Thesis for the MSc in Sustainable Business and Innovation

Scaling up the process of variable valuation based on subjective wellbeing
A methodological research

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Preface

This research project started during my internship at Impact Institute, a social enterprise based in Amsterdam that has the vision of realizing the impact economy. As an analyst intern, I got to experience different ways to calculate social and environmental impact from primary and secondary data. While monetization of variables was done frequently, it was clear that it would be very beneficial in terms of resources if there was a more systematic way of valuating social variables. The idea of researching into the possible combination of subjective wellbeing with a publicly available social database sparked my curiosity and led to this methodological research.

Summary

Impact assessment is the first step to understand the positive and negative effects created by an activity or product. Social impact is not often measured quantitatively, and this prevents social impact data to be presented side by side with environmental and financial impact data. Methodologies have been developed to measure social impact based on the effects that selected variables have on subjective wellbeing, and present these as a monetary value. Existing methodologies however rely on very specific primary data collection methods and this requires a great amount of time and financial resources. The goal of this thesis is to adapt these published methodologies to solely require secondary data. This builds on existing theories and can be directly applied in real life situations where for example a company wants to measure its social impacts.

To do this, an overview of the existing published methodologies was carried out and the "Three Stage Wellbeing Valuation" approach (3S-WV) stood out as being the most complete and well explained methodology. This led to an in-depth understanding of this paper that would then allow for its adaptation, and an evaluation of its strengths and limitations. The European Social Survey database (ESS) was chosen as main source of secondary data for this adaptation as it has a strong research background, is carried out frequently with thousands of European citizens and is publicly available. The 3S-WV has three stages, the income model (where the relationship between income and wellbeing is determined), the non-market good model (where the relationship between the variable in question and wellbeing is determined) and the monetary equivalent value (where the previous two stages are combined to reach a monetary value). For the purpose of validation, the variable *unemployment* was used to test the adaptation of the methodology and when comparing the value obtained using secondary data to the one obtained in the published paper where primary data was used, the difference was minimal. This leads to the conclusion that this methodology is worth pursuing in further research that would start by carrying out the valuation of more variables and carrying out a statistical analysis of these results.

Contents

List of abbreviations

EA	Environmental Assessment
EIA	Environmental Impact Assessment
ESS	European Social Survey
GDP	Gross Domestic Product
SIA	Social Impact Assessment
SWB	Subjective Wellbeing
WTA	Willingness to Accept
WTP	Willingness to Pay
3S-WV	Three Stage Wellbeing Valuation

1. Introduction

Wellbeing is defined as "the state of being happy, healthy, or prosperous" ('Well-being', n.d.). Until the beginning of the current millennium, a country's GDP and other standard measures of economic performance were accepted as equivalent to a population's wellbeing. Based on the nations' economy and far from personal life satisfaction, this indicator started losing its association to wellbeing (in the dictionary sense of the word) as research about 'what matters most to people' started being developed (OECD, 2011). An accurate measure of wellbeing is of great value for decision and policy making purposes. Being able to evaluate if a certain good or activity has increased the wellbeing of its stakeholders is a valuable way to test its success and suitability (Dolan & White, 2007).

Measuring one's wellbeing can be of great importance when calculating the impact created by a certain activity on its stakeholders. Having this value can help one understand the trade-offs of an activity, for example if there is social damage arising as a way to create financial benefit, then there is a trade-off that needs to be taken into consideration. The Impact Economy is a movement with the focus to 'generate a financial return and deliver a demonstrable social and/or environmental benefit' (Martin, 2016). This can be monitored through the systematic development of impact assessments by businesses. Calculating social benefit is not an easy task, as one might be directly and/or indirectly affected by a certain business, activity or product. However, if one is able to measure the amount of wellbeing that a certain activity creates for the people involved, and since wellbeing is directly related to social benefit**,** this measurement can be used as an estimation of the social benefit created (Cummins, 2000).

Over time, different approaches to measuring wellbeing as an indicator have emerged such as the desire fulfilment account, the objective lists account and subjective wellbeing. Economists have commonly used the 'Desire Fulfilment Account' approach, also known as *preference* approach, which is based on market behaviour. It assumes that the more preferences satisfied by an individual, the higher the wellbeing achieved. This approach has encountered many problems such as the difficulty in measuring the wellbeing that arises from non-market goods, such as clean air, or the lack of ability that people have in making wellbeing maximising decisions (Cummins, 2018). The 'Objective Lists Account' has also been previously used; it is based on making lists of basic human needs that once satisfied allow people to develop their own wellbeing. The main problems with this approach are the difficulty in weighing different items, as they might contradict each other, being subject to certain types of error and lack of objectivity (Cummins, 2018). More recently, a new term has arisen and has been the target of much research, Subjective Wellbeing (SWB). This is based on people's evaluations of their own wellbeing, through the form of a questionnaire (van Hoorn, 2007). This is an intuitive and appealing approach that is based on straightforward questions that people can clearly answer (Cummins, 2000; Dolan & White, 2007). This method has been recently studied by many and has been stated to 'serve as an empirically adequate and valid approximation for individually experienced welfare' if certain criteria in the data collection process are met (Frey et al., 2009).

With SWB, authors such as Daniel Fujiwara (an expert on variable valuation) have estimated the monetary valuation of specific activities, commonly referred to as variables (Dolan et al., 2019; Fujiwara et al., 2014, 2017). These papers are of extreme relevance as they show that a monetary value can be attributed to a variable, which is something novel. These valuation papers don't always use the same terminology, but they all try to find a monetary value that represents the presence or absence of a variable in terms of the wellbeing it brings or takes. This can be how much one would be willing to pay to gain a certain amount of wellbeing, or how much one would be willing to accept for a loss of wellbeing. Variable valuation as carried out in the literature cannot be easily extended to other variables, this is due to the very specific data collection methodologies used and the lack of detailed explanation of this process. In this thesis we attempt to find a method for which the valuation of variables can be estimated without the need for primary data collection. Having the monetary value equivalent of a variable, activity or product allows it to be compared and placed side by side to financial and environmental values. This value brings lots of benefits to the Impact Economy, allowing one to quantify a trade-off, which was not possible before. It also serves as a starting point for the development of better methods. A suitable source of data for this research is the European Social Survey (ESS). The ESS is a publicly available survey carried out every two years in multiple European countries with tens of thousands of participants who answer questions on various topics including politics, wellbeing and demographic.

Currently, to carry out a valuation of an event, project, product or variable based on SWB, full papers including high levels of research detail and data analysis are needed. This process ensures that the correlation between the variables is very likely to be causational, that the methodology used is trustworthy, and therefore the obtained variable valuation is significant and accurate. Although these significant accurate values are naturally of high relevance, the significant accurate value can often be traded by an estimation that is significantly faster and simpler. Finding a way to obtain these monetary values for multiple variables even without the details presented in previous research is of great interest to society, as it shows how much one's wellbeing is as important as financial or environmental data when making decisions as these can finally be placed side by side.

Determining a methodology that would allow one to obtain a close estimation of the value of a given variable based on its impact on one's wellbeing has various direct scientific benefits, these include the process of going through the available methodologies and evaluating each one, re-applying it and understanding its adaptability as well as expanding on the existing methods. This also considerably expands the number of variables for which a valuation can be obtained and can also be used as a preliminary research for more detailed variable valuations. In terms of what this research brings to society, the main point is that it makes the whole variable valuation process simpler and quicker to carry out, this makes impact assessment more appealing to small entities and makes this process publicly accessible. This can be a big step for companies to be able to carry out valuation of the social impacts their products or activities have and allow them to make better decisions that decrease negative impact and increase positive impact. This also allows companies to present their impacts in a quantitative and less subjective way, allowing consumers to make more informed choices. This methodology makes it easier to understand the trade-offs taking place within the triple bottom line.

The aim of this thesis is to determine how the ESS can be used to estimate as accurately and systematically as possible the valuation of a variable based on SWB. To do this a deep understanding of how valuation is calculated for the few variables already published as well as a thorough statistical understanding on how to reach monetary values through correlations and logic is required. An understanding of the ESS is also needed to make sure the results portray what is intended. The method will then be validated with existing published data. The aim is to make this method scalable, relevant and to show that it is reliable in its estimations. The development of this method would allow for various variables that are less common in the present literature to be incorporated into impact assessments, which are of high importance when facing this changing economy.
Therefore, the research question is as follows:

How can the monetary value of variables based on subjective wellbeing be estimated using secondary data?

2. Literature Review and Theory

2.1 Impact assessments

Impact assessments have aided decision making for over 50 years, starting in the 1960's. Environmental assessments (EA) estimate the positive and negative environmental consequences of a plan, policy, program and projects related to the building of infrastructures. If the project is proposed by an individual or company then it is called an environmental impact assessment (EIA) (Vanclay, 2002). This process was designed to evaluate the effect of a proposed project or development in the communities, ecosystems and economies involved. Soon after the establishment of the EA, social impact assessments (SIA) also started to be developed but did not receive the same attention as the environmental assessments. EAs are regulated and compulsory to obtain a license for the development of new projects and, are associated with frameworks such as the International Standardization Association (ISO). In 1996 the ISO 14001 (environmental certification) was implemented, but ISO only published a guidance on social responsibility (ISO 26000) in 2010, this not being a certification but solely a guiding document (Franks & Vanclay, 2013). This shows a difference in importance given to social and environmental assessments.

Slootweg et al. (2001) propose a framework for environmental and social impact assessment (see fig. 1) showing the interconnectedness of environmental and social impacts, and how focusing on direct environmental impacts, disregards the indirect social and also environment effects. The same limitations will occur when focusing on the direct social impact, neither of them is sufficient to understand the entirety of the impacts being caused.

Franks and Vanclay (2013) elaborate a scheme (fig. 2) showing how the social impact assessment can be an adaptive management process. This is a process based on the prediction of impacts, their management and adaptation to mitigate impacts. This is a valuable process as it allows for evaluation and improvement of the current methods, however, impacts are never measured. The lack of tangible data in this process does not allow for an in depth understanding of the impacts and the strength of the solutions put in place. This theory shows the scientific relevance of this research, it shows how important it is to have a variety of methods to measure impact, as this will enhance decision making and in the development of products that are continuously better socially and environmentally. Having a method that aids in impact assessment, specifically by determining a monetary value for impacts created, enhances the step of "Scoping and formulation of alternatives" as one is able to compare potential impacts caused by an action, as well as in the step "Monitoring and reporting" as having adequate and specific ways of measuring impact will allow one to report on the caused impact. This methodology aims to build upon this theory proposed by Franks and Vanclay (2013) by proposing a practical way to implement it in real life situations.

Figure 1:

Integrated framework for environmental and social impact assessment (Slootweg et al. 2001)

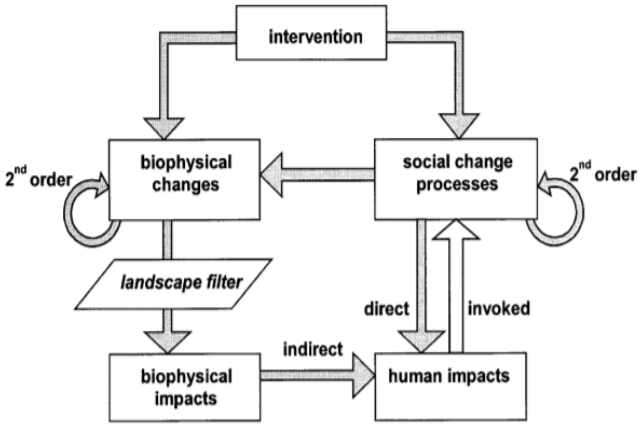
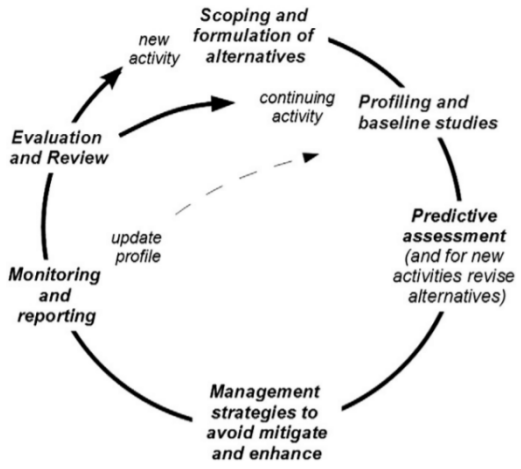


Figure 2:

SIA as an adaptive management process (Franks and Vanclay, 2013)

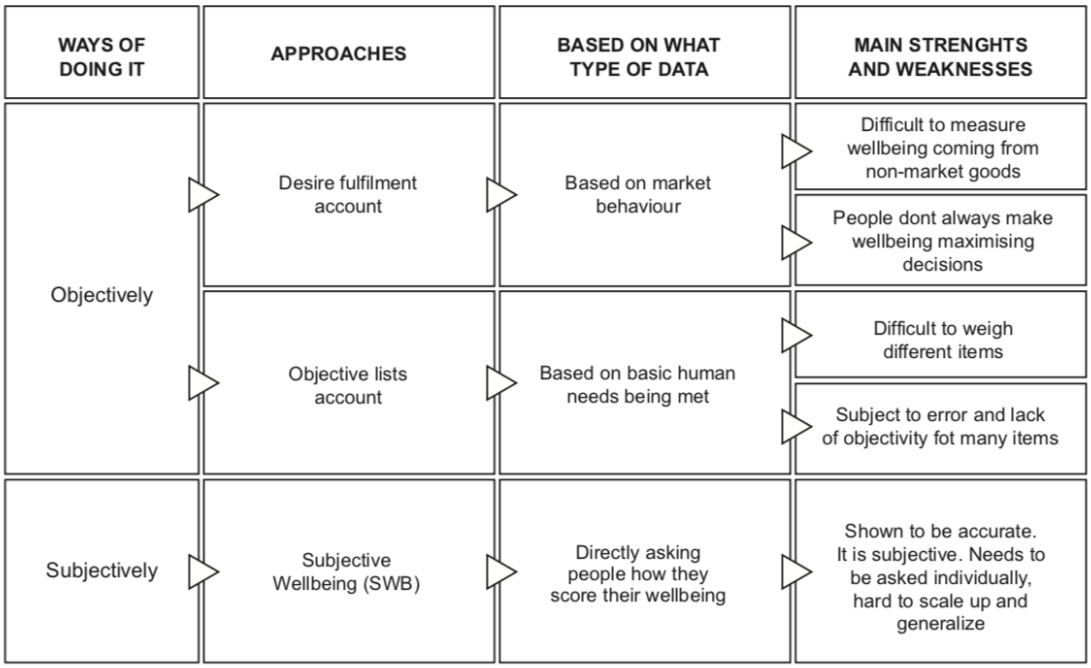


2.2 Approaches to measure wellbeing

Wellbeing, like most things, can be measured objectively and subjectively. One example of objective measurement of wellbeing include the desire fulfilment account (also known a *preference approach*), this is based on market behaviour and the calculation of how many preferences are met. A second example of objectively measuring wellbeing, that ironically struggles to be completely objective, is the objective lists account, this is based on the amount of basic human needs satisfied. Measuring wellbeing subjectively is very straightforward and is simply asking the individual how he scores his wellbeing on a scale. Subjective wellbeing has shown to 'serve as an empirically adequate and valid approximation for individually experienced welfare', and although it is the most recent of these three approaches, it is very present in recent studies and seems to be the most accurate. The Subjective Wellbeing approach follows the theory behind using the Likert scale for unquantifiable measurement. SWB becomes less subjective when asked to a great number of people and when combined to other contextualizing questions. The downsides of SWB are that on one hand it relies on people's subjective interpretation of the questions and on the other hand on the need to conduct individual interviews or surveys, the answers individuals give to these SWB questions cannot be estimated and therefore implies difficulty in scaling up and generalizing results. The figure below (fig. 3) shows an overview of these most common ways in which wellbeing can be measured.

Figure 3:

Overview of the different ways in which wellbeing can be measured



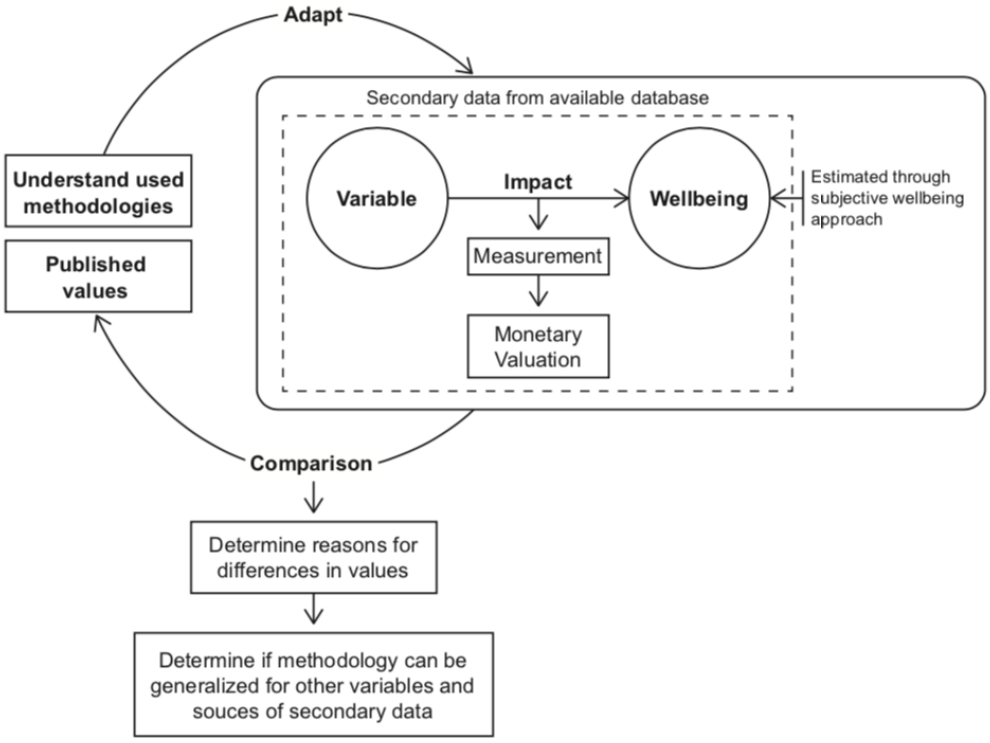
Once the data is collected and analysed, it can be presented in many ways and converted to a variety of types. The reason why this variable valuation is presented in monetary values is because it is a way to facilitate its understanding. As published in the Harvard Business Review and other journals, the most important thing to do when presenting data, is to make it relatable in terms of time, size and things (Duarte, 2019). Giving real life examples helps the viewer to process and understand the data. For this project this data has to be presented in a way that makes sense for all other possible variables, as well as for anyone viewing this data. It is also important that the data extracted from this methodology can be compared to other relevant data. This has led to the area of welfare economics, a field that aims to put welfare in monetary terms as way to make it comparable to financial terms (Fujiwara, 2013a). As many variables have already been measured using a monetary value, it only makes sense to develop this methodology with the aim of obtaining a monetary value for the impact of the variables on wellbeing in a replicable and time efficient way. For that, a framework has been developed.

2.3 Theoretical framework

Figure 4 presents the theoretical framework for this methodological paper. This has many sections that call for careful consideration. The first and perhaps most important point is to go through the already published methodology with the aim to grasp purpose of every step and all the needed input data. Because one methodology is the base for the adaptation, it essential that I am comfortable with its entirety. Ensuring that this methodology that will be used as the base for the adaptation comes from trustworthy sources and is scientifically sound will allow for the adapted methodology to have a strong and reliable structure. Secondly this chosen methodology will be adapted to be used with a chosen database. The database choice is very important as it will affect the way in which results are obtained, having a data source that is multidisciplinary, but also rigorous in its data collection methodologies will increase the chances of obtaining reasonable and accurate final results. After the adaptation of the methodology is done, this will result in the ability to measure the impact of a variable on wellbeing (wellbeing measured through the subjective wellbeing approach), and finally a monetary valuation of a variable will be obtained. The evaluation of this methodology will be done by returning to the published data, comparing results of the valuation of the same variable. This will give insights on the strengths, weaknesses, and on the possible generalization of the methodology for multiple variables and databases, and if so, what the requirements need to be met. The starting point and end point of this paper is based on the existing literature, which needs to be the most accurate and reliable to ensure quality in the methodology developed.

Figure 4:

Theoretical framework



3. Dataset & Methodology

3.1 Dataset: European Social Survey

The European Social Survey (ESS) is an academically driven social survey, conducted face-to-face in multiple countries across Europe. Interviews for data collection are carried out every 2 years since its establishment in 2001. The project is funded by the European Commission together with the contribution of each participating country for the respective data collection. This survey is recognised as high-quality survey when compared to other cross-European surveys (Hough et al., 2013). The main aim of the ESS is to measure attitudes, beliefs and behaviour of over thirty countries over time (European Social Survey, 2016).

Many studies have used the ESS as the main data source (see table 1) such as large-scale empirical tests of procedural justice theory, studies on the determinants of work-life balance, studies on the relations between Internet use, socio-economic status (SES), social support and subjective health. The most recent dataset published (ESS9-2018) includes the interviews that took place in 2018 and 2019 and became publicly available in October of 2019. This round of interviews comprises valid answers from over 45.000 participants (in 19 countries) to more than 120 different questions divided into 8 categories, these being, 'media and social trust', 'politics', 'subjective well-being, social exclusion, religion, national and ethnic identity', 'timing of life', 'gender, year of birth and household grid', 'socio-demographics', 'justice and fairness' and 'human values'.

Table 1:

Examples of literature using the ESS as its main data source

Citation	**Title**
(Card et al., 2005)	*'Understanding attitudes to immigration: The migration and minority module of the first European Social Survey'*
(Fieldhouse et al., 2007)	*Something about young people or something about elections? Electoral participation of young people in Europe: Evidence from a multilevel analysis of the European Social Survey*
(Reeskens & Hooghe, 2008)	*'Cross-cultural measurement equivalence of generalized trust. Evidence from the European Social Survey (2002 and 2004)'*
(Senik et al., 2009)	'*Immigration and natives' attitudes towards the welfare state: evidence from the European Social Survey'*
(Bilsky et al., 2011)	*'The Structural Organization of Human Values—Evidence from Three Rounds of the European Social Survey (ESS)'*
(Aassve et al., 2013)	*'Age norms on leaving home: multilevel evidence from the European Social Survey*
(Billiet et al., 2014)	*'The relation between ethnic threat and economic insecurity in times of economic crisis: analysing data from the European Social Survey'*
(Verbakel et al., 2017)	*'Informal care in Europe: findings from the European Social Survey (2014) special module on the social determinants of health'*

An *Online Analysis* feature is available on the ESS website, allowing for the statistical analysis of the full data gathered in each round. This feature allows users to carry out regressions, to group different variables into one, to filter for certain variables such as specific countries and many other useful operations. This allows flexibility and freedom for the user to analyse and interpret the available data, as well as having the option to export such analysis to desktop applications such as Excel. This database is ideal to be used in the valuation of variables through wellbeing because it is accessible, easy to analyse through regressions, has a very high number of participants answer a very large number of questions on a variety of topics, and these participants are spread all over Europe. The fact that there are big research teams and funds going into this project also ensure questions are being asked in a standardised form, and that the data can be trusted.

3.2 Method

To find a way in which the European Social Survey can be used to estimate the monetary value of social variables based on wellbeing, the following steps will be taken:

1) Gather already published valuation methodologies and identify the best approach

Using wellbeing to determine the value of a certain variable is a relatively new approach. This means that even though it has been done multiple times, there is not a single defined and established way or methodology to follow. Understanding the strengths and weaknesses as well as the reasoning behind their development is fundamental when choosing the methodology that will guide this research. To do so, the main valuation papers published to date will be presented together with the methodology used. This will allow us to understand the frequency in which each methodology is used, as well as to understand if different methodologies are used for specific purposes or situations that might be similar to the goal of this research.

2) Understand the theory and the requirements for the use of this methodology and check for suitability

Once one methodology is chosen, it is important to gather the papers in which it has been used and try to process the way in which it has been built, the reasoning and the theory on which it was built. This methodology is the backbone of this process, and having a profound understanding of its elements, its strengths, weaknesses, as well as its applicability and flexibility is essential. Once the structure is understood, one will be able to make more informed decisions on how to adapt it if necessary, or the format of the input data in order to have the correct output.

3) Apply the methodology for a comparable variable

To understand if the application of this chosen methodology to the ESS database is accurate, there is the need for a term of comparison in terms of results. Therefore, the procedure should be carried out with a variable for which a wellbeing valuation has taken place and is published. It is vital that there is enough data on this variable available on the ESS database. If possible, it is also preferred if this variable is interesting to valuate and if its scope is clear, preferably a binary variable for which an individual either answers yes or no instead of a scaled answer. As a first attempt, this will make the analysis more graspable and easier to interpret, compare and most importantly to evaluate the success of the implementation of the methodology with the data.

4) Compare results obtained in methodology paper and results obtained using ESS data

The comparison of the results is what will determine the success of the match of the database with the methodology and any adaptations that might have taken place. As there are no previous examples where this has been done before. It is difficult to stipulate a gap of difference that is or not acceptable to be able to determine if this methodology is or is not acceptable. The focus should not be given exactly on the difference of values, but on understanding what led to the observable differences and then determine if these are or not acceptable, and if anything can be adapted to make the results as accurate as possible.

4. Results

4.1 Existing methodologies and identification of best approach

To be able to use a widely available database for a process that usually requires very specific data, there is the need to understand the different methodologies used so far, what their strengths and weaknesses are, and chose the most adequate to be used with the new data input. The table below (table 2) shows the methodology used in each publication as well as the year in which they were published and the valued variable.

Table 2:

Valuation papers and the methodology used. Blue coloured rows represent same methodology used.

Author and year	Variable	Methodology used
(Frey et al., 2009)	Terrorism	Life Satisfaction Approach
(Zijlmans, 2009)	Unemployment	Own methodology specific to data
(Fujiwara, 2012)	Adult learning	Wellbeing Valuation Approach
(Fujiwara, 2013a)	Unemployment	Three-Stage Wellbeing Valuation Approach
(Fujiwara, 2013b)	Participating in museums	Wellbeing Valuation Approach
(Fujiwara et al., 2014)	Culture and sport	Wellbeing Valuation Approach
(Fujiwara et al., 2015)	Health and educational benefits of sport and culture	CASE (this is not personal WB, so different calculations are made)
(Fujiwara et al., 2017)	Public libraries	WTP calculated, not variable valuation.
(Brenig & Proeger, 2018)	Crime reduction	Life Satisfaction Approach
(Dolan et al., 2019)	Olympics	Own methodology specific to data

The table above shows there are two methodologies used more than once, the Life Satisfaction Approach (LSA) and the Wellbeing Valuation approach (WV). These two methodologies, even though having different names, are equivalent (Fujiwara, 2013). These equivalent methodologies are based on the same principles of including regressions made between SWB and the variable in question and using those values in combination with the household income. The Three-Stage Wellbeing Valuation approach (3S-WV) represents an improved version of the Wellbeing Valuation Approach as the author Fujiwara aims to reduce the limitations presented with the WV approach.

For the purpose of this thesis, the 3S-WV will be used as the main guide. The reasons behind this choice in methodology are the fact that this is an improved version of a methodology that already is shown to be reliable and used multiple times by various authors, it has been used to evaluate a variable for which there is data on the ESS, and finally that there is a full paper describing and explaining each step of the methodology. These three reasons combined make this an obvious choice, where no other methodology seems to be more adequate. Understanding this paper and the methodology is a fundamental part of this thesis, in which we will try to generalize and reproduce the methods using a different input database. In the following sections we will take an in-depth be look at Fujiwara (2013a) and the three different stages will be described. Because the variable used in the chosen methodological paper is unemployment, the adaptation will be carried out for this variable to ensure it can be validated through comparison.

4.2 Understand the theory and the requirements for the use of this methodology and check for suitability

The paper *"A General Method for Valuing Non-Market Goods Using Wellbeing Data: Three-Stage Wellbeing Valuation"* published by Daniel Fujiwara in July 2013 starts by explaining the theory behind wellbeing valuation, as well as the most commonly used terms that can cause some confusion. He follows by explaining in detail the theory behind the Wellbeing Valuation Approach (WV), determining its weaknesses and then finally the main part of the paper is about the new proposed methodology. While the detailed theory behind the old approach used is not of utter relevance in this research, the terminology is. Therefore, the explanation of this methodology can be found in appendix 1, while a table with the most relevant terminology can be seen below in table 3.

The table shows that Compensating Surplus implies a change in welfare, while the Equivalent Surplus implies that a positive or negative change in welfare is substituted by a monetary compensation, leaving the individual with the same welfare level. It is also important to keep in mind that values obtained with this methodology, both old and new versions, are **not** equivalent to Willingness to Accept or Willingness to Pay values. The values obtained will be called *monetary equivalent value* and can be used for both Compensating Surplus and Equivalent Surplus.

Table 3:

Relationship between the different terminology (Fujiwara, 2013a)

	Compensating Surplus (CS)	**Equivalent Surplus (ES)**
Welfare gain	*WTP for the positive change*	*WTA to forego the positive change*
Welfare loss	*WTA the negative change*	*WTP to avoid the negative change*

4.2.1 The Three Stage Wellbeing Valuation Approach (3S-WV)

This approach attempts to solve the problems found with the initial Wellbeing Valuation Approach, these being: parametric restrictions due to this being a single-equation model, bias on the impact of the good Q on income M and unidentified populations for all the parts of the equation. This is done by separating the one equation used in the WV approach into 3 different models: the income model, the non-market good model and the monetary equivalent model.

a) Stage 1 – The Income Model

This stage focuses on understanding the relationship between income and SWB. This stage is particularly important and difficult because this relationship can be affected by multiple hidden exogenous variables. The author in this case uses data from lottery winners to establish causality between changes in income and changes in wellbeing. This will ensure that other factors that affect both income and SWB are not taking part in the understanding of this relationship. Using lottery winners is a common practice in research involving the impact of income on various variables.

The clearest exogenous changes in income can be understood when using national surveys that include data on lottery wins. Literature on the reasoning behind this choice is explained in various papers (Gardner & Oswald, 2007; Lachowska, 2017). The author explains how the data from lottery winners is treated and which relevant variables are taken into account, for example the short-term euphoria of being the winner of a prize. This is done by dividing the derivative of SWB by the derivative of M (income). When this is applied to the British Household Panel Survey database, a final value is presented as:

$$\frac{\mathrm{d}\, SWB}{\mathrm{d}\, M} = 1.1 \qquad (1)$$

In the discussion of the paper, it is mentioned that "the estimate for the causal effect of income (f'_M) is generic enough to be used elsewhere". The possibility to use this value 1.1 in other contexts is a very valuable trait of this methodology because this first stage seems to be the most specific and complex to replicate.

b) Stage 2: The non-market good model (unemployment)

Using a large list of independent variables (see table in appendix 2), a regression analysis is made to understand the relationship between the independent variable in question (unemployment, indicated as Q in the equation) and SWB. By doing this, a clear and usable value is obtained. This value is -0.44. This means that being unemployed instead of employed reduces ones SWB by -0.44 on a scale of 1-7. This step seems to be straightforward as long as there is a defined variable in the database that can be used together with the SWB variable in a regression analysis.

$$\frac{\mathrm{d}\,SWB}{\mathrm{d}\,Q} = -0.44 \tag{2}$$

c) Stage 3: The monetary equivalent cost of unemployment

This section is mostly about combining the results of the previous two stages. For this stage it is fundamental to know the median household income of the population in question (in Fujiwara (2013a) it is £23,000). The following two equations are presented as the final results for the valuation of the impact of unemployment on SWB. The first one, CS represents how much one would need to receive to maintain his life satisfaction if he became unemployed, after controlling for loss of wage income. The second one, ES represents how much money would be needed to be taken away from an individual for his life satisfaction levels to decrease to the amount he would have if he were to be unemployed. CS in this case would be the most preferred result, as with most non-market good valuation.

Compensating surplus for unemployment

$$CS = e^{\left[\frac{-g'_Q}{f'_M} + \ln(M^0)\right]} - M^0 = e^{\left[\frac{0.44}{1.1} + \ln(23{,}000)\right]} - 23{,}000 = \mathbf{£11{,}312\ per\ year} \tag{3}$$

Equivalent surplus for unemployment:

$$ES = M^0 - e^{\left[\ln(M^0) + \frac{g'_Q}{f'_M}\right]} = 23{,}000 - e^{\left[\ln(23{,}000) - \frac{0.44}{1.1}\right]} = \mathbf{£7{,}583\ per\ year} \tag{4}$$

The three different models can be connected in four ways shown in the table 4 (below). This makes the outcome more specific to the desired valuation purpose. The same stages are needed to obtain the final result. It is relevant to understand that while CS for welfare gain and ES for welfare losses are capped off at the individual's income, the remaining 2 formulas do not have a theoretical maximum value and have their limits on infinity. The reason why there are four different formulas shown, is because different ones will be more accurate in different situations. Having the option of using either of these four ensures the result of this valuation process will be the most adequate to represent a real-life situation.

Table 4:

The four ways in which the 3 models can be combined to achieve different purposes

	Compensating Surplus (CS)	Equivalent Surplus (ES)
Welfare gain	$CS = M^0 - e^{\left[\ln(M^0) - \frac{g'_Q}{f'_M}\right]}$	$ES = e^{\left[\frac{g'_Q}{f'_M} + \ln(M^0)\right]} - M^0$
Welfare loss	$CS = e^{\left[\frac{-g'_Q}{f'_M} + \ln(M^0)\right]} - M^0$	$ES = M^0 - e^{\left[\ln(M^0) + \frac{g'_Q}{f'_M}\right]}$

4.2.2 About the quality of 3S-WV

The main issues with the WV approach are identified and tackled in this new approach. Knowing that this methodology has already been thoroughly applied to various variables gives extra value to this improved version as it makes it easier to understand how it is applied in real life situations.
In terms of weaknesses, it is important to be aware that when applying this approach, there are necessary conditions that need to be met, them being sample matching (where the data used for every stage comes from the same population) and data treatment (that needs to be systematic). Weaknesses include the lack of information on using this approach with other sources of data, and how it can be applied. For example, when SWB questions are answered on a different scale than the one used in 3S-WV, how does this affect steps 2 and 3.

4.3 Apply the methodology for a comparable variable

4.3.1 The format of the data from the ESS (European Social Survey)

The ESS database requires no software for simple analyses such. The data can also be downloaded in SAS, SPSS and STATA for further analysis. Each question can have a different answer type (binary, quantitative or scale). When looking for a question that can be used as variables for analysis it is important to understand its type of answer to be able to process and interpret results.
One question that is commonly used when performing wellbeing valuation analysis is the SWB question. In the ESS the most appropriate question to use is "All things considered, how satisfied are you with your life as a whole nowadays? Please answer using this card, where 0 means extremely dissatisfied and 10 means extremely satisfied.". Here the participant can answer from a range of 0-10, and of course can also refuse to answer or answer "I don't know" just like in any other question.
In this case, since we are looking at unemployment, it is relevant to look at questions such as "Which of the descriptions on this card applies to what he/she has been doing for the last 7 days?" where answers include: unemployed (looking for a job), unemployed (not looking for a job), paid work, education, retirement… These variables can also be re-coded in order to adapt them to the study, for example one could make a general unemployed variable that includes the two types of unemployment above.

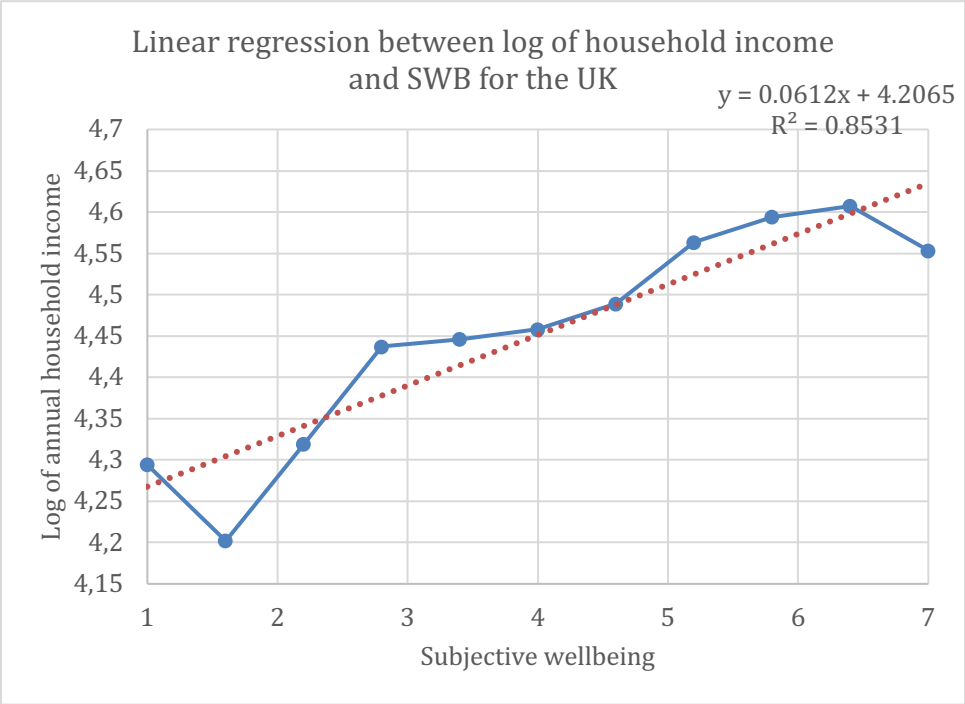
4.3.2 Stage 1: Using ESS data on the income model

Stage 1 is about the relationship between household income and wellbeing. In the original paper, a database is used that has multiple questions about playing in the lottery. This allows for a very specific study on the impact of income on wellbeing where a lot of details are taken into account such as the momentary happiness of winning a prize, the amount of money spent playing in the lottery, etc. According to the author, this is the best way to understand this relationship between income and wellbeing because it is a rapid change in income, and it does not affect the past of the persons upbringing or opportunities because the individuals did not plan to have this new source of income.

Because the ESS does not have questions on lottery, we study the relationship between income and SWB using the yearly household income. Given the notably skewed distribution of income, the log of the annual household income was taken. The SWB question is very similar in both databases, but the answer scale is different, in the Fujiwara paper it goes from 1-7, while on the ESS the scale goes from 0-10. Not having the lottery data, we cannot expect the same result. There was an attempt to produce this value using the ESS data, but even with all data adaptations done to replicate the original paper, the value was very far off at 0.06 (see figure 5) compared to 1.1. Not having lottery data means that the methodology for this stage cannot be reproduced and while the number obtained still represents the relationship between the two variables, it is not usable to insert in stage 3 of the 3S-WV approach. This stage of the approach does not seem to be reproducible with databases that do not have questions about lottery participation and prize winning (or any other variable that is exogenous to income). The advantage about having chosen a very detailed and complete methodology to adapt is that the author, has stated that the value obtained in the paper for this stage can be applied in further research. This first step of the 3S-WV approach has been carried out very carefully and with a very specific methodology and primary data collection and according to the author it can be used to represent the relationship between wellbeing and income in further research independently of the data used. This is of great importance as it ensures it is a reliable value and can be used systematically for this step. Therefore, the value for this stage will be taken from the original paper, this being 1.1.

Figure 5:

Graphic representation of the relationship between income and subjective wellbeing using data from the ESS.



4.3.3 Stage 2: Relationship between unemployment and SWB using ESS data

There is a great similarity between the data from BHPS database and the ESS database when it comes to unemployment related questions. This makes this stage of the wellbeing valuation process simpler and straight forward. For this step another regression analysis will be made between the desired variable for valuation and SWB. To do this these variables need to be identified as questions in the ESS, understood and any processing of the variable needs to be carried out. According to the guiding paper, certain variables need to be taken into account as control variables, this will make sure that the impact of the desired variable is the only one being taken into account, and other factors are not influencing the analysis. Because we are replicating the paper at this stage, the same control variables will be used as well as a UK filter will be applied. As portrayed in table 5, never having been married as well as owning a house were not considered as there was not enough data on these. In brackets is represented the name of the variable as used in the database analysing software.

Table 5:

Variable input for an OLS regression analysis

Independent variable	Dependent variable	Control variables
Unemployment (unemp)	Subjective Wellbeing (SWB_rec)	Income (income_rec) Retired (doing last 7 days: retired) Poor health (PoorHealth_rec) Age (age_rec) Married (marrieduk_rec) Divorced (DivorcedUk_rec) Widowed (WidowedUK_rec) Separated (together with divorced) Never married – too few cases Carer (Doing last 7 days: housework, looking after children…) Low education (education_rec) Live in safe area (SafeArea_rec) Debt burden (not available) Interviewed in the winter (Winter) House owned (not available) Spouse employed (Partner doing last 7 days: paid work) Number of children (Nchildren_rec)

The variable input shown in figure 5 was used to carry out an OLS regression. This regression showed that many of the variables do not have a significant impact on SWB. Therefore, the variables that had a significance level above 10% were excluded in order to facilitate the interpretation of the results. The final regression carried out with significant variables can be seen in figure 6 below.

Figure 6:

Output of regression analysis post exclusion of insignificant variables

	B	SE B	Beta	T	Significance	Tolerance
PoorHealth_rec	-1.10	0.10	-0.26	-11.03	0.0000	0.90
Doing last 7 days: retired	0.80	0.11	0.18	7.46	0.0000	0.84
income-rec	0.07	0.02	0.11	4.23	0.0000	0.71
Partner doing last 7 days: paid work	0.34	0.10	0.09	3.38	0.0007	0.69
unemp	-0.74	0.25	-0.07	-2.96	0.0031	0.95
SafeArea_rec	0.27	0.11	0.06	2.59	0.0097	0.94

Intercept	6.82
Valid N	1,787.18
Multiple R	0.376
Multiple R Squared	0.141
Adjusted R Squared	0.138
F value	48.80
F sign	0.0000

As seen above the relationship between unemployment and SWB when considering other significant variables is -0.74. This means that being unemployed reduces ones SWB by -0.74 on a 0-10 scale. Because the scale used in the original model goes from 1-7, this value is converted to accommodate the same scale.

-0.74 → 11-point scale
-0.47 → 7-point scale

Therefore, the value for stage 2 of the 3S-WV is:

$$\frac{d\,SWB}{d\,Q} = -0.47 \tag{5}$$

4.3.4 Stage 3: The monetary equivalent cost of unemployment

Stage 3 is about the actual valuation of the variable. There is the need for the input of 3 values. The value obtained in stage 1, the value obtained in stage 2 and the median household income of the population being studied. Due to reasons described above, the ESS was not suitable to obtain this value as there is no lottery information, therefore this value will be taken from the guiding paper (Fujiwara, 2013a) where it is stated that "the estimate for the causal effect of income (f'_M) is generic enough to be used elsewhere". Even though it would be ideal that all the input values into stage 3 come from the same database and population, this solution seems reasonable and it ensures it matches the methodology perfectly. Opting to use this value decreases the number of calculations needed to obtain a final *monetary equivalent value* for a variable. This increases the potential generalization of this methodology and facilitates the valuation of a great number of variables. The value obtained in stage 2 can be used and it is: -0.47. Finally, the median household income of the population, in this case the UK can be extracted from financial sources, however, since in the guiding paper an interim and fictitious value is used, we will make two analysis and obtain two final values. Value used in guiding paper: £23,000. Accurate value for 2015 when paper was published: is £23,898.59.

Input values
Updated UK household income: £23,898.59[1]
Fictitious household income in paper: £23,000.00
Stage 1 value: 1.1 (from 3S-WV)
Stage 2 value: -0.47

Formula:

$$CS = e^{\left[\frac{-g'_Q}{f'_M} + \ln(M^0)\right]} - M^0 \tag{6}$$

Calculation:

$$\boldsymbol{CS = e^{\left[\frac{0.47}{1.1} + \ln(23{,}000)\right]} - 23{,}000 = £12{,}260.62\ per\ year}$$

The value obtained when using the ESS result for stage 3 is £12,260.62

$$CS = e^{\left[\frac{0.47}{1.1} + \ln(23{,}898.59)\right]} - 23{,}898.59 = £12{,}739.64\ per\ year \tag{7}$$

This value is obtained using the real annual household income of the UK in the last year. And it is here as it can be used in further studies if desired. This value is more realistic than the one above which was calculate in order to compare it to the results found in the original paper by Fujiwara.

[1] https://worldpopulationreview.com/country-rankings/median-income-by-country

4.4 Compare results obtained in methodology paper and results obtained using ESS data

The value obtained when using the ESS result for stage 3 is **£12,260.62**, the value presented in the methodology paper as a result for stage 3 is **£11,312.00**. This represents a difference of £948.62 which the value obtained with the ESS data is 8.4% higher than the original methodology paper.

These results are a positive indication that the 3S-WV methodology can be adapted to be used with the European Social Survey as a source of secondary data.

5. Discussion

The results show that by following each step of the chosen methodology, with a reliable database, a similar monetary value was obtained for the variable in question. The chosen methodology paper was dissected and allowed for an understanding of each part of the formulas used. This was then interpreted and adapted to be used with a publicly available and reliable database, the European Social Survey. This was done for the variable of unemployment, as this could then be compared to the values obtained in the literature. The final value obtained, after the adaptation process was 8.4% higher than the one published in the paper. Considering the differences in data collection methods and the different ways in which data was presented, the difference between the values is considered acceptable. This means that the procedure should be tested with other variables, as this indicates a successful adaptation of methodology. This is a valid contribution to the scientific community as it builds on the knowledge and methodologies published regarding impact assessment and measurement. This is especially valuable to society as making the process for variable valuation easier and faster allows for companies to understand where social harm is being created. This will hopefully lead to the management of these impacts in such a way as to lower negative social impacts associated with products and activities. The first step to correct something that is harmful is to identify its harmfulness and understand its causes, the methodology developed gives positive evidence of being a valuable tool to quantify this impact.

These results are relevant because using valuation methods based on wellbeing is becoming more and more useful for decision making processes. The importance of how variables can impact one's wellbeing are gaining more weight and understanding. Being able to match a reliable variable valuation methodology with a publicly available database and obtaining a value in a close range from published values (while being very time and resource efficient), is a good first step to increase the use of subjective wellbeing in decision making. This methodology also contributes to the current design and approach of well-known impact assessment methodologies. Impact assessment being an extremely important area in a changing world that needs to track its progress. This allows for progress in social variables to be measured and estimated. This has not been done before, and if this method can be generalized to other variables and databases, its potential is extremely significant.

These results represent an exploratory research into a possible methodology. This means that the results obtained, even though showing signs of success, need to be tested further with many different variables. The replication of this promoted methodology needs to be further explored for one to truly understand its strengths and limitations. However, from the research done so far, there are clear strengths such as being a time-effective process to carry out, being very versatile as a great variety of variables can be examined. For this methodology 2 data sources are sufficient, having this reduced number of sources increases the reliability and decreases the chance of data incompatibility. It uses the ESS which is a very complete and scientifically accepted based database. The weaknesses of this methodology would be that it has not been used enough times to test for sensitivity, the impact of details such as the scales in which data is presented is not clear and it assumes a pre-research phase where it is confirmed that the variable in question has an impact on subjective wellbeing.

To further develop this research, it is important to statistically test this approach, that means carrying out this methodology multiple times using variables whose valuation has been published and comparing results. It is also necessary to further explore the impact of each of the three input values on the final result. It would also be important to propose standards that determine the significance of the impact of a variable on wellbeing. And finally, it would also be interesting to extract a value for step 1 of the methodology from the ESS database, this would definitely ensure sample matching throughout the whole methodology.

6. Conclusion

To answer the question *"How can the monetary value of variables based on subjective wellbeing be estimated using secondary data?"* a methodological research has been carried out and applied to a real-life situation. By understanding the strength of using subjective wellbeing as an indicator, looking into the most detail oriented and accurate methodologies published so far and applying these to a widely used database, an exploratory result has been obtained. These results appear to be promising as they are similar to the published value from the paper following the guiding methodology. Successfully using the European Social Survey to estimate the monetary value of social variables is a step forward towards having impact assessments that include wellbeing be very easy and quick to execute. This new developed methodology requires statistical tests to be carried out before using it, but the results obtained so far show that this combination of methodology (3S-WV from Fujiwara (2013a)) and the ESS database are worth researching more into, as this can have a great influence on the way social impact assessments can be carried out by individuals, companies and governments.

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9. Appendices

Appendix 1: The Wellbeing Valuation Approach explained

The paper *"A General Method for Valuing Non-Market Goods Using Wellbeing Data: Three-Stage Wellbeing Valuation"* published by Daniel Fujiwara in July 2013, is the chosen paper to be followed as the base of this thesis. This paper starts by explaining the foundation of the terms and the reasoning behind the whole valuation process. In previous valuation papers terminology such as Compensating Surplus (CS), Equivalent Surplus (ES), Willingness to Pay (WTP) and Willingness to Accept (WTA) were widely used. These were then measured using the methods *revealed preference (RP) or stated preference (SP)*, that are fundamentally different from using SWB. While SWB is based on having people answer how satisfied they are with their life in a scale of X to X. The RP and SP approaches are based on things like human basic needs and human priorities where each human being's wellbeing is based on his material possessions. The table below shows the relationship between the various terms that are relevant to understand as they are what originate the current proposed method. The table shows that CS implies a change in welfare, while the ES implies that a positive or negative change is substituted by a monetary compensation, leaving the individual with the same welfare level.

	Compensating Surplus (CS)	**Equivalent Surplus (ES)**
Welfare gain	*WTP for the positive change*	*WTA to forego the positive change*
Welfare loss	*WTA the negative change*	*WTP to avoid the negative change*

The formula used to explain CS is as follows:

$$CS = (M^1 - M^0) + \frac{SWB'_X \cdot X'_Q (Q^1 - Q^0)}{SWB'_M} + \frac{SWB'_Q (Q^1 - Q^0)}{SWB'_M}$$

In words, this formula states that Compensating Surplus equals the impact of the good on income, plus the marginal rate of substitution between income and the indirect effect of the good on SWB, plus the marginal rate of substitution between income and the direct effect of the good on SWB. This can otherwise be represented as:

$$CS = -\frac{\mathrm{d}\, SWB}{\mathrm{d}\, Q} \cdot \Delta Q \Big/ \frac{\mathrm{d}\, SWB}{\mathrm{d}\, M}$$

There are two conditions for the use of this formula which are (1) the derivatives must come from the same population group; this is called *sample matching* and (2) the impact of the good (Q) on SWB must be clear and relevant. It is also important to keep in mind that values obtained with this formula are **not** equivalent to WTA or WTP values. The values obtained with this formula will be called *monetary equivalent value* and can be used for both CS and ES.

This WV methodology however has 3 main flaws described in the paper. These being (1) parametric restrictions, the author has noticed an assumption made in the above formula that always brings the final amount to be much higher than expected, this is because CS and ES cannot be estimated with single-equation models. (2) Bias, the causal impact of the good Q on income and on SWB is difficult to ensure, this is because many of the control variables used affect these variables directly. To avoid the problem of indirect effects, even when M and Q are correlated one must be measured before the other, and this is difficult to determine. (3) Undefined sample populations, it is difficult to ensure the samples used in the numerator and denominator are the same for both derivative fractions, and this is needed to come up with meaningful conclusions.

Appendix 2: Control variables used by Fujiwara on stage 2 of 3S-WV

Table showing all the control variables used by Fujiwara on stage 2 of the 3S-WV (Fujiwara, 2013a)

Independent variables	(1)		(2)	
	Coefficient	S.E.	Coefficient	S.E.
Redundant unemployed	-0.441***	-0.065	-0.436***	-0.062
Log (household income)	0.164***	0.012	0.092***	0.013
Retired			0.209***	0.048
Poor health			-0.150***	-0.008
Age			-0.067***	-0.005
Age^2			0.001***	0.000
Married			0.086***	0.023
Divorced			-0.243***	-0.050
Widowed			-0.283***	-0.085
Separated			-0.464***	-0.070
Never married			-0.242***	-0.033
Carer			-0.113**	-0.046
Low education			0.023	0.016
Wales			-0.008	-0.024
Scotland			-0.017	-0.021
N. Ireland			0.178***	0.031
Live in safe area			0.153***	0.021
Debt burden			-0.315***	-0.022
Winter interview			-0.004	-0.018
House owned			0.099***	0.019
Spouse employed			0.124***	0.026
Number of children			-0.007	-0.010
Year			-0.004*	-0.002
Constant	3.549***	(0.120)	5.735***	0.146
Observations	24,411		24,395	
R-Squared	0.011		0.078	