SEFIRA

SEFIRA IS A EU FP7 COORDINATION ACTION ON
Socio Economic Implications
For Individual Responses to
Air Pollution policies in EU +27

Discrete choice experiments to inform environmental policy makers:

the SEFIRA-EPPE Decision Support System

Environmental **P**olicy **P**references **E**valuation

Prototype v1.0

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1. Introduction

Air pollution has been on the European political agenda since the late 1970s and today is still receiving attention. Degraded air quality severely affects the health of citizens worldwide. Policy makers have instruments to improve air quality at different scales (European, national, regional, local/city), mainly to evaluate technical type of measures - e.g. GAINS (Greenhouse Gas - Air Pollution Interactions and Synergies), MERLIN (Multi-pollutant multi-effect modelling of European air pollution control strategies), RIAT (regional integrated assessment tool). There is increasing evidence that such measures will not be enough to reduce air pollution concentrations to acceptable levels. One reason for this is that studies of health effect are suggesting that adverse impacts on human health can occur even at concentrations which meet existing legal targets. Policies involving non-technical (behavioural) measures, such as RIAT+ and MAQ, are therefore likely to play an increasingly important role in the future in Europe. Such policies will inevitably involve behavioural changes, purchasing decisions, and lifestyle changes.

Disaggregate choice modelling has been also used to generate estimates of non-market environmental benefits and to quantitatively investigate individual's preferences, behaviours and acceptability (e.g. Bennett and Blamey 2001, Hoyos, 2010, Hoyos, Mariel and Hess, 2013; Valeri and Cherchi, 2016a). An overview of the drivers affecting policy acceptability from an individual perspective is described in Valeri et al. (2014).

DCMs are a quantitative approach with a consolidated worldwide scientific literature in many disciplines to understanding what people would do in response to different products, services or policy measures, as in the SEFIRA survey. However, it is yet less exploited their contribution in supporting the decision-making process of public Institutions.

Some scientific studies in the environmental fields propose scenario simulations. For instance, to simulate the market penetration of alternative fuel cars see for instance Horne et al. (2005), Daziano and Achtnicht (2013), and Valeri and Danielis, 2015). In addition at single ‘what-if’ scenario simulations, Hensher et al. (2005, section 12) demonstrate how outputs from DCMs may be used to create decision support systems (DSS), which allow not expert modellers (i.e. policy makers) to conduct self-explained ‘what-if’ scenario simulations to test potential policies. An example has been provided by Valeri (2013) where a DSS to evaluate inter and intra-competition between air and high speed rail transport in the Rome-Milan (Italy) corridor has been realised, aimed to support Transport Regulation and/or Antitrust Authorities, in setting fuel/energy price and emission/air quality regulations and subsidies for international companies or for defining the relevant market.

DCEs for policy purposes might provide useful input mainly:

- To design new policy-mixes based on the different combination of policy drivers’ levels.
- To estimate price sensitivity with willingness to pay measures and using these value also for Cost Benefit Analysis.
- To estimate the consumer surplus for welfare analysis.

- To create cost-value charts for each attribute which compare the perceived value of each benefit with the cost to deliver that benefit. When perceived value is higher than actual cost, you have identified an opportunity to add value to a product or to charge an elevated price for the benefit. Cost-value charts can be included with any conjoint project to give you a visual method of identifying opportunities and weaknesses and quantifying the relative value of each benefit tested.
- To simulate the overall acceptability or preferences for specific environmental policies, conducting *what-if* scenario simulations.

In the SEFIRA DCM case study, the models' output may be used at least:
1) To create an *ad-hoc* DSS to allow the *ex-ante* evaluation and comparison of potential air quality policies in term of individuals' preferences and acceptability.
2) To feed already existing tools and/or integrated assessment models for environmental, air quality and transport assessments.

2. A recap of the SEFIRA-DCM survey

Within the EC-FP7 SEFIRA project, using discrete choice experiments we investigated individual preferences for environmental policy drivers in seven European countries (Austria, Belgium, Germany, Italy, Poland, Sweden, United Kingdom), complemented by estimates of elasticity and willingness to pay measures. Preference heterogeneity and the role of socio-economic and attitudinal variables are explored with a modelling approach. The selection of the country reflected different socio-economic and political patterns of the society.

In order to describe the environmental policies to test in the empirical survey, we carried out several meetings with experts with interdisciplinary backgrounds. This allowed us to consider interdisciplinary aspect belonging to the environmental policy domain. During these meetings, it came out the importance of considering recent and urgent air quality issues impacting on pollution such as individual's habits of mobility and eating and also those affected by pollution such as human health. The importance of these issues is also confirmed by a survey carried out within the SEFIRA project aimed to analyse social network contents regarding perceived environmental concerns by the general public in the surveyed countries (Giardullo, 2016).

We characterized each environmental policy based on five key drivers (Table 1):
1. Country-specific cost of the measure implementation.
2. Required changes in the individual's mobility behaviour.
3. Required changes in the individual's eating habits.
4. Reduction of premature deaths due to the atmospheric pollution.
5. Distribution of implementation costs of the measure to the community.

For each choice experiment proposed, the individual was required to choose between two potential environmental policies. Each alternative was characterized by a different combination of the policy drivers' levels as described in Table 1. See further detail of the questionnaire in Avataneo et al. (2015).

Table 1 – Characteristics of the experimental design

Type	Description	Country	Levels			
			1	2	3	4
Cost of the measure:	The annual cost you will have to bear as a consequence of the implementation of the environmental policy	*Austria:*	No cost required	10 euro per year	28 euro per year	55 euro per year
		Belgium:	No cost required	10 euro per year	28 euro per year	55 euro per year
		Germany:	No cost required	10 euro per year	25 euro per year	52 euro per year
		Italy:	No cost required	10 euro per year	25 euro per year	50 euro per year
		Poland:	No cost required	25 zt per year	60 zt per year	120 zt per year
		Sweden:	No cost required	115 sek per year	290 sek per year	580 sek per year
		UK:	No cost required	10 £ per year	23 £ per year	45 £ per year
Required changes in your mobility behaviour *:	The decrease required in the use of polluting means of transportation (car/motorcycle), compared to your present use of these vehicles.	*The same for all countries:*	No reduction required	-25% of days fewer per month	-50% of days fewer per month	
Required changes in your eating habits *:	The decrease required in the consumption of beef, pork, lamb and horse meat or of milk and dairy products, compared to your present consumption.	*The same for all countries:*	No reduction required	-25% of days fewer per month	-50% of days fewer per month	
Reduction of premature deaths:	The impact of the policy on the reduction of premature deaths caused by the presence of particulates and ozone. In Europe, there were almost 500,000 premature deaths caused by atmospheric pollution in 2013.	*The same for all countries:*	50,000 fewer premature deaths per year	125,000 fewer premature deaths per year	250,000 fewer premature deaths per year	
Distribution of measure costs:	It indicates how the costs of the environmental measure must be distributed to the community.	*The same for all countries:*	Those who pollute more, pay more	The poor pay less		

Note: * = the two policy drivers about habits have been pivoted based on the stated status quo value stated by each respondent.

Results of the SEFIRA-DCM survey are described for the seven countries in Valeri et al. (2016b), while further in-depth analysis that consider individual's socio-economic and attitudinal data (i.e. environmental concern and intention) for the Italian sample are reported in Valeri et al. (2016c), founding interesting similarities and differences across and within countries. For instance, for all the countries the annual cost of the policy, the decrease in pollution-related deaths, and the '*polluters pay more*' principle to distribute cost within the community are the drivers with a high impact on the stated policy acceptability. On the other hand, the policy drivers which present differences across countries are those related to the changes in the mobility and eating habits. They have been found not significant for specific countries (Italy and Poland). However, the in-depth analysis on the Italian sample that exploits better preference heterogeneity demonstrated that there is an important share of the sample sensitive towards personal engagement in term of changes in the mobility and eating habits.

3. Objective

The goal of this deliverable is to report an on-going activity aimed to create and implement a DSS to allow the *ex-ante* evaluation and comparison of potential air quality policies in term of individuals' preferences and acceptability. This is a further extension of the SEFIRA project.

The DSS is called **SEFIRA-E**nvironmental **P**olicy **P**references **E**valuation): **SEFIRA-EPPE**. The prototype version (v1.0) of the DSS works in Microsoft Excel. Next version will be created R code in a *Shiny* app.

4. Prototype description

The prototype has four spreadsheets in order to:

- enter in enter in the DSS (see the homepage in Figure 1).
- provide a brief description of the available leverages contained in the DSS (see Figure 2).
- set policy input in the DSS (see Figure 3)
- see the simulation results in different formats (see Figure 4).

Figure 1 – SEFIRA-EPPE: homepage (Pag. 1)

Figure 2 – SEFIRA-EPPE: Description of the policy leverages (Pag. 2 – Policy details)

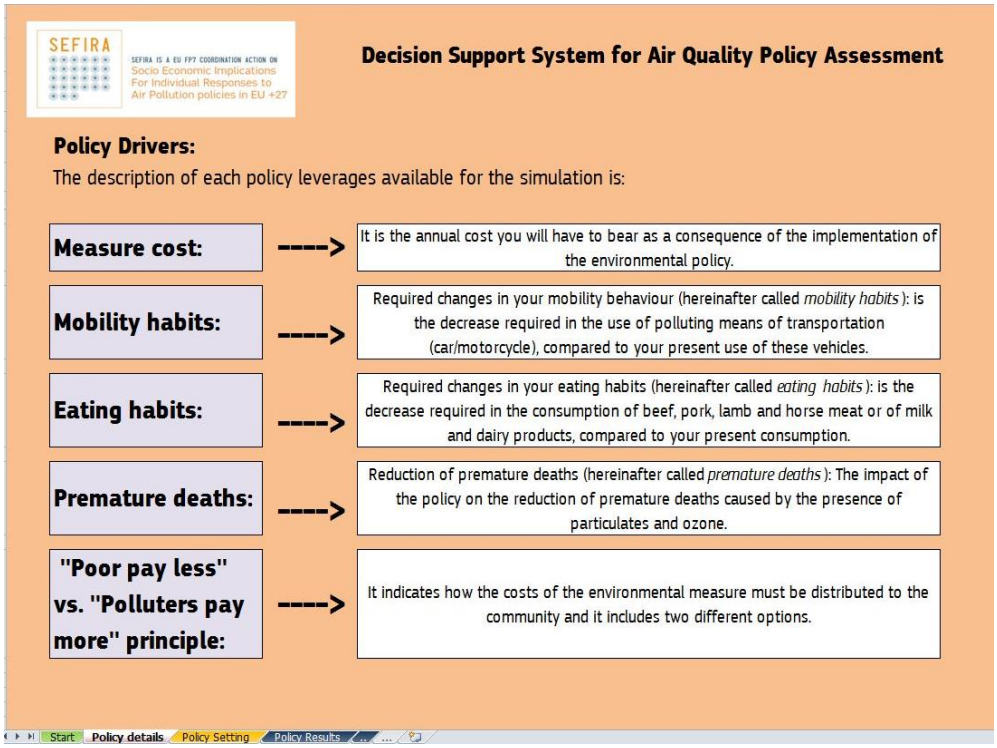


Figure 3 – SEFIRA-EPPE: How to set input for the policy simulation (Pag. 3 - Policy setting)

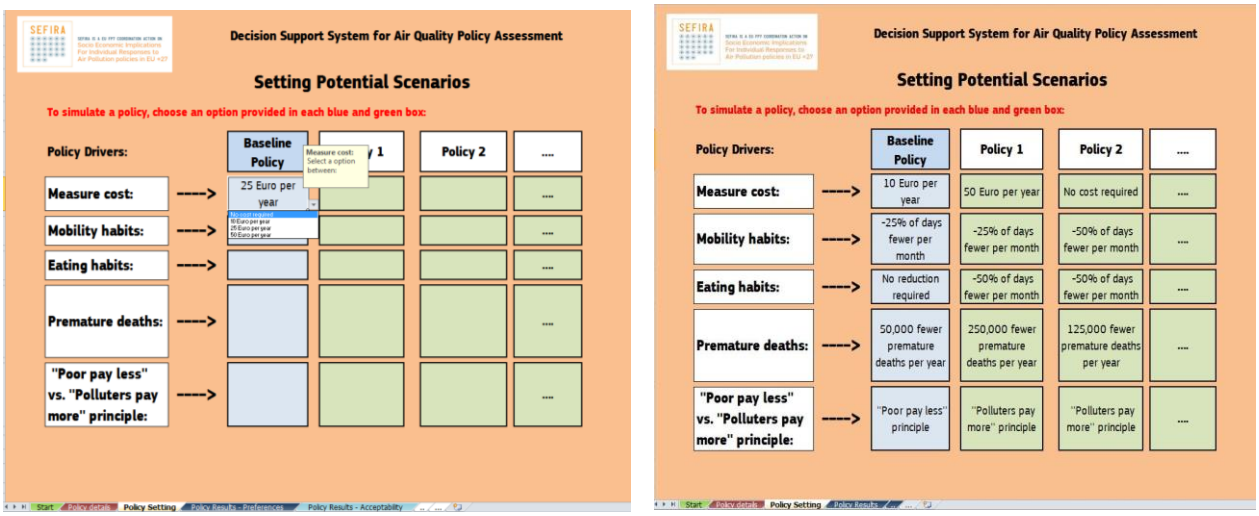
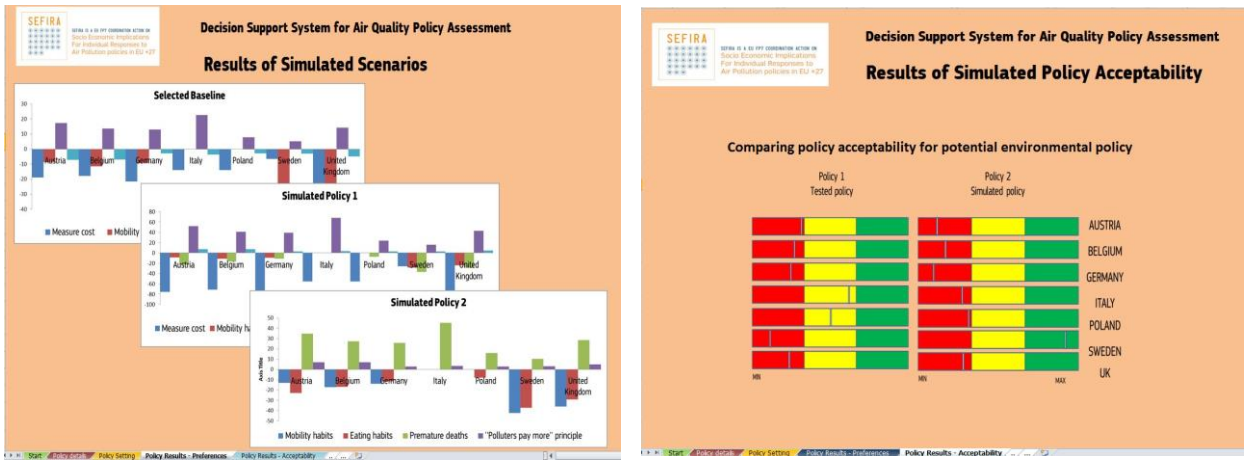


Figure 4 – SEFIRA-EPPE: How to visualise policy simulation results – different options (Pag. 4)



5. References

Avataneo, L., Gatta, V., Kazepov, Y., Maione, M., Polidori, P., Sergi, V., Valeri, E., 2014, Scientific methodological paper on the questionnaire preparation including willingness to pay estimates, Deliverable D.4.2, FP7 Cooperation Project SEFIRA, available at: http://www.sefira-project.eu/ad/deliverabless/.

Bennett J., Blamey R., (2001), The Choice Modelling Approach to Environmental Valuation, Edward Elgar publishing.

Daziano, R.A., Achtnicht, M., 2013. Forecasting adoption of ultra-low-emission vehicles using Bayes estimates of a multinomial probit model and the GHK simulator, *Transp. Sci.* 0(0), 1–13. http://dx.doi.org/10.1287/trsc.2013.0464.

Daziano, R.A., Bolduc, D., 2013. Incorporating pro-environmental preferences towards green automobile technologies through a Bayesian hybrid choice model, *Transp. A: Transp. Sci.* 9(1), 74–106.

Giardullo P., 2016, Social perception of Air Quality, Deliverable D6.7, FP7 Cooperation Project SEFIRA, available at: http://www.sefira-project.eu/ad/deliverabless/.

Hackbarth, A., Madlener, R., 2013. Consumer preferences for alternative fuel vehicles: a discrete choice analysis. *Transp. Res. Part D: Transp. Environ*. 25(0), 5–17.

Hensher, D. A., Rose, J. M., & Greene, W. H. 2005. Applied choice analysis: A primer. Cambridge, UK: Cambridge University Press.

Hoyos, D., (2010), The state of the art of environmental valuation with discrete choice experiments. *Ecological Economics*, 69(8), 1595-1603.

Hoyos, D., Mariel, P., Hess, S., (2015), Incorporating environmental attitudes in discrete choice models: an exploration on the utility of the awareness of consequences scale, *Science of The Total Environment*, Volume 505, 1 pp. 1100–1111.

Horne, M., Jaccard M.,Tiedemann, K., 2005. Improving behavioural realism in hybrid energy-economy models using discrete choice studies of personal transportation decisions, *Energy Econ*. 27(1), 59–77.

Valeri, E., 2013. Air and rail transport in the Rome-Milan corridor: competition policy implications based on a discrete choice analysis. PhD Thesis. University of Trieste. http://www.openstarts.units.it/dspace/handle/10077/9507.

Valeri E., Polidori P., Sergi V., Kazepov Y., Maione M., Amann M., Williams M., 2014, Investigation on the possibility of interaction between DCA and GAINS model, Deliverable D.4.1, FP7 Cooperation Project SEFIRA, available at: http://www.sefira-project.eu/ad/deliverabless/.

Valeri, E., Danielis, R., 2015. Simulating the market penetration of cars with alternative fuel/power train technologies in Italy. Transp. Policy 37, 44–56.

Valeri, E., Cherchi, E., 2016a. Does habitual behavior affect the choice of alternative fuel vehicles? *Int. J. Sustain. Transp*. http://dx.doi.org/10.1080/15568318.2016.1163445.

Valeri, E., Gatta, V., Polidori, P., Avataneo, L., Maione, M., Kazepov, Y., Sergi, V., Williams, M., Barratt, B., 2016b. Modelling Individual Preferences for Environmental Policy Drivers, Deliverable D.4.4, FP7 Cooperation Project SEFIRA, available at: http://www.sefira-project.eu/ad/deliverabless/.

Valeri, E., Valerio Gatta, Désirée Teobaldellic, Paolo Polidoric, Benjamin Barrattd, Sandro Fuzzie, Yuri Kazepovf, Vittorio Sergig, Martin Williamsd, Michela Maione, 2016c, Modelling individual preferences for environmental policy drivers: Empirical evidence of Italian lifestyle changes using a latent class approach, *Environ. Sci. Policy* (2016), http://dx.doi.org/10.1016/j.envsci.2016.05.019.