAG

Den elektrisitet generert fra fornybar kilde dvs. vindkraft, solenergi, vannkraft og biomasse anses å være miljø stabil fra det punktet av Co2-utslipp og ressursmangel. Ifølge International Panel of Climate Change (IPCC) den gjennomsnittlige temperaturen på jorda er spådd å øke mellom 0,8 og 3,5 grader Celsius innen år 2100 e.Kr. dersom CO2-utslipp politikk ikke blir gjennomført snarest (IPCC Report, 2014). Den elektrisitet generert fra fornybare energikilden er dyrere enn for elektrisitet generert fra ikke fornybare kilder som det av fossilt brensel. Forbrukerne må bære denne kostnaden enten direkte gjennom ekstra kostnad på strømregningen som premie eller indirekte gjennom grønne skatter. I den siste årets ulike studier har blitt publisert for å studere betalingsvillighet (WTP) for fornybar energi. Økningen i antall studie har også gjort det ganske vanskelig å gjenkjenne den virkelige determinanter for forbrukeren WTP. Det er svært viktig å finne ut den faktiske faktor som virkelig påvirker forbrukerens vilje til å betale, og min studie vil prøve å fylle gapet i dette emnet. Denne studien vil bruke både OLS og Meta regresjonsmodell for å fange de viktige faktorene som effekt forbrukeren WTP. Både uttalt preferanse teknikk dvs. Betinget Verdivurdering og valg Experiment (CE) har blitt brukt i studiene blant CE har spådd de høye estimatene. Funnene i min studie viser også at forbrukerne har høyere betalingsvillighet for elektrisitet produsert fra den generiske kilde og undersøkelsen spesifikke og metodiske variabler spiller en viktig rolle for å fastslå forbrukernes betalingsvillighet. Videre denne studien bruker også meta analytisk overføring til de politiske nettsteder og sammenligne resultatene med de faktiske verdiene og finne ut overføringsfeil. I denne studien fem forskjellige modeller har blitt brukt til å sammenligne overføringsfeil, dvs. fire er meta analytisk og en er andelsverdien overføring med inntekt justering, hvorav enhet fordel overføring med inntektsutjevning har produsert den lave overføringsfeil sammenligne med meta analytisk overføring.

Nøkkelord : Ordinært Minst Square , Meta regresjon, Betinget Verdsettings , valgeksperimentet , grønn elektrisitet , fornybar energi, fordelen overføring

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CHAPTER 1: INTRODUCTION

1.1 Background

Global warming is regarded as one of the biggest threat to the global world. Global warming is the increase in earths temperature which is caused by increase in green house gases into the atmosphere. The heavy industrialization in the global community is the major source of CO2 and other toxic gases which is released from burning the fossil fuel. In the present context many industrialized nations has started to set up an ambitious renewable energy target in order to mitigate the climate change. According to International Panel of Climate Change (IPCC) "the average temperature on earth is predicted to increase between 0.8 and 3.5 Degree Celsius by the year 2100 AD if the CO2 emission policies are not implemented urgently" (IPCC Report, 2014). In order to cope up with the global warming many nations has started making the strategy to minimize the use of non renewable energy and maximize the use of renewable energy. In the current scenario the electricity generated from the renewable sources like that of hydro, solar, wind, biomass and other renewable resources is costlier than that of non renewable energy sources i.e fossil fuel, thus the difference amount is paid by the customer either through a higher price for renewable energy i.e. premium or indirectly through the means of taxes.

In the recent years many studies have been done in order to investigate the consumer preference for the type of electricity and their Willingness to Pay (WTP), but in spite of all the available information from these studies regarding the consumer's attitude towards renewable energy, it is very difficult for the policy makers in the higher level to get the overall understanding of the consumer's behavior. To analyze this behavior, it is very important to find the exact explanatory variables which clearly reflects the consumer's attitude and the range of individual values for a specific study sites and the renewable energy sources. In order to study theses overall effect, meta analysis is regarded as one of the important tool or the statistical technique for combining the findings from the independent studies. "A good meta analysis aim for complete coverage of all the relevant studies which look for the presence of heterogeneity, and explore the robustness of the main findings using sensitivity analysis". (Lain et al., 2009). Meta Analysis is one of the important and popular statistical methods which are used widely in behavioral, social and the medical sciences. Meta Analysis, according to the Glass (1976), represents "the statistical analysis of a large collection of analysis results from individual studies for the purpose of integrating the findings". It is also known as the research synthesis (Cooper and Hedges, 1994),

the combining of information and systematic review (Petticrew and Roberts, 2006). It has become one of the standard methodology used in synthesizing research findings in the social, behavioral and medical sciences. A quantitative meta analysis ensures global comparability of WTP for renewable energy and provides evidence for global preferences. According to Simon et al., "Meta Regression Analysis investigates whether particular covariates modifiers explain any of the heterogeneity of the the treatment effect between studies".

1.2 Problem Statement

Not much research on the meta regression analysis on consumer willingness to pay for green electricity has been done, as per my knowledge three articles Soon and Ahmad (2015), Chunbo et al., (2015) and Swantje et al, (2015) has been published which discuss about the characteristics that explain the heterogeneity in WTP. In this thesis I will use the OLS and meta regression analysis to find out the factors that affect the consumer's willingness to pay for green electricity and to what direction it goes. I will further discuss the results of meta regression and explore the efficiency and robustness of the result when transferring the values along with the transfer error. Therefore, my thesis will try to answer the two reaserch question i.e

I. Which factors affect the consumer willingness to pay (WTP) for green electricity and in what direction?
II. Is the transfer error of meta analytic transfer less than unit value transfer?

1.3 Hypothesis

The main hypothesis of my study is that the the independent variables described in the descriptive statistics (please see table 2) has a positive effect on consumer willingness to pay. I have listed my hypothesis according with the expected sign. If the expected sign for the independent variable is (+) than it has positive effect with the dependent variable i.e WTP values/lnWTP values and the null hypothesis will be rejected but in the case of negative sign (-) there will be negative effect with the dependent variables. Regarding the Meta analytic transfer the main hypothesis of this study is that the meta analytic result is the most preferred transfer technique among other transfer methods so in order to test the hypothesis I will compare the results with four different models under meta analytic transfer and one with unit value transfer with income adjustment.

1.4 Structure

The main objective of my research is to carry the meta analysis of consumer willingness to pay for green electricity. The whole research will focus on answering the two research questions. The research study is divided into six parts starting from Introduction to the conclusion. The first part will be the introduction part where I will try to explain the general introduction of my topic along with the problem statement and the hypothesis of my study. Second chapter will discuss about the various economic theories on environmental valuation technique, meta analysis and the meta analytic benefit transfer. Third chapter is based on the methodology part which will explain about the data sorting, selection of studies, descriptive statistics and publication bias and the robustness along with description about effect size and its derivation, choice of moderator variables, model selection and weights of primary studies. Chapter four is the major part part of the research which will discuss about the result depending upon the meta regression and OLS model. It will also analyze the result on validity and reliability of meta analytic transfer along with transfer error. The last chapter will be the conclusion/recommendation part which will focus on giving the concluding remarks along with the short summary of the result and further discusses about the limitation and recommendation for further research.

CHAPTER 2: ECONOMIC THEROIES

2.1 Environmental Valuation Technique:

Environmental valuation is the process of giving the monetary values for the environmental goods and services which cannot be directly measured in the monetary term like that of economic goods and services i.e. it does not posses the market price. Examples of environmental goods and services include scenic views, mountains, biodiversity which is reflected in species like that of animals or plants. Furthermore, it also includes many indirect processes such as watersheds, water supply, forest and carbon sequestration, erosion control, and ecosystem conservation. As my research is more concerned with the valuation of renewable resources I will try to focus more on the renewable energy. Renewable energy has the multiple benefits to the environment such as reduction of green house gas emissions, increased fuel diversity and reduction of energy price volatility that effect on the economy. It further increases the economic productivity and Gross Domestic Product (GDP) of the country by strengthening the production process.

Environmental valuation technique is the type of methods which are used to value the environmental goods and services which do not posses the market price. There are generally two methods which are used widely in the studies for the purpose of environmental valuation of goods and services i.e. behavioral (revealed preference method) and attitudinal (stated preference method). Basically revealed preference method seeks natural experiments to estimate the demand function for the environmental good i.e analyzing the choices made by the individuals which is generally used to compare the effect of defined policies on consumer's behavior. There are generally four types of revealed preference method i.e travel cost method, hedonic pricing, hedonic wage and averting cost method. As the study I used for the meta analysis has only used the stated preference technique, I will only be discussing about the stated preference method in my study. Stated Preference Method are designed surveys that generally ask the consumers how much they are willing to pay for using the environmental goods and services. The survey creates a type of hypothetical market where the response can be evaluated similar to the behavior observed in the markets (Mendelsohn et al., 2009).

Stated preference methods can be used to value any environmental goods and services even at the level of quality that are currently not in existence i.e. they are capable of capturing non use value which can't be measured using the revealed preference methods (Olmstead 2010). Stated

preference basically seeks the willingness to pay (WTP) of an individual consumer to secure a benefit from renewable energy or willingness to accept to forego a benefit. Stated preference method acts as a tool which is used to query individual/households to express their maximum value in the context of hypothetical market i.e creates the hypothetical scenarios in the absence of real market in which agents make decisions that mimic the reality of market (Mitchell and Carson, 1989). Contingent Valuation (CV) and Choice Experiment (CE) are the example of stated preference method that are widely used in the valuation of environmental goods and services.

Contingent Valuation (CV) is the survey based method, which is used to find the individual/household preferences by directly asking them the value to the environmental attributes and to directly state their preference towards environmental changes. Choice Experiment (CE) are used to determine the preference by measuring WTP for changes in the level of attributes. In the choice experiment individual/household are asked to choose the preferred alternative from the set of alternatives and usually ask to respond to a sequence of choices. Basically in the studies regarding consumer WTP for renewable energy, CV and CE method has been used in order to estimate the WTP for renewable energy and the factors that affect it and choice among various alternative renewable energy sources i.e. generic, wind, solar, hydro etc.

2.2 Meta Regression Analysis

Basically in the primary studies we run the normal regression in order to access the relationship between one or more independent and the dependent variables. In the case of meta analysis, moderator variable is at the level of subject and the dependent variables are the effect size in the studies. Meta regression is therefore the term used to refer these procedures if they are used in the meta analysis. Borenstien et al., (2009). According to Glass (1976), "Meta Analysis is the statistical analysis results from individual studies for the purpose of integrating the findings".

Meta Analysis is the analysis of the primary studies analysis which attempts to integrate and explain the literature. Over the past two decades, meta analysis has been widespread in psychological, health and educational research. (Rosenthhal, 1984; Hedges and Olkin, 1985). The main object of the meta analysis is its effect size. According to Glass (1976),

"Effect Size (g) = $(\mu e - \mu c)/\sigma$,

Where, μe is the mean value of experimental group, μc is the mean value of control group, and σ is the standard deviation of the control group. ”

Meta regression analysis helps to dig the past studies and provide coherence to the different opinions expressed about the subject matter, which will help the researchers to answer the remaining questions and take the research into the different level. It further forces the researcher to include all the published/unpublished research of that topic or at least use the random sample of the studies. (Stanley and Jarell 2004)

There are generally two different types of model used in the meta analysis i.e Fixed Effect Model (FE) and Random Effect Models (RE). these two models imply very different statistical and sampling assumptions (Erez, Bloom and Wells, 1996; Hedges, 1988; NRC 1992). Even though both the methods are seen to be widely used in computing meta analysis, National Research Council (1992) has pinpoint the uncertainty of the findings in meta analysis using fixed effect models. According to them “FE confidence intervals are too narrow and fail to account for true between-studies variance that RE models include as a defining parameter. The undue confidence and precision claimed by the FE models may lead to inappropriately strong conclusions, provide misleading projections”.

According to the Stata Journal (2008), the meta regression RE model can be computed using the following mathematical formulae,

Here, i is the total number of n studies which provides estimate yi as the effect of interest. In our meta regression model yi is represented by WTP values. Each study also provides the standard error of the estimates σ, but in our cases many studies has not provided the standard error.

Random effect meta analysis allows the true effects, θi to vary between the studies by assuming that they have normal distribution around a mean effect, θ which forms,

(A) $yi \text{ I } \theta\text{i} \sim \text{N}(\theta\text{i}, \sigma\text{i}2),$ where

(B) $\theta\text{i} \sim \text{N}(\theta, \sigma 2)$

Here, $\tau 2$ is the between study variance which is estimated from the meta regression dataset. So, from A and B we get,

(C) $yi \sim \mathrm{N}(\theta, \sigma i2 + \tau 2)$,

or equivalently,

(D) $yi = \theta + vi + \epsilon i$ where,

(E) $vi \sim \mathrm{N}(0, \tau 2)$ and

(F) $\epsilon i \sim \mathrm{N}(0, \sigma i2)$

Here, $\tau 2$ is the between study variance which is estimated from the given dataset.

Now, the RE meta regression extends RE meta analysis by replacing the WTP mean i.e. θ with the linear predictor, $xi\beta$ where, β is a k*1 vector of coefficients and xi is a 1*k vector of meta coefficient. So here in our model C and D can be further written as:

(G) $yi \sim N(xi\beta, \sigma i2 + \tau 2)$ or , equivalently

(H) $yi = xi\beta + ui + \epsilon i$ where,

$ui \sim N(0, \tau 2)$ and $\epsilon i \sim N(0, \tau i2)$

The RE model can be considered either an extension to fixed effect meta regression which allows for residual heterogeneity or an extension to the random effect meta analysis that includes study-level covariates.

2.3 Environmental Value Transfer

Environmental value transfer is the adaptation of existing information or data to the new context i.e it uses WTP estimates for some environmental change from a previous study (the study site) to value the environmental change of the policy site. Value transfer is comparatively cheaper and faster than the original valuation study but there is doubt regarding its accuracy because of the transfer error.

There are two major approaches to benefit transfer as unit value transfer i.e either simple unit transfer or unit transfer with income adjustment and function transfer i.e either benefit function from one study or function transfer from meta analytic study simply known as meta analytic transfer.

Simple unit transfer is the easiest approach where we can directly transfer the mean WTP estimate from the study site to policy site whereas in some cases adjustment may be required as there may be the difference in socio economic characteristics between the study site and the policy site i.e income, education (Navrud and Ready 2006).

Unit value transfer with income adjustment can be calculated as:

$$Bp' = Bs(\frac{Yp}{Ys})\beta$$

Here Bp' is the adjusted benefit estimate at the policy site, Bs is the primary benefit estimate i.e WTP values from the estimate site, Ys and Yp are the income levels at the study and policy site respectively whereas β is the income elasticity of WTP for environmental goods.

Second approach is the value transfer function where the values are transferred to policy site based on the site own characteristics using the value transfer function of the study site.

In this study for the purpose of value transfer i will be excluding all the observation from one study n-1 and use it as a policy site and will compare the transferred estimate to the actual value of the study. Despite value transfer based on the meta analysis being one of the most preferred it is not free from the transfer error. This generally happens when the data underlying the estimated relationship in the meta regression does not represent the policy site where the value had been transferred to. In order to find the transfer error, I will be using the unit value transfer technique with income adjustment i.e mean WTP from the study which is most similar to the one which is excluded and will adjust the estimate with GDP/Capita and income elasticity of WTP. After that the WTP values are compared to the actual estimate and hence transfer error is being calculated. At last the value from unit value transfer and meta analytic transfer is compared and analyzed to see which method has produced the less transfer error.

Lindhiem and Navrud (2015) has discussed about the concept of relative transfer error (TE) in their study regarding the reliability of meta analytic benefit transfer of international value of statistical life estimates, which in my case can be used in order to measure the reliability and validity of meta analytic benefit transfer which can normally be defined as:

$$\text{Relative TE} = (\text{WTP T} - \text{WTP B})/\text{WTP B} * 100\%$$

Where, T= transferred or predicted value, either from function or the unit value transfer with/without income adjustment, B= estimate of the true (but unknown) value at policy site. Here, TE is mostly defined in the terms of percentage of error i.e by how many percent the estimated and transfer values missed the true value for a particular policy context where we assume that the researcher is aware about the true value.

2.4 Literature Review

In the recent years many studies have been done in order to investigate the consumer preference for the type of electricity and their Willingness to Pay (WTP). Majority of the studies shows that consumers have positive attitude towards renewable energy and a willingness to buy electricity from the renewable electricity sources, even at premium (Se-Ju Ku et al., 2010, Oliver et al., 2011, Zoric et al., 2012). These studies have used the stated preference method i.e Contingent Valuation (CV) and Choice Experiment (CE) in order to reveal the consumers WTP for renewable energy. The WTP for every individual studies seems to vary depending upon the various explanatory variables like that of education, income, age, environmental knowledge and other factors which directly refer the individual attributes. Oliver et al., (2011) found a significant positive link between household income and WTP for green electricity, their study also showed that not only are the higher income household more likely to pay a premium, but typically they were also willing to pay an even a bigger premium than low income households. Zografakis et al., (2010) showed that "WTP is higher in households with high income, larger household size, higher level of energy information, awareness concerning climate change, higher investment in energy saving measures and the groups who suffer more from electricity shortages than others". Kaenzig et al., (2013) found that "consumers are willing to pay a significant price premium for an upgrade from the current default electricity mix to more environmentally friendly default electricity mix". Bigerna et al., (2014) found that age and sex are negatively related to WTP, while income, education and professional status positively affect the estimates. The result further showed that younger citizens are more likely to support the renewable energy target, while women are found to be more supportive than men.

The article by Sundt et al., (2015) provides a comprehensive overview of the valuation of literature on green electricity and has identified various key characteristics that determine people WTP for green electricity. The article comprises of 18 studies published between 2004 and 2013 with 85 observations. They have carried the research based on both consumer WTP/Household and WTP/Kilowatt hour. The result showed that people in Finland and US

expressed the largest WTP/HH but a low WTP/KWH. From the point of view of quantitative results, the meta regression analysis showed that the preferences for electricity generation is dependent upon various renewable energy sources. In contrast to other renewable energy sources hydro electricity was less preferred probably because it consumes more land and has more significant impact to the environment than that of other renewable energy sources. Furthermore, it was also found that people tend to have higher WTP if the power plant was substituted for renewables, which proves that the knowledge about electricity generation from renewable energy source plays an important role in deciding the type of renewable energy sources they want to use. The study shows that WTP is highly significant with the explanatory variables like knowledge on renewables, price, household characteristics, income and education and while ignoring those attributes during the WTP estimations might end up to the biased coefficients.

The article by Chungbo et al., 2015 is based on 142 observations from 29 studies. In order to perform the meta regression analysis they have used fixed effect and mixed effect meta regression model. The result showed the significant impact on context and background on which the primary studies were conducted. In theie study consumer WTP for renewable energy was positively associated with RE penetration in the current energy consumption including the proposed energy portfolio whereas negatively associated with the current household electricity consumption level. The study shows that people had higher WTP for electricity produced from solar or generic renewables than biomass energy. The study also finds the effect of survey administration on WTP i.e. online surveys (that was default in their model) has lower WTP values whereas survey that used choice experiment method has higher WTP than that of other stated preference techniques. The social, economic and demographic variables seemed to have positive impacts on consumer WTP i.e. income, education and additional household characteristics.

The article by Soon and Ahmad (2015) has used both meta analysis and OLS regression model to calculate the summary WTP estimates from the primary studies and to explain the determinants of WTP. Their study is based on 30 primary studies with 127 WTP observation. They have used the random effect meta analytic approach and has found the summary WTP estimate of USD 7.16. According to their findings urban residents and North American households have higher WTP while Asian households have lower WTP which may be the result of differences between knowledge, information awareness and exposure to RES use.

Furthermore, their findings show that the type of RES doesn't play important role for determining WTP values nor do the temporal mode of payment.

So as a conclusion, the above mentioned evidence from the studies reviewed support for the promotion of renewable energy which is increased through social, demographic and the economic variables i.e. most importantly, education, environmental awareness and household income.

Sundt and Rehdanz (2015) has used the meta analytic benefit transfer in their study to check the realibility of transfer error. For this purpose, they have explored the validity of the predicted WTP for renewable energy in four ways. First they used two student t-test to check whether the predicted mean WTP value is significantly different from the mean of observed values, after that they performed another t-test in order to analyze the significance of Pearson's correlation coefficient, which measures the linear correlation of two metrics asymptotically normally distribute variable. Third they evaluate the quality of value transfer by calculating the absolute percentage error and mean absolute percentage error (MAPE) to judge on the quality of the average forecasting performance of meta regression value transfer function. (Brander et al., 2006). Lastly they studied the ealtionship of the observed WTP and the predicted WTP by using OLS regression.

Even though meta analytic benefit transfer is the most popular and widely used benefit transfer method its not free from the transfer error as it is based on primary valuation of studies. Lindhiem and Navrud (2015) has conducted realibility of meta analytic benefit transfer models and has compared the BT methods with unit based transfers which are often used by the researchers. They have investigated on how quality screening in meta analysis affects precision in MA-BT and how precision compares between MA-BT and unit transfer models.

CHAPTER 3: METHEDOLOGY

3.1 Data collection and selection criteria.

The first and foremost task while performing meta analysis is to search the relevant studies to include in the meta analysis. Stanley (2001) has suggested to use all the studies estimating the parameter in question if possible. Sometimes the idea of searching all the studies based on the parameter in question is not possible as there may be more than thousand studies based on that same topic. In this study I had used the keyword WTP for renewable energy, stated preference technique, choice experiment, contingent valuation, non market valuation, benefit transfer along with the country key as China, India, US, UK and other nations. All the primary studies have been searched using the academic search engine as Google Scholar, Research Gate, Science Direct, Scopus and virtual LRC. I also went through the academic publications from World Bank, Asian Development Bank, Environmental Protection Agency (EPA), United Nation Environment Program (UNEP). In addition to that various other websites and journals has been used in order to calculate the GDP values, PPP values, RE Share values, Consumer Price Index (CPI) etc. from world bank, index mundi, Ministries of Environment and Statistics of the respective countries.

At the end of my search I ended up with 55 studies and scrutinized each of them based on the selection criteria. The major selection criteria for my research was based on four factors i.e

Study Type: Consumers Willingness to pay for renewable energy; where only the studies which has used the stated preference model as the valuation technique was selected and the studies with revealed preference technique was excluded.

Issue: Studies on consumer WTP on renewable energy sources (hydro, solar, wind, biomass etc.) was included whereas studies using non renewable energy sources such as nuclear and fossil fuel was excluded.

Data level: Only the study with WTP/household/month was included whereas study on WTP/household/Kilowatt-hour was excluded.

Crucial Statistics: Studies with either mean or median WTP was included whereas WTP on percentage on total income/consumption and other factors were excluded from the study.

At the end 21 final studies with 99 observations were selected to run the final meta regression analysis. I tried to include all the continents in my analysis so that the result will be more inclusive.

In the meta regression model, the dependent variable is vector y, which is the WTP values measured in US$/month/HH and the base year is 2008. In this research I had collected the data from 21 studies consisting of 99 observations. Stated preference method has been used in all the studies where 11 studies used CE as the valuation method and remaining 10 uses the CV method.

Table 1: Primary studies included in meta analysis.

Author (Year Published)	Survey Year	Country	Method	WTP Values
Voisenat and Mukherjee (2015)	2013	Chile	CE	1
Nomura and Akai (2004)	2000	Japan	CV	4
Brochers et al., (2007)	2006	United States	CE	20
Bollino, C.A (2009)	2006	Italy	CV	6
Navrud and Bråten (2007)	2005	Norway	CE	6
Aravena et al., (2012)	2008	Chile	CV	4
Bigerna and Polinori (2014)	2007	Italy	CV	8
Gracia et al., (2012)	2010	Spain	CE	3
Kosenius and Olikainen (2013)	2008	Finland	CE	6
Ivanova G. (2012)	2004	Australia	CV	5
Yoo and Kwak (2009)	2006	South Korea	CE	2
Bermann et al., (2006)	2003	Scotland	CE	3
Zoric and Hrovatin (2012)	2008	Slovenia	CE	1
Zografakis et al., (2010)	2007	Greece	CV	2
Ku and Yoo (2010)	2006	South Korea	CE	3
Kaenzig et al., (2013)	2009	Germany	CE	4
Oliver et al., (2011)	2006	South Africa	CV	5
Longo et al., (2008)	2005	United Kingdom	CE	5
Lienhoop and Macmilan (2007)	2002	Iceland	CE	2
Ponce et al., (2011)	2007	Chile	CV	3
Guo et al., (2014)	2010	China	CV	6

Total study: 21 primary studies, 99 observations.

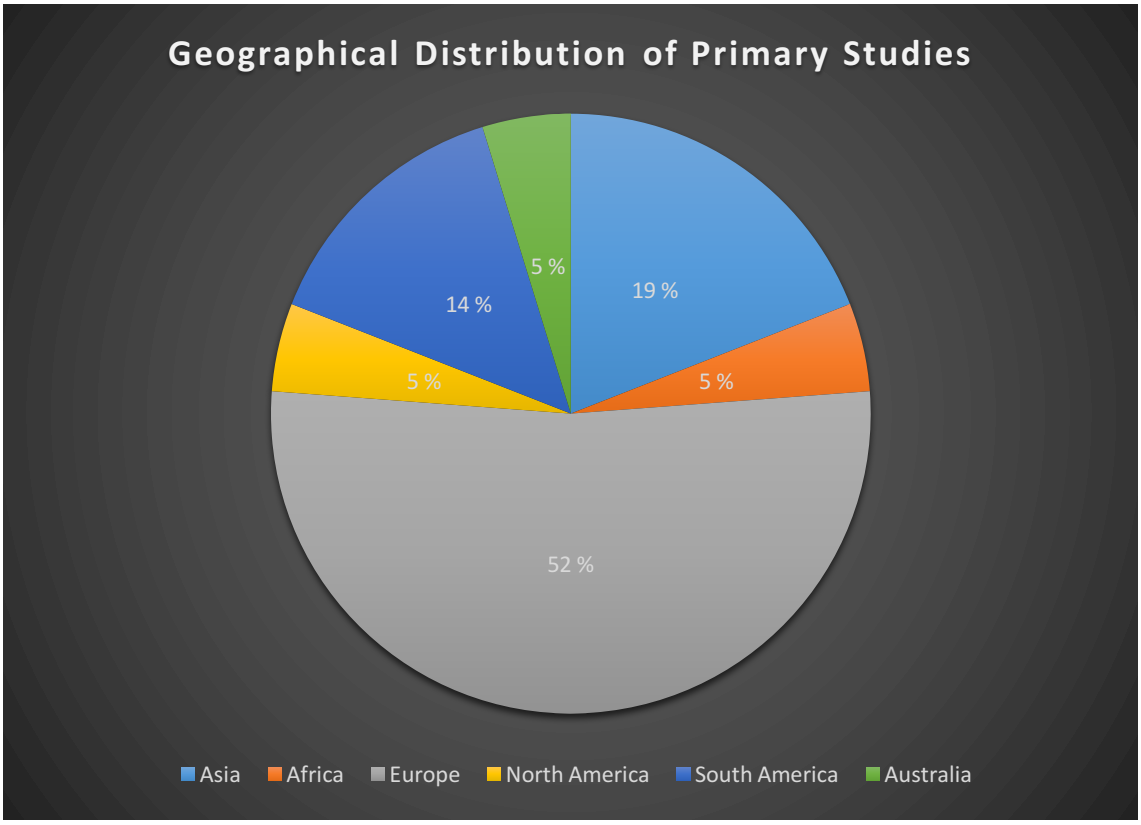

Figure 1: Geographical distribution of primary studies.

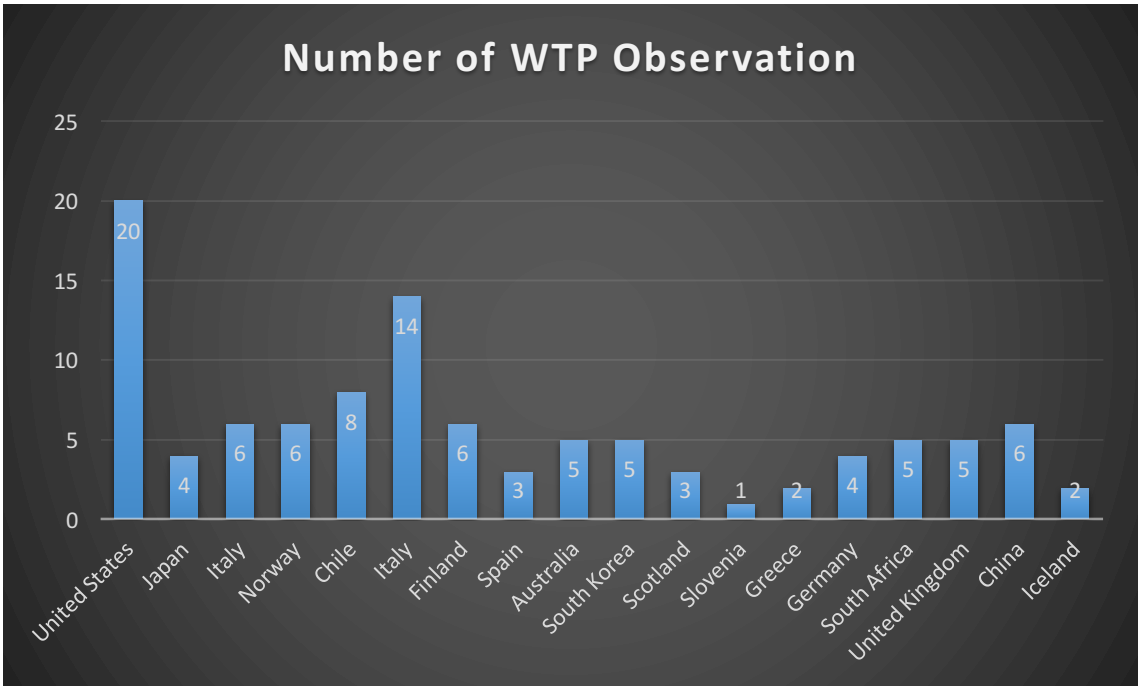

Figure 2: Number of WTP Observations included in meta analysis.

3.2 Effect Size Definition and Description of Independent Variable.

In meta analysis the dependent variable is called the effect size. Effect Size are used to standardize the findings of the study from a specific area of the research. Here in this study the dependent variable is the vector y which is the willingness to pay value measured in CPI-USD/Capita/HH with 2008 and natural logarithm of WTP values as a base price, whereas the independent variable is the combination of four matrices i.e country specific variables, methodological variables, socio economic variables and description of goods variable.

Country specific variables consist of information on proportion of renewable energy in the total national energy production of the year 2008, which in our study is expected to have positive effect in WTP. Further more HH Income 2008 which is the National GDP/capita/month is also expected to have the positive impact on the WTP values. Generally, we can see that the increase in consumer income will tend to have positive impact on WTP values. Bigerna et al., (2014, Aravena et al., (2012), Bergmannn et al, (2004) found positive impact of mean household income on willingness to pay.

Survey specific variables consist the information on various methodology used in the survey to collect the primary studies i.e. respond method used in the survey, year of survey, sample size, valuation method i.e used to capture the design of WTP scenario (CV or CE),WTP measurement whether its mean or median WTP and payment frequency whether the consumer wants to pay the additional amount in monthly or in bimonthly/trimonthly/annual basis. All the above mentioned variables are expected to have positive impact on consumer WTP except the valuation method as some studies has shown that CE method is more preferable than the CV method. Brochers etal, 2007, Gracia et al., (2012) Zoric et al., (2012). In this study i have defined one socio economic variables which is captured by the set of dummy variable controlling the socio economic characteristics of respondents that can directly affect the consumers WTP i.e, gender which is expected to be positive.

There were other socio economic variables mentioned in the primary study but as they were not included while calculating the WTP estimates and didn't reflect the direct connection with the WTP estimates, Yoo and Kwak (2009), Bollino (2009) and Arvena et al., (2012), i have excluded it from my study.

Variables collected for conversion of effect size are the variables which explains the methodology or the process of conversion of WTP and Standard Error (effect size) nominal values in common values. Now this leads to the linear regression model:

$$\text{Yi} = \alpha + \beta cXci + \beta mXmi + \beta sXsi + \beta dXdi + \varepsilon i$$

Where α is the constant term, $\beta c, \beta m, \beta s, \beta d$ are the vectors of coefficient that contain the information about the marginal effects whereas εi is the error term that corresponds to WTP values yi with i=1…., n where n is the number of extracted WTP values.

Table 2: List of Descriptive Statistics

Definition of meta analysis variable and descriptive statistics:

Variables	**Description**	**Sign**	**Mean (SD)**
Dependent variables			
Willingness to Pay (WTP)	WTP in CPI-USD/Household/Month (Local currency converted to USD using consumer price index of respective nation of 2008 as a base year)		26.69 (49.14)
LnWillingness to Pay (lnWTP)	Natural Logarithm of WTP in CPI-USD/Household/Month (Local currency converted to USD using consumer price index of respective nation of 2008 as a base year)		2.53 (1.16)
Country specific variables			
HH Income	NationalGDP/Capita/Month/ 2008_USD	+	3308 (1808)
RE Share	Proportion of renewable energy in current national energy production.	+	18.46 (20.50)
Survey-Specific Variables			
Year of Survey	Calendar year when year of survey was conducted	+	2006 (2.29)

Sample Size	Number of valid response of survey	+	537 (436)
Respond method	Dummy=1 if direct interview, 0 if online/mail.	+	0.35 (0.004)
Valuation Method	Dummy= 1 if CV method used, 0 if CE used for calculating WTP estimates.	-	0.46 (0.50)
WTP measurement	Dummy=1 if has Mean WTP, O if has median values.	+	0.95 (0.22)
Payment Frequency	Dummy=1 if paid monthly, 0 otherwise i.e annually, bi-monthly, tri-monthly etc.	+	0.74 (0.44)
Socio-Economic Variables			
Gender	Dummy=1 if male respondent, O if female respondent	+/-	0.79 (0.41)
Description of goods variable			
Type of Energy	Dummy=1 if Generic "Renewable", 0 otherwise.	+	0.44 (0.50)

3.3 Model Selection and Weights

The most important task in meta analysis is to assign a weight to each study we are using for the regression and to select the appropriate model i.e. fixed and random effect model. Nelson and Kennedy (2009) has argued about using the inverse of standard errors of the primary studies in order to weight the moderator variable but in my case as all the given 21 studies do not provide the standard errors and because of lack of knowledge about the covariance of the WTP values its difficult to retrieve the correct standard errors. But in the studies of Stanley and Rosenberger (2009) they had discussed about using the square root of the sample size instead of standard errors as the standard errors and dependent variable are jointly determined incase the meta analysis is non linear function of the estimated parameters in primary studies. This

actually results in weighting the pooled effect size by the sample size and not by its inverse. It further assumes that studies with larger sample size tend to have more precise estimates i.e smaller confidence interval and it gives the WTP values from those studies relatively greater weight in estimating the pooled prevalence rates. Stanley and Rosenberger (2009)

In my study as the WTP values are non linear function of regression parameters I will be using square root of the sample size to weight the moderator variable.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Meta Regression Analysis:

Table 1 represents the estimation results of Ordinary Least Square (OLS) regression and the meta regression models. OLS regression is a generalized linear modeling technique which is used to model a single, multiple or categorical variable which has been recorded on at least an interval scale (Hutcheson, G.D 2011). In OLS model it implicitly assumes that all estimates are independent and has the same weight whereas in the case of meta regression it assumes that all the estimates have the different weight. In this study, Model 1 and Model 2 presents the study of OLS regression with WTP values and the natural logarithm of WTP values as the dependent variable respectively. The main objective of converting the WTP values in to natural logarithm is to make the dependent invaraible fit the assumptions underlying the regression model. Like wise Model 2 and 3 presents the estimation result of meta regression with WTP values and natural logarithm of WTP values as the dependent variable respectively. Basically if we use linear values for the dependent variable (Y) and independent variable (X) in the original scale, then the econometric specification is called lin lin model. So here in our case Model 1 and Model 3 is therefore the lin lin model, whereas if we use natural log values for the dependent variable (Y) and keep independent variable (X) in the original scale than the econometric specification is called log lin model. So here in our study model 2 and model 4 is the log lin model. In the log lin model the coefficients are used to determine the impact of the independent variable (X) on the dependent variable (Y), the interpretation is that the coefficient in the log lin model represents the estimated percentage change in the dependent variable for one unit change in independent variable. In this study Model 1 and 3 are the preferred model as both the model outperforms other models with respect to adjusted R square criteria i.e adjusted R2 in model 1 and model 4 are greater than that of other models i.e 55.29% and 36.59% respectively. Model 1-4 includes all the variables which are included in the descriptive statistics (See table 1)

The dependent variable for all the four models is the WTP estimates of primary study which was later adjusted to 2008 US$ to the WTP values using the CPI of the respective country with PPP exchange rates. In the case of meta regression, summary estimates are calculated by assigning weights to each study. Basically weights are calculated by taking the inverse of the standard errors but in this case, as all the primary studies have not provided the standard errors, I took the inverse of the sample size in order to calculate the weight. In the case of OLS

regression no weights are necessary as there are no random effect in linear regression model. The OLS regression also helps to check the robustness in the meta regression model in terms of consistency in coefficient signs. As this study is based on the multiple WTP estimates from the primary study, it is vital to address this issue as multiple estimates from the same study are unlikely to be independent to each other and are likely to be correlated. However, the easiest option is to select only one estimates from each study if multiple estimates are reported, but limiting to one estimate per study will increase the chances of missing the important information from the study which may impact the result.

The main purpose of meta regression analysis here is to identify the sources of heterogeneity in the reported mean WTP across studies. The significant coefficient are the determinants of variation in the WTP estimates across the studies. In the Analysis of Variance (ANOVA) adjusted R2 is used to find how well the data fits the statistical model. It can also be termed as coefficient of determination which is the percentage of the response variable variation that is explained by the linear model (Frost 2013). Here both the Model 1 and 3 shows 55.29% of variance in OLS and meta regression model which means that both the OLS and meta regression models has 55.29% of the variability of the response data around its mean whereas the model 2 and 4 has adjusted R2 of 36.59% which is less than that of model 1 and 3 and is not prefered. I haven't included much meta regressors in my model in order to minimize the loss of degrees of freedom and reduce the probability of committing type 1 error. Type 1 error is the incorrect rejection of a true null hypothesis which simply detects the error that is not present in the study. In the result we can see that there is positive effect between the household income and WTP estimates, which clearly accept the hypothesis of this study and hence rejects the null hypothesis. The interpretation is that, the increase in income will lead to increase in WTP values as per our expected sign. According to the coefficient values in model 1 and 3 1 unit of increase in household income will lead 0.01 $ increase in WTP values. Here, household income means the national GDP/capita /month. As all the primary studies have not reported the mean household income, I have used GDP/capita as its proxy. As the information on GDP per capita is on macro level and out of sample information, this can be the major reason behind the low WTP values.

Furthermore, i also run the regression with natural logarithm of wtp_value as dependent variable and natural logarithm of hh income/month as the independent variable with other variables in original scale and found that 1% of change in household income will lead 0.55% of change in wtp values i.e the coefficient of hh income/month was 0.5587 at 10% level of

signifinace which clearly rejects the null hypothesis. (please see appendix-6 for regression results).

Renewable energy share is also highly significant with the WTP estimates which mean that the people are more aware about the renewable energy and is ready to pay more in order to use the generic energy. Here in this study renewable energy share is the proportion of renewable energy in the total national energy production of the respective countries in the year 2008. In the result we can see that 1 unit of change in RE share will lead to increase WTP by 0.41 USD i.e nearly 50 cent.

Similarly, if we see the methodological variable, survey year is seen to be highly significant with the WTP estimates. Survey year is the calendar year when the survey was done for the primary study. The increase in survey year increases the WTP estimates i.e more household have increasingly higher WTP for RE use over time. It means that people are more interested in talking about the renewable energy and is aware about the impact of fossil fuel to the environment. As an effect the increase in the survey year attracts more respondents to increase their WTP for renewable energy. If we observe the study carried in Italy, Bollino, CA (2006) we can see that the WTP was 2.44 Euro whereas it was increased by nearly double in the study carried by Bigerna and Pollinori (2007) i.e. 4.62 Euro which clearly shows the positive effect of survey year in WTP estimates. The same is the case of sample size which is also highly significant and has positive effect in WTP values.

Table 3: OLS and Meta Regression Result

OLS and Meta Regression Results

Variables	**WTP_Value**		LnWTP_Value		**WTP_Value**		LnWTP_Value	
	Linear Regression		Linear Regression		**Meta Regression**		Meta Regression	
	Model 1		Model 2		**Model 3**		Model 4	
	Coef.	**t-stat**	Coef.	t-stat	**Coef.**	**t-stat**	Coef.	t-stat
Country Specific								
HH Income2008	**0.0140****	**2.50**	0.0004**	3.45	**0.0140****	**3.70**	0.0004**	3.73
RE_Share	**0.4193**	**1.38**	0.0088	1.01	**0.419***	**2.26**	0.0088	1.43

Methodological

Survey Year	**6.3472***	**2.50**	0.0502	0.70	**6.3472****	**2.96**	0.0502	0.83
Sample Size	**0.0244***	**1.90**	0.0007	0.18	**0.0244***	**1.82**	0.0007	0.20
Respond Method	**62.0613****	**3.56**	0.7319*	1.98	**62.0613*****	**5.30**	0.7319*	2.22
Valuation Method	**-21.1865**	**-1.53**	0.2599	0.67	**-21.36***	**-1.76**	0.2599	0.76
WTP Measure	**17.8895**	**1.62**	0.7197	1.61	**17.255***	**0.98**	0.7196	1.45
Payment Frequency	**64.1546*****	**4.13**	0.7799*	1.95	**56.3111*****	**3.87**	0.7801	1.90

Socio Economic

Gender	**-21.0092***	**-2.05**	-0.0775	-0.20	**-23.5486***	**-2.01**	-0.0775	-0.23

Description of Goods

Type of Energy	**27.022*****	**3.67**	0.0479	0.17	**27.022*****	**3.54**	0.04805	0.17
Constant	**-12846.9***	**-2.52**	-101.93	-0.70	**-12846.9****	**-2.99**	-101.90	-0.84

F-Statistic	**3.87**	5.35	**12.02**	6.09
Adjusted R-Squared	**55.29%**	36.59%	**55.29%**	36.59%
Root-MSE	**32.863**	0.92577		
Tau2			**1080**	0.857
I-Squared RES			**100 %**	100 %
Number of Obs	**99**	99	**99**	99

***: Significance level at 1%**

****: Significance level at 5%**

***: Significance level at 10%**

The interpretation is that the OLS and meta coefficient on sample size indicates more household are aware about the importance in RE use which is clearly reflected by their increase in their WTP.

The coefficient for respond method is also seen to have the positive and significant effect on WTP in all the four models with highest in model 1 and 3. In this study, respond method is defined as the dummy variable which is 1 if direct interview was used as the method of data collection in primary study and 0 if online/mail was used. Majority of the study used in this analysis have used the random sampling method and face to face interview. Random sampling method helps to minimize biasness in selecting the households for the survey. In the meta regression results we can clearly see that WTP increases up to maximum 62 USD when the interview method is used. Aravena et al., (2012) has used the direct interview method for their data collection where the respondent rate using direct interview was 97% i.e 711 repondent out of 726 repondent actively took part in the survey. Moving to valuation method use of CV method has negative effect on WTP compared to that of CE method as per our hypothesis and thus the null hypothesis is rejected. The interpretation is that; the people are willing to pay more money if choice experiment method is used. The reason behind this can be the easiness of answering question using choice experiment method as the respondent can directly sated their choices. The another possibility can be the use of CE method in one of our primary study with highest number of WTP estimates. In this study I have used 20 WTP observations from Brochers et al., (2007) where the respondent has been provided with three choice alternatives A, B and C with the respondent rate of 32.5%, 28.5% and 39% respectively. In this study WTP methods are defined as the dummy variable which is 1 if Contingent Valuation (CV) method is used and is 0 when Choice Experiment (CE) method is used.

Payment frequency has the positive effect in the WTP estimation and is highly significant at 1 % level which clearly rejects the null hypothesis and is as per our expected sign. It means that consumer care much about the method of paying the electricity bill and the temporal modes of payment. The interpretation is that its easy for consumers to pay the electricity in the monthly basis as they have to pay little amount of additional money in their current bill but if they have to pay once in a year than it may decrease their WTP as they need to pay the total amount once at a time. In this study payment frequency is defined as the dummy variable which is 1 if consumers are willing to pay the additional amount monthly or 0 otherwise i.e. either annually, bimonthly or tri-monthly.

Likewise, energy type seems to have positive and highly significant effect in our models which mean that people are aware about the benefits of generic energy which reflects their awareness about the threat of global warming in future. Here energy type is defined as the dummy variable which is 1 if the energy type is generic and 0 if others. Gender is significant to the WTP estimates but has shown the negative effect. The result shows that the male respondent has lower willingness to pay than that of female. The interpretation can be as the female are more conscious about the energy use and effect of renewable energy to the environment, John Metcalf of city lab during his survey in states of city poll in United States found that the women appear to be more open-minded on the subject than man and 44% of male poll takers said that they wouldn't pay additional cash for solar or wind energy, compared to 36% of women. Here in this study gender is defined as the dummy variable which is 1 if respondent is male and 0 if the respondent is female.

4.2 Comparative analysis of the results with previous meta analysis.

Regarding the previous study on meta analysis of consumer willingness to pay for renewable energy, as per my information there has been three articles published on the topic. All of the three studies were published in the year 2015.

The first article by Chunbo Ma et al., (2015) has presented their findings from meta regression analysis of primary studies on WTP for various types of renewable energy and the factors that impact on WTP. The study has used fixed effect and mixed effect meta regression model categorizing it into 8 models. Models S1 to S4 used the square roots of the sample size as weights for the moderator variable whereas model S5 to S8 has used the square root of the number of observation as weights for the moderator variable. The results of their meta regression suggest that the main factor affecting the WTP estimates are related to survey administration, design and model specification, RE type, context variables, socio economic variables and their energy consumption patterns. In addition to that they have also found that people have significantly higher WTP for electricity generated from solar, wind or generic sources than hydropower or biomass. Additionally, "WTP estimates for renewable energy was positively associated with the RE penetration in the current energy consumption but negatively associated with current household energy consumption level".

The second article by Soon and Ahmad (2015) has focused their study to calculate the summary WTP estimates from many reported WTP estimates and to explain the determinants of WTP.

They have used both OLS regression model and meta regression model to compare the results. By using random effect meta analytic approach they found summary WTP estimate of USD 7.16. According to their findings urban residents and North American households have higher WTP while Asian households have lower WTP which may be the result of differences between knowledge, information awareness and exposure to RES use. Furthermore, their findings show that the type of RES doesn't play important role for determining WTP values nor do the temporal mode of payment.

The third article by Sundt and Rehdanz (2015) has presented their meta regression results depending upon the two dependent variables i.e natural logarithm of WTP/HH and WTP_KWH and two models. The two models differ with respect to the specification of country's renewable energy share in total energy production. Model 1 uses the percentage shares (RE_Share and Hydro_Share and Model 2 uses the natural logarithm of (Ln_RE and Ln_Hydro).

Their findings show that in contrast to other renewable energy sources a higher share of hydropower in countrys electricity generation reduces WTP for the renewable energy. The explanatory variables i.e knowledge about renewables, household characteristics, income and education significantly influences the WTP estimates and ignoring these attributes in future WTP estimates might result in biased coefficient.

In this study I have used both OLS and meta regression analysis to compare my result. I have included 4 models in my study where Model 1-2 is the OLS regression whereas Model 3-4 is the meta regression result that represents random effect model. Model 1 and 3 includes all the variables defined in the descriptive statistics with WTP values as dependent variable while model 2 and model 4 includes all the variables defined in the descriptive statistics with logarithm of WTP values as dependent variable. In my study methodological variables i.e survey year, sample size and respond method are highly significant with WTP values, which is pretty similar to the administrative and design variables specified by Chungbo et al., (2015) which has positive effect on WTP estimates. In my study RE share is highly significant and has positive impact on WTP estimates and same is the case of Chungbo ma et al., (2015) and Sund and Rehdanz (2015. Soon and Ahmad (2015) shows that there is no any effect of payment frequency in WTP estimates which contrast with my study as payment frequency is highly significant with WTP estimates in my case. After analyzing all four studies more or less except some variables the overall result is similar, the other differences may have been occurred because of the differences in model selection and the selection of the primary study as all the

four study has used different study. It is for sure that demand for renewable energy is going to be higher for the upcoming years. The increase in WTP estimates by increasing survey year in all the four studies clearly present that issue.

4.3 Benefit Transfer

4.3.1Meta Analytic Transfer

Environmental value transfer uses the non-market valuation information from the existing studies in order to value the natural resources or sites. (Smith 1992; Brookshire and Neil 1992). For valuing the environmental goods like that of water quality, wetlands, forest conservation benefit, and renewable energy etc., the meta-analytic benefit transfer has become an increasingly common method, at least for the purpose of academic investigations of reality. (Brander etal., 2012; Lindhjem and Navrud 2008; Stapler and Johnston 2009).

In this study for the purpose of value transfer i will be excluding all the observation from one study n-1 i.e Bollino C.A (2009) Italy which only has six WTP estimates and use it as a policy site and will compare the transferred estimate to the actual value of the study.

Despite value transfer based on the meta analysis being one of the most preferred it is not free from the transfer error. This generally happens when the data underlying the estimated relationship in the meta regression does not represent the policy site where the value had been transferred to. In this study I will be using both meta analytic transfer and unit value with income adjustment and will check the transfer error by comparing both the methods. Unit value transfer technique with income adjustment uses the mean WTP from the study which is most similar to the one which is excluded and will adjust the estimate with GDP/Capita and income elasticity of WTP. After that the WTP values are compared to the actual estimate and hence transfer error is being calculated.

The Benefit transfer in this study will be based on the following meta-regression model.

$$\text{Yi} = \alpha + \beta cXci + \beta mXmi + \beta sXsi + \beta dXdi + \varepsilon i$$

Where α is the constant term, $\beta c, \beta m, \beta s, \beta d$ are the vectors of coefficient that contain the information about the marginal effects whereas εi is the error term that corresponds to WTP values yi with i=1,…., n where n is the number of extracted WTP values.

Meta Analytic transfer will be based on the following Meta Analysis Regression model:

Yi(WTP_Value)

$$= \alpha\ (Constant) + \beta 1(HH\ Income\ 2008) + \beta 2\ (RE\ Share)$$
$$+\ \beta 3\ (Survey\ Year) + \beta 4\ (Sample\ Size) + \beta 5\ (Respond\ Method)$$
$$+ \beta 6\ (Valuation\ Method) + \beta 7\ (WTP\ Measure)$$
$$+ \beta 8\ (Payment\ Frequency) + \beta 9\ (Gender) + \beta 10\ (Type\ of\ Energy)$$
$$+ \beta 11\ (Package) + \varepsilon i(Error\ Term)$$

Table 4. Meta Regression Results after excluding all the WTP observations of Italy, Bollino CA (2000)

	WTP_value	**LnWTP_value**
Variables	**Co-efficient**	**Co-efficient**
HH Income 2008	0.0149***	0.0004***
RE_Share	0.33951*	0.0075
Survey Year	5.32196*	0.04032
Sample size	0.0565**	0.00039
Respond Method	64.31494***	0.75023*
Valuation Method	-20.2548*	0.26877
WTP Measure	40.8818	0.9468*
Payment Frequency	59.7759*	0.7086*
Gender	-28.3870*	-0.01604
Type of Energy	16.1674*	0.8437**
Constant	-10953.7*	-82.097

****: Significance level at 1% **: Significance level at 5% *: Significance level at 10%*

In this study I will be using the four different models in order to compare the meta analytic transfer result and check the transfer error. Model 1 uses WTP value as dependent variable whereas Model 2 uses logarithm of WTP values as dependent variable. In Model 3 and model 4, I will be using only two variables i.e one independent and one dependent variables and compare the results with model 1 and 2 and see the changes.

Model 1

Calculation of Yi (WTP Value) for policy site:

Yi(WTP_Value) =-10953.7+0.3395104*1+0.0149657*3308+ 5.392196*2006+0.056565*468 + 64.31494*1 -20.25481*1 + 40.88182*1 + 59.77592*1 -28.38708*1 + 16.1674*1

Yi (WTP_Value) = -10953.7 + 0.3395104 + 49.50 + 10816 + 26.472 + 64.314*0 + 20.254 + 40.8818 + 59.7759 – 28.387 + 16.167 = 47.30 USD

As the study of Italy has six WTP observations I have used the mean value of the six WTP estimates as the true value of study site. i.e 10.39+9.89+11.18+2.97+4.55+11.43/6 = 8.40

Transfer Error: Transferred value (Policy Site) – True Value (Study Site)/ True Value (Study Site0*100 % = 47.30 USD – 8.40 USD/8.40 USD = 463.09 % TE

Model 2 (A)

(Taking LnWTP Value as dependent variable)

Yi (LnWTP_Value) = -82.097*0 + 0.0004*3048 + 0.0075*0 + 0.040323*0 + 0.0003969*0 + + 0.75023*1 + 0.26877*0 + 0.9468*1 + 0.70867*1 – 0.1604*0 + 0.8437*1

Yi (LnWTP_Value) = 0+1.2192+0.75023+0.9468+0.70867+0.8437 = 4.4686 USD

Transfer Error: Transferred value (Policy Site) – True Value (Study Site)/ True Value (Study Site0*100 % = 4.4686 USD – 8.40 USD/8.40 USD = -46.80 % TE

Model 2 (B)

Instead of taking the mean value of the WTP estimates if we took the WTP observation of the study which is nearly same of study site than the transfer error will be lower than that of the previous one.

Transfer Error: Transferred value (Policy Site) – True Value (Study Site)/ True Value (Study Site0*100 % = 4.4686 USD – 4.55USD/4.55 USD = -1.78 % TE

Model 3

(Taking the natural logarithm of WTP_value as the dependent variable and hhinc_month as the only independent variable)

Yi (LnWTP) = 1.8285+ 0.0002*3308 = 2.49 USD

TE= 2.49-8.40/8.40* 100 = -70.35%

Note: I also run the regression using natutal logarithms of wtp_value and hh income but the result was huge with high transfer error so i excluded it from the comparison.

(Taking the natural logarithm of WTP_value as the dependent variable and natural logarithm of hhinc_month as an independent variable keeping all other variables in original scale) (1)

Yi (lnWTP_value) = -91.52651*0 + 0.5844*3308 + 0.4374*0 + 0.000*0 + 0.1411*19.18-0.3698*0 + 0.9745*1 + 0.6844*1 + 0.2423*0 – 0.0030*0 +0.9357*0 = 1933.19 + 2.793 + 0.9745 + 0.6844 – 91.52561 = 1845 USD

Model 4:

(Taking the WTP_value as the dependent variable and hhin_month as independent variable).

Yi (WTP_ value) = 4.0947+0.00720*3308 = 21.4609+6.4142 = 27.91

TE= 27.91-8.40/8.40* 100 = 232.28%

From the above results we can clearly see that, even though meta analytic transfer is regarded as one of the best methods to transfer the WTP estimates to the policy site its not free from the transfer error. All the models above have shown the higher transfer error with model 4 being the highest and model 2 as the lowest.

Now in the next step I will be using the Unit benefit transfer with income adjustment and compare the above results with the later one.

4.3.2 Benefit Transfer using Unit value transfer with income adjustment.

For the purpose of this study I will be using the WTP estimates of Italy as the policy site and and the WTP estimates of Spain, Garcia et al., as the study site by taking and mean WTP value of Spain which I think is most similar to the policy site i.e Italy and will be adjusting this estimate with GDP per capita and an income elasticity of WTP of Spain.

Model 5:

Unit value transfer with income adjustment can be calculated as:

$$Bp' = Bs\left(\frac{Yp}{Ys}\right)\beta$$

Here Bp' is the adjusted benefit estimate at the policy site i.e Italy, Bs is the primary benefit estimate i.e WTP values from the study site i.e WTP estimates of Spain, Ys and Yp are the income levels at the study and policy site respectively whereas β is the income elasticity of WTP for environmental goods.

For the purpose of this study I will be using GDP/Capita 2008 of the respective countries as the income level. Here in this study I will assume that Spanish people has the same WTP for using the environmental resources as that of Italians. So in this case I will be using 1 as the income elasticity of WTP for environmental goods in Spain and Italy.

Bp' = 8.40 (40659/35578)1 = 9.60

Transfer Error in USD= Transferred Value – Actual Value = 9.60-8.40= 1.2 USD

Lindhiem and Navrud (2015) has discussed about the concept of relative transfer error (TE) in their study regarding the reliability of meta analytic benefit transfer of international value of statistical life estimates, which in my case can be used in order to measure the reliability and validity of meta analytic benefit transfer which can normally be defined as:

Relative TE = (WTP T – WTP B)/WTP B *100%

Where, T= transferred or predicted value from Spain, B= estimate of the true (but unknown) value at policy site i.e Italy. Here, TE is mostly defined in the terms of percentage of error i.e by how many percent the estimated and transfer values missed the true value for a particular policy context where we assume that the researcher is aware about the true value.

Relative TE= (WTPT-WTPB)/WTP B*100

9.60-8.40/8.40*100%= 24.28%

Table 5: Comparison of various models (All the amounts are in USD)

	Model 1	Model 2 A	**Model 2 B**	Model 3	Model 4	**Model 5**
Transferred Value	47.30	4.4686	**4.4686**	2.49	27.91	**9.6**
Actual Value	8.4	8.4	**4.55**	8.4	8.4	**8.4**
Transfer Error	38.9	-3.9314	**-0.0814**	-5.31	19.51	**1.2**
Transfer Error %	463.09%	-46.80%	**-1.78%**	-70.35%	232.28%	**24.28%**

From the above results we can clearly see that meta analytic transfer has highest transfer error compare to that of benefit transfer with income adjustment. The benefit transfers with income adjustment has 24.28% of transfer error which can be considered best among the other results.

CHAPTER 5: CONCLUSION AND RECOMMENDATION

This study provides the findings from OLS and Meta Regression analysis of the primary studies on the consumer's willingness to pay for the renewable energy and explore the factors that affect the consumer's WTP for green electricity. It further discusses the results of meta regression to find the efficiency and robustness of the result when transferring the values along with the transfer error.

This study is based on 21 primary studies with 99 observations which was conducted from 2000 to 2013 AD. The maximum number of WTP observations used in this study is from the United States (US) Brochers et al , (2007) i.e 20 observations and minimum from Chile Voisenat and Mukherjee (2015) and Slovenia Zografakis et al., (2006) with 1 observation respectively. This study has used both Simple Linear Regression and Meta Regression Model to find the effects of various independent variables i.e survey specific, country specific, methodological and description of goods variable with the dependent variable i.e WTP values in our case. I have used four different models in this study among which model 1 and model 3 are the preferred one as the adjusted R2 of both the models is greater than that of model 2 and 4.

The findings of this study shows that people have significantly higher willingness to pay for renewable energy if they have high income which clearly accept the hypothesis of this study. If people have more income than they are more serious and aware about the environment and will posse's higher willingness to pay for renewable energy. The same is with RE share in total electricity production, which means that if the government adopt the policy of increasing the renewable share in their total energy portfolio it will have the positive impact for the local people to increase their WTP for renewable energy. People were also seem to have higher WTP for the generic electricity compare to other types of renewable sources. Many of the primary studies didn't specify the type of RE being measures and instead use RE in generic, so this study didn't categorize the type of electricity sources, instead of that the dummy variable was used to capture the people's willingness to pay for either generic or other renewable sources. The findings further show that the survey specific variables have also the positive impact on consumer's willingness to pay. Increase in survey year has positive impact on WTP values which means that as the year increases people are more concerned about the benefits of renewable energy and the effect from overuse of fossil fuel which will lead to increase in global warming and climate change and can affect the future generations. Additionally, consumer was willing to pay more if the method of payment vehicle i.e electricity bill was on the monthly

basic than that of annual/bimonthly and trimonthly basis. The interpretation is that, its easy to pay little amount extra in your monthly bill than that of paying large sum of amount in a year.

This study has also explored the results of meta regression to find the efficiency and robustness of the result when transferring the values along with the transfer error. I have used 4 models based on the meta analytic transfer and one model based on the unit value transfer in order to compare the results. In order to find the transfer error (n-1) study has been excluded from the dataset i.e Bollino C.A (2009) Italy which has six WTP estimates and has used it as a policy site. Furthermore, for the purpose of unit values benefit transfer I had used the study from Spain Garcia et al., (2012) as a study site and Italy as the policy site and has compare the transferred estimate to the actual value of the study.

According to (Engel, 2002; Rosenberger and Philips 2002) "value transfer based on meta-analysis has the advantage of using estimates from various studies and it tends to perform better". As the literature mentions meta analytic being the preferred one but it might produce the high transfer error, which can be reflected from my study i.e all the four models based on meta analytic transfer has produced the high transfer error with 463.09% being the highest and -1.78* as the lowest. If we compare the result of meta analytic transfer with the unit value transfer with income adjustment than unit value transfer has the lower transfer error than that of meta analytic transfer.

From the above studies its clear that the demand for renewable energy is going to be higher for the upcoming years. The conclusion part has summarized the answers of my two research question and the major conclusion of this study is that the household exhibit higher willingness to pay for renewable energy and is affected by certain methodological, survey specific and country specific variables.

The major limitation of this Master Thesis is the ineluctable exclusion of some of the pertinent primary studies which do not meet my selection criteria and also the lack of time frame as I have to finish my master thesis in 4.5 months. But I am quite sure that the studies which i have included are the relevant one and that the WTP estimates extracted from the studies are comparable. I hope in the near future more studies will be done in this topic to find out the consumer WTP in the micro level as well as the comprehensive meta analysis in the macro level

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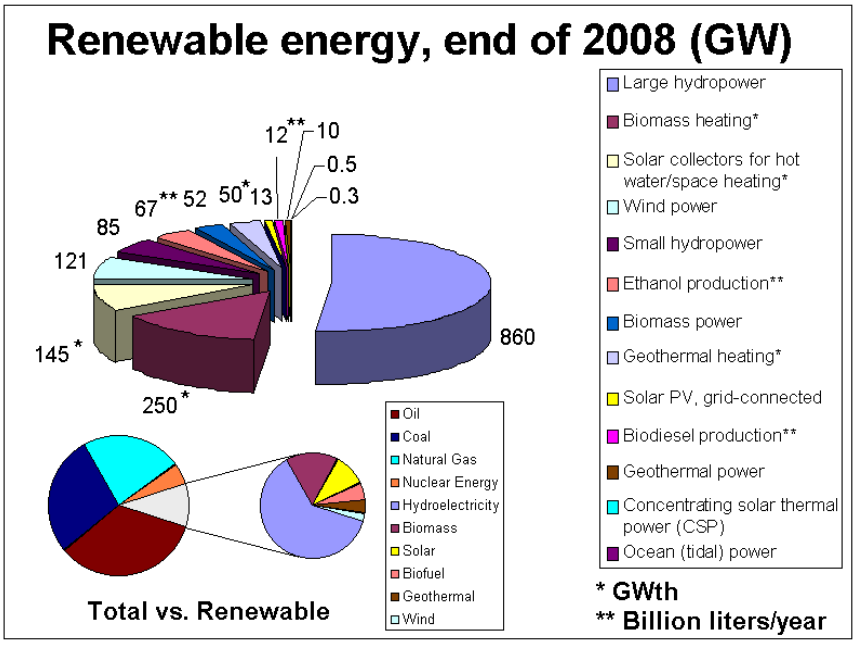
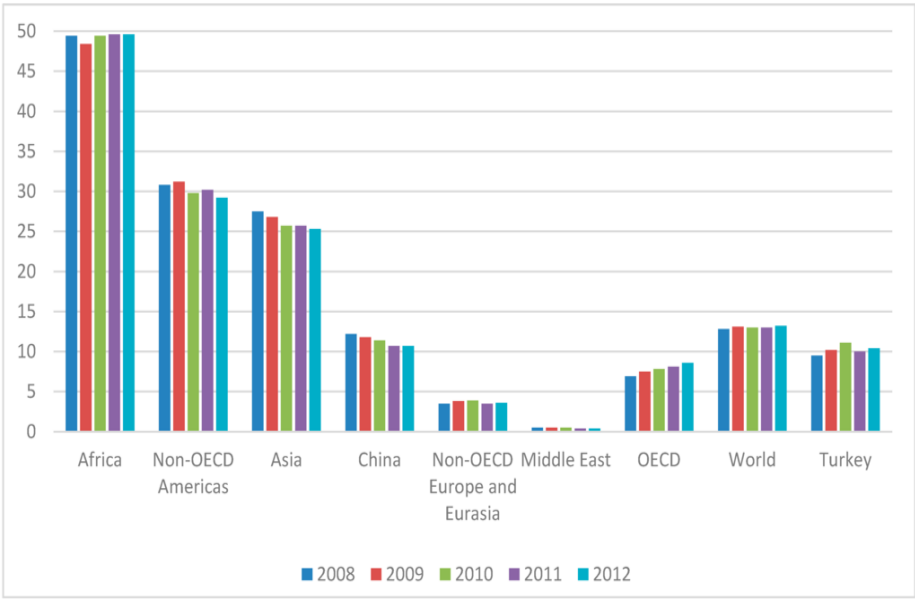
Appendix A:

Global Renewable Energy consumption at the end of 2008



Global Renewable Energy Shares from 2008-2012



Appendix B:

Summary of Regression Model:

Variable	Obs	Mean	Std. Dev.	Min	Max
paper_id	99	8.525253	5.438606	1	19
author	0				
pu_year	99	2009.869	2.978311	2004	2015
country	0				
sur_year	99	2006.283	2.285895	2000	2013
samp_size	99	536.7273	435.5886	41	1601
samp_obs	99	1511.04	2015.228	41	7566
re_share	99	18.46566	20.505	1	90.1
cpi2008_usd	99	96.96465	3.007993	84.7	102.1
rep_stder	57	294.7721	1777.599	.04	13450
HHinc_annum	99	39698.53	21696.18	3441	96880
HHinc_month	99	3308.21	1808.015	286.75	8073.333
reportedwtp	99	692.7626	1860.734	-6	14860
wtp_value	99	26.69698	49.1475	-5.759058	276.3858
weight	99	.0043369	.0044371	.0006246	.0243902
gender	99	.7878788	.4108907	0	1
energy_type	99	.4444444	.4994328	0	1
package	99	.5454545	.5004636	0	1
respond_type	99	.3535354	.4805	0	1
payfreq	99	.7373737	.4423005	0	1
valuation_~d	99	.4646465	.5012867	0	1
wtpmeasure~e	99	.9494949	.2200991	0	1

Linear Regression of dependent variable with all the variable in descriptive statistics

Linear regression

Number of obs =	**99**
F(10, 88) =	**4.06**
Prob > F =	**0.0001**
R-squared =	**0.5939**
Root MSE =	**33.053**

wtp_value	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	**6.34729**	**2.538195**	**2.50**	**0.014**	**1.30316**	**11.39142**
samp_size	**.0244807**	**.0129121**	**1.90**	**0.061**	**-.0011795**	**.0501408**
re_share	**.419385**	**.3044058**	**1.38**	**0.172**	**-.1855575**	**1.024327**
HHinc_month	**.0140343**	**.004422**	**3.17**	**0.002**	**.0052464**	**.0228222**
gender	**-21.00923**	**10.24666**	**-2.05**	**0.043**	**-41.37231**	**-.6461509**
energy_type	**27.02279**	**7.362473**	**3.67**	**0.000**	**12.39142**	**41.65416**
respond_type	**62.06137**	**17.41006**	**3.56**	**0.001**	**27.46253**	**96.66022**
payfreq	**64.15467**	**15.53192**	**4.13**	**0.000**	**33.28824**	**95.02109**
valuation_method	**-21.18657**	**13.86671**	**-1.53**	**0.130**	**-48.74374**	**6.370593**
wtpmeasuretype	**17.88956**	**11.07381**	**1.62**	**0.110**	**-4.117311**	**39.89644**
_cons	**-12846.92**	**5106.891**	**-2.52**	**0.014**	**-22995.79**	**-2698.047**

Meta Regression of dependent variable with all the variable in descriptive statistics

Meta-regression

Number of obs =	**99**
REML estimate of between-study variance tau2 =	**1092**
% residual variation due to heterogeneity I-squared_res =	**100.00%**
Proportion of between-study variance explained Adj R-squared =	**54.77%**
Joint test for all covariates Model F(**10,88**) =	**12.87**
With Knapp-Hartung modification Prob > F =	**0.0000**

wtp_value	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	**6.347289**	**2.142567**	**2.96**	**0.004**	**2.089387**	**10.60519**
samp_size	**.0244807**	**.0134287**	**1.82**	**0.072**	**-.002206**	**.0511673**
re_share	**.4193851**	**.1853533**	**2.26**	**0.026**	**.0510343**	**.7877359**
HHinc_month	**.0140343**	**.0037893**	**3.70**	**0.000**	**.0065039**	**.0215647**
gender	**-21.00923**	**11.64084**	**-1.80**	**0.075**	**-44.14296**	**2.124494**
energy_type	**27.02279**	**7.638011**	**3.54**	**0.001**	**11.84385**	**42.20173**
respond_type	**62.06138**	**11.70323**	**5.30**	**0.000**	**38.80366**	**85.3191**
payfreq	**64.15467**	**13.52871**	**4.74**	**0.000**	**37.2692**	**91.04014**
valuation_method	**-21.18657**	**12.18624**	**-1.74**	**0.086**	**-45.40416**	**3.031014**
wtpmeasuretype	**17.88956**	**17.70986**	**1.01**	**0.315**	**-17.30507**	**53.08419**
_cons	**-12846.92**	**4300.139**	**-2.99**	**0.004**	**-21392.54**	**-4301.296**

Linear Regression of natural logarithm of dependent variable with all the variable in descriptive statistics

Linear regression

Number of obs =	98
F(10, 87) =	5.87
Prob > F =	0.0000
R-squared =	0.4375
Root MSE =	.92059

lnwtp_value	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	.0507483	.0704311	0.72	0.473	-.0892411	.1907377
samp_size	.0000721	.0004167	0.17	0.863	-.0007562	.0009004
re_share	.008247	.0068547	1.20	0.232	-.0053775	.0218715
HHinc_month	.0004068	.0001186	3.43	0.001	.0001711	.0006425
gender	-.0861632	.3848919	-0.22	0.823	-.8511777	.6788512
energy_type	.9567603	.2184139	4.38	0.000	.522639	1.390882
respond_type	.7262732	.3672548	1.98	0.051	-.0036856	1.456232
payfreq	.7530898	.366526	2.05	0.043	.0245797	1.4816
valuation_method	.2593935	.3861257	0.67	0.504	-.508073	1.02686
wtpmeasuretype	.7171089	.4519992	1.59	0.116	-.1812885	1.615506
_cons	-102.7836	141.4491	-0.73	0.469	-383.9291	178.3619

Meta Regression of natural logarithm of dependent variable with all the variable in descriptive statistics

Meta-regression

Number of obs =	98
REML estimate of between-study variance	tau2 = .8474
% residual variation due to heterogeneity	I-squared_res = 100.00%
Proportion of between-study variance explained	Adj R-squared = 37.30%
Joint test for all covariates	Model F(10,87) = 6.77
With Knapp-Hartung modification	Prob > F = 0.0000

lnwtp_value	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	.0507335	.0601502	0.84	0.401	-.0688215	.1702884
samp_size	.0000721	.0003741	0.19	0.848	-.0006716	.0008157
re_share	.0082499	.005195	1.59	0.116	-.0020756	.0185755
HHinc_month	.0004068	.000106	3.84	0.000	.0001962	.0006174
gender	-.0861799	.3242269	-0.27	0.791	-.7306161	.5582562
energy_type	.9567658	.2154383	4.44	0.000	.5285587	1.384973
respond_type	.726353	.326156	2.23	0.029	.0780826	1.374623
payfreq	.7531896	.3768264	2.00	0.049	.0042062	1.502173
valuation_method	.2593738	.3394281	0.76	0.447	-.4152764	.934024
wtpmeasuretype	.7170387	.4937366	1.45	0.150	-.2643161	1.698394
_cons	-102.7539	120.7257	-0.85	0.397	-342.7093	137.2016

Appendix C: (Benefit Transfer)

Linear Regression Model excluding the study of Policy Site i.e Italy

Linear regression

Number of obs	= 93
F(10, 82)	= 5.23
Prob > F	= 0.0000
R-squared	= 0.6456
Root MSE	= 31.837

wtp_value	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	5.392197	2.167486	2.49	0.015	1.080376	9.704018
samp_size	.056565	.0168613	3.35	0.001	.0230225	.0901076
re_share	.3395103	.2557984	1.33	0.188	-.1693542	.8483749
HHinc_month	.0149657	.0041891	3.57	0.001	.0066323	.0232991
gender	-28.38708	11.23547	-2.53	0.013	-50.73801	-6.036155
energy_type	16.1674	7.679188	2.11	0.038	.8910459	31.44375
respond_type	64.31493	16.62744	3.87	0.000	31.23766	97.39221
payfreq	59.77591	14.28719	4.18	0.000	31.35414	88.19768
valuation_method	-20.25481	13.13058	-1.54	0.127	-46.37571	5.866098
wtpmeasuretype	40.88182	14.51191	2.82	0.006	12.01302	69.75063
_cons	-10953.7	4360.506	-2.51	0.014	-19628.14	-2279.268

Meta Regression Model excluding the study of Policy Site i.e Italy

Meta-regression

Number of obs	= 93
REML estimate of between-study variance	tau2 = 1014
% residual variation due to heterogeneity	I-squared_res = 100.00%
Proportion of between-study variance explained	Adj R-squared = 60.24%
Joint test for all covariates	Model F(10,82) = 14.94
With Knapp-Hartung modification	Prob > F = 0.0000

wtp_value	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	5.392196	2.080981	2.59	0.011	1.252462	9.53193
samp_size	.056565	.015743	3.59	0.001	.0252472	.0878829
re_share	.3395104	.1799284	1.89	0.063	-.0184244	.6974453
HHinc_month	.0149657	.0036592	4.09	0.000	.0076864	.022245
gender	-28.38708	11.401	-2.49	0.015	-51.06731	-5.70686
energy_type	16.1674	7.958996	2.03	0.045	.3344187	32.00038
respond_type	64.31494	11.2904	5.70	0.000	41.85474	86.77513
payfreq	59.77592	13.08855	4.57	0.000	33.73862	85.81321
valuation_method	-20.25481	11.74092	-1.73	0.088	-43.61123	3.10162
wtpmeasuretype	40.88182	18.23046	2.24	0.028	4.615634	77.14801
_cons	-10953.7	4175.691	-2.62	0.010	-19260.48	-2646.924

Meta Regression Model with natural logarithm of dependent variable excluding the study of Policy Site i.e Italy

Meta-regression		Number of obs	= 92
REML estimate of between-study variance		tau2	= .8739
% residual variation due to heterogeneity		I-squared_res	= 100.00%
Proportion of between-study variance explained		Adj R-squared	= 37.74%
Joint test for all covariates		Model F(10,81)	= 6.52
With Knapp-Hartung modification		Prob > F	= 0.0000

lnwtp_value	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sur_year	.0403238	.0616719	0.65	0.515	-.0823838	.1630315
samp_size	.0003969	.0004633	0.86	0.394	-.000525	.0013188
re_share	.0075026	.0053107	1.41	0.162	-.0030641	.0180692
HHinc_month	.0004152	.0001078	3.85	0.000	.0002007	.0006297
gender	-.1604498	.3347952	-0.48	0.633	-.8265874	.5056877
energy_type	.8437087	.2374593	3.55	0.001	.3712392	1.316178
respond_type	.7502323	.3317893	2.26	0.026	.0900758	1.410389
payfreq	.7086738	.3843943	1.84	0.069	-.0561503	1.473498
valuation_method	.2687702	.3447789	0.78	0.438	-.4172316	.954772
wtpmeasuretype	.9468477	.5353587	1.77	0.081	-.1183482	2.012044
_cons	-82.09707	123.7535	-0.66	0.509	-328.3277	164.1335

Simple Linear Regression of wtp value and hhinc_month

Linear regression		Number of obs	= 92
		F(1, 90)	= 17.73
		Prob > F	= 0.0001
		R-squared	= 0.1256
		Root MSE	= 1.114

lnwtp_value	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
HHinc_month	.0002239	.0000532	4.21	0.000	.0001183	.0003295
_cons	1.82854	.201888	9.06	0.000	1.427454	2.229625

Simple Linear Regression of log values of wtp value and hhinc_month

Linear regression

Number of obs	**92**
F(1, 90)	**17.73**
Prob > F	**0.0001**
R-squared	**0.1256**
Root MSE	**1.114**

lnwtp_value	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
HHinc_month	**.0002239**	**.0000532**	**4.21**	**0.000**	**.0001183**	**.0003295**
_cons	**1.82854**	**.201888**	**9.06**	**0.000**	**1.427454**	**2.229625**

Taking Natural logarithm of wtp values as dependent variable and hhinc_month as independent variable keeping all varaibles in original scale.

> etype, wsse(weight)

Meta-regression

Number of obs	**92**
REML estimate of between-study variance	tau2 = **.9659**
% residual variation due to heterogeneity	I-squared_res = **100.00%**
Proportion of between-study variance explained	Adj R-squared = **31.19%**
Joint test for all covariates	Model F(**10,81**) = **5.12**
With Knapp-Hartung modification	Prob > F = **0.0000**

lnwtp_value	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnHHinc_month	**.584424**	**.2447808**	**2.39**	**0.019**	**.0973871**	**1.071461**
sur_year	**.0437447**	**.0699418**	**0.63**	**0.533**	**-.0954176**	**.182907**
samp_size	**.0000929**	**.00049**	**0.19**	**0.850**	**-.0008819**	**.0010678**
re_share	**.0141137**	**.0051884**	**2.72**	**0.008**	**.0037905**	**.0244369**
gender	**-.3698592**	**.3690461**	**-1.00**	**0.319**	**-1.104145**	**.3644268**
energy_type	**.974554**	**.2608757**	**3.74**	**0.000**	**.4554932**	**1.493615**
respond_type	**.6844882**	**.3536761**	**1.94**	**0.056**	**-.0192163**	**1.388193**
payfreq	**.2423898**	**.367623**	**0.66**	**0.512**	**-.4890648**	**.9738443**
valuation_method	**-.003013**	**.3841965**	**-0.01**	**0.994**	**-.7674436**	**.7614175**
wtpmeasuretype	**.935757**	**.568905**	**1.64**	**0.104**	**-.1961854**	**2.067699**
_cons	**-91.52651**	**141.179**	**-0.65**	**0.519**	**-372.4285**	**189.3755**

Taking Natural logarithm of wtp values as dependent variable and natural logarithm of hhinc_month as independent variable keeping all varaibles in original scale

Meta-regression — Number of obs = 98
REML estimate of between-study variance — tau2 = .9326
% residual variation due to heterogeneity — I-squared_res = 100.00%
Proportion of between-study variance explained — Adj R-squared = 30.99%
Joint test for all covariates — Model F(10,87) = 5.36
With Knapp-Hartung modification — Prob > F = 0.0000

lnwtp_value	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnHHinc_month	.5587053	.2395151	2.33	0.022	.0826431	1.034768
sur_year	.0519821	.068363	0.76	0.449	-.0838967	.1878609
samp_size	-.0002164	.000402	-0.54	0.592	-.0010154	.0005826
re_share	.0147437	.0050696	2.91	0.005	.0046674	.02482
gender	-.2862466	.3554918	-0.81	0.423	-.9928251	.4203318
energy_type	1.078641	.240345	4.49	0.000	.6009294	1.556353
respond_type	.6659308	.3471645	1.92	0.058	-.0240962	1.355958
payfreq	.2869828	.3592087	0.80	0.427	-.4269834	1.000949
valuation_method	-.0237951	.3770984	-0.06	0.950	-.7733189	.7257287
wtpmeasuretype	.7036279	.5224787	1.35	0.182	-.3348551	1.742111
_cons	-107.6544	138.0355	-0.78	0.438	-382.015	166.7062

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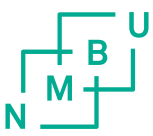

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