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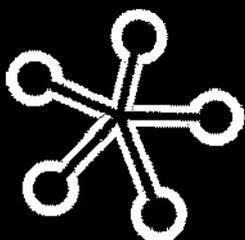
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Economic valuation in Web surveys; A review of the state of the art and best practices

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**Economic valuation in Web
surveys;
A review of the state of the art
and best practices**

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Abstract

This paper is a review of the currently existent economic valuation surveys (with stated preference methods) developed for and administered through the web. Valuation surveys that employ stated preference techniques are not particularly verbose about the details of their web development or administration. Web surveys for economic valuation are a new, interest raising field, given the worldwide continually increasing computer literacy and internet access. Currently most web valuation studies are concerned with the valuation of a topic of interest (mostly from environmental and energy economics) and hardly few, if any at all, are concerned with the experimentation on the web opportunities themselves and the effect they have on the results of the studies. The paper also presents the advantages of web survey and contributes to consolidating an informed state of the art for field practitioners, developers and reviewers of relevant papers.

Keywords: data; economic surveys; stated preference techniques; valuation; web;

1. Introduction

A survey is a research process to gather information on what people know, think, or do (Delavar, 2006). Surveys are conducted either by mail, telephone, web or personal interviews. The latter are divided into print surveys, face to face interviews using computer assisted personal interviews (CAPI) and self-administered online studies or computer assisted web interviews (CAWI). Face to face surveys provide good quality data with high response rates and high reliability but they are expensive and time consuming (Mulhern et al., 2013). CAPI is a middle mode survey category which is a mixture of a personal interview with computer tools. Web surveys are used for collecting answers on various topics such as health, social and economic behaviors, as well as voting intentions and consumer preferences (Bruggen and Dholakia, 2010). The marketing science uses web surveys to test various product or service concepts, customer satisfaction, and for branding evaluations. The first e-mail surveys began in the 1980s while the first web-based surveys began in the 1990s (Schonlau et al., 2001). Those were general marketing surveys and not economic valuation ones though.

1.1. Advantages of web surveys

In comparison to telephone surveys, web surveys produce more reliable data estimates, namely they have no interviewer effects and no transcription errors, while they also enjoy scope sensitivity (Nielsen, 2011). They additionally have a low delivery cost, more design options and are less time consuming than telephone surveys, even though they might not be appropriate for all survey research topics (Braunsberger et al., 2007). Speed of return for the completed web questionnaire ranges from 2-3 days for 80% of the responses, most of which are usually returned within the first 24 hours (Weber and Bradley, 2006). Also, web surveys require less data entry time and their design can be adapted so that not to permit the possibility for respondents to skip items, especially when this tactic harms the research quality (Couper et al., 2001). Another advantage of web surveys is that they give respondents time to think and they can be completed at a time of convenience for the respondents, without interrupting their daily routines (Marta-Pedroso et al., 2007). Online focus groups and chat rooms are also possible (Evans and Mathur, 2005) within this framework.

Internet facilitates the presence of a number of stimuli, such as visual effects and attractive fonts that prevent the attention of the interviewee from falling. Moreover, links can be inserted in web questionnaires so that, if a respondent clicks on a word or phrase, a window appears in which concepts or scenarios are further explained (van der Heide, 2008). The quality of web data can be safeguarded by posing a minimum completion time (Mulhern et al., 2013). This will

discourage respondents from answering too quickly, a fact that can affect the quality of their responses.

Survey reminders and invitations are also cheap and easy to send in web surveys. Through the web niche respondents can be reached with invitations and recruitment processes that cost much less than personal interviews. The cost for a web questionnaire completed through market research companies is estimated at 3US\$ or less per respondent, depending also on the research context (Balderas-Tores, 2012). Ladner et al. (2002) have reported the cost of the print survey to be eleven times higher than its web counterpart. Furthermore, a paper version of questionnaire may be inferior in terms of richness of the experimental design (Litvine and Wüstenhagen, 2011).

Notwithstanding web surveys being criticized for the fact that they cannot be perceived by computer illiterate people or non-users of the internet (Wansink, 2001), there are nevertheless positive elements in web surveying that cannot be overseen. For example, a web survey allows the use of interactive elements like graphics and flash animations in various parts of the questionnaire. Unlike to personal or telephone surveys, in web surveys it is more difficult to provide explanations of questions and exchange of ideas between respondents and the interviewer (Mac-Kerron and Mourato, 2009), or the elicitation format may seem difficult to understand, something which the personal interview is supposed to solve (Arrow et al., 1993). However, a well organized web survey can overcome or mitigate even such problems. For example, in Susaeta et al. (2011) the research company had included a toll free helpline providing assistance with survey questions to improve the respondent performance. There are also ways to communicate question clarity problems by indicating appropriate space for the respondents to write comments about their experience in understanding the survey (Tores et al., 2012).

Web implementation of a survey is also more successful for the investigation of sensitive or intimate topics such as health. Namely web surveys run less the risk of social desirability bias which refers to the situation where the respondent in a personal or telephone interview, provides those answers that will make him/her socially agreeable in front of the interviewer (Duffy et al., 2005). This is also reported as “warm glow” effects in environmental valuation surveys (Nunes and Schokkaert, 2003; Abbott et al., 2013), where respondents state that they are willing to pay a high amount for remedying an environmental problem, but the statement is not true. Also, web surveys tend to produce less extreme, more neutrally toned responses (Frippiat and Marquies, 2010). In addition to this, Willingness to Pay (WTP) in web-surveys has been found to be more conservative than in personal surveys (Marta-Pedroso, 2007).

1.2. Disadvantages of web surveys and possible remedies

However, Couper et al. (2007) warn that web survey respondents appear to be younger and their education and income situation is better than that of non-respondents. This finding is also partly verified in Mulhern et al. (2013) who find that their web sample over-represents educated people at least to a degree level. Therefore, web surveys are more successful in cases of universal use of computers and internet such as by students in a campus (Couper, 2000) or when the population is homogeneous, e.g. equally rich and educated, such as in some highly industrialized countries of Europe and America. Otherwise, web surveys run higher the risk of sample selectivity and representativeness bias. However, there is also research with evidence for the reverse situation. Namely that belonging to web respondents was not a necessary and sufficient condition for being educated or socially privileged, in countries with similar characteristics and equal internet penetration across social groups, such as the Netherlands (Goldenbeld & Craen, 2013).

On the other hand, web surveys are criticized for their lower response rate, about 10% compared to other survey types (Fan and Yan, 2010), although web surveys produce more complete and higher quality responses (Truell, 2003). Response rates for online surveys have fallen in the past years because they are no longer a novelty, their number has increased and the spreading of viruses and undesired spam-mails have contributed to a decrease in their popularity (Sanchez-Fernandez, 2012). To improve the low response rates, several means are used: incentives and gifts (Su et al., 2008), personalization of invitation (Sauermann & Roach, 2013), follow up contacts and the use of different modes of survey (Manfreda et al., 2008). For example, the more personalized the invitation for the research, the higher the response rate (Joinson & Reips, 2007).

Web surveys produce higher response rates when respondents are sampled from panels rather than when they are recruited at a one-off basis (Manfreda et al. 2008). According to Bruggen and Dolakia (2010), consumers' need for cognition, their curiosity, agreeableness, extraversion and conscientiousness plays a role in their joining a web panel. Therefore, leaving out attitudinal and psychological characteristics of the respondents and using strictly demographic weighs, when selecting web panels may lead to bias. Bruggen and Dholakia (2010) also discern between active non-respondents who actively decide not to respond and the passive non-respondents who neglect to answer or inform about changes in their details of communication. Not much research has been devoted, however, to examine the differences in characteristics between people who join web panels and surveys and diligently answer them, and those who do not join or participate (Tourangeau, 2004).

There are various pieces of research that deal with comparisons between the web survey and other survey types and provide evidence of result equivalence (Huang, 2006; Norman et al., 2010; Mulhern et al., 2013; Riechl et al., 2013). For example, the print version resulted in less missing observations in a school students survey (Denniston et al., 2010). A comparison between CAPI and CAWI is provided by Scasny and Alberini (2012). Furthermore, in a non-randomized mix mode design, web results were comparable with mail ones in a survey of alcohol use at eight U.S. colleges (MacKabe et al., 2006). While in web surveys, it might be useful to also allow the opportunity of print surveys (Hayslett and Wildemuth, 2004) or other forms of survey for people to choose, if they feel more comfortable with them.

Overall, it is understood that there are many factors (survey or respondent related) that may influence the response rate in all kinds of surveys, web ones included. The length of the survey is typically negatively correlated with the response rate (Kallantar and Talley, 1999; Jepson et al., 2005; Rolstad et al., 2011). The risk taking behavior of respondents may decrease the response rate (Kypri et al., 2009). The salience of the topic also affects the response rate. Aizaki et al. (2013) found that, without the interest of respondents in a topic, results will not necessarily show a positive change in respondents' valuation, despite the detailed information provided at the interview onset. It remains of high interest how to present web surveys, question writing, question ordering, and visual display of the web questionnaire. The first contact of the respondent with the survey also plays a role. Innovativeness and trust into the survey increase the response rate (Fang et al., 2009). Internet surveys run the risk of being perceived as spam and be rejected altogether (Fan and Yan, 2010). Yet, there is little literature examining all these issues in all types of survey and no literature to cover these aspects within the web context, according to our knowledge.

Particularly in the web context, appear other design issues whose effects are worthy of investigating. The speed of the internet, the number of survey questions, a friendly operating interface, enjoyment from the activity, general attitude towards information technology and the perceived usefulness constitute users' concerns when answering web surveys (Huang and Liaw, 2005). For example, the worth of providing all questions in one page (the so-called "scrolling design") versus "the screen by screen design" (Lindjem and Navrud, 2011; Schaik and Ling, 2003) in which respondents have to answer a group of questions and then move to another group of questions.

The scrolling design allows respondents a richer context within which to answer their questions, since they can better understand the whole framework and the rationale of the survey. Also, this design requires less computer time to contact with the web server (Dillman, 2007). The screen by screen design, on the other hand, allows respondents to skip questions, not applicable to them and given that it is divided in thematic groups, it induces respondents to give more

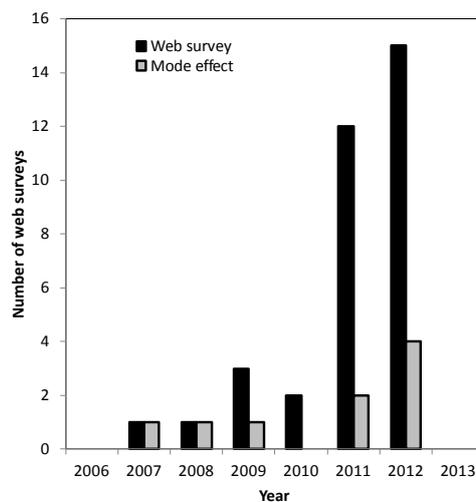
consistent responses (Peytchev et al., 2006). Furthermore, regarding design issues, Couper et al. (2001) noted that text-entry boxes were easier to skip than were multiple-choice versions and thus produced more missing data. Moreover, long entry boxes had more missing data than short entry boxes. Last, respondents may not concentrate on the meaning of the text on the screen but only read it superficially. They cannot preserve attention for long, if the survey is not sufficiently interesting or attractive, and they are very much influenced by graphics (Couper et al., 2004; Couper et al., 2007). Also, Nielsen (2011) suggests a high variance in the scope sensitivity in the web-based sample and therefore this aspect also needs further investigation in the future research on the field.

There is one review of web surveys held in 2001 (Schonlau et al., 2001) which refers to surveys generally and consequently has not taken into account the recent explosion of web valuation studies in economics. Our paper is an up-to-date review of economic valuation surveys using the web. Thus, we do not expand generally on web surveys, or the so-called “pop-ups”, although we refer to general surveys characteristics, their advantages and disadvantages in our introduction. The paper structure is as follows: Following this introduction, part 2 presents up to date web economic valuation studies with stated preference techniques, part 3 is a discussion centered on three issues: i) the sampling frame, the web panels and the problem of self selection, ii) the survey topics, design, visualization and implementation and iii) mixed mode effects in economic valuation surveys, part 4 deals with projections of the economic valuation in the era of the internet boom and part 5 is a conclusion.

2. Web surveys on economic valuation with stated preference techniques. A presentation and discussion

This part deals with the selection and analysis of the up-to-date economic valuation web surveys. We have searched bibliographic databases with keywords “valuation and online”, “valuation and web” and “web surveys and economics”. We have resulted in the collection of 39 surveys that use stated preference techniques such as contingent valuation or choice experiments. None of these studies have perused hedonic pricing, while only a couple of them indirectly used travel cost elements (Jorgensen et al., 2012; Veisten et al., 2012), but themselves were, in essence, contingent valuation studies and were also included in our studied sample as such. The collected studies are very recent and their publication dates range from 2007-2013 with the largest bulk of them published from 2011 onwards. This shows that web valuation studies are a new and interest raising area in the field of stated preference valuation. This web dimension is going to render valuation studies much cheaper but reliable, subject to careful design and validation. The increasing number of web surveys (black bars) on economic valuation, appearing in scholarly journals is presented in Figure 1 (2013 excluded). Also, mode effect studies (in grey bars) have an increasing tendency in 2011-2012 but overall they are fewer than the single mode web studies.

Figure 1 Web valuation studies from 2007-2012



Our purpose in this paper is to summarize these studies with reference to web development (topic, content, length, formatting, wording, ordering etc.) and web survey delivery (sampling method, invitation design, incentives etc.). Noteworthy is that none of the collected web surveys has been used to address methodological issues. Also, we have omitted online surveys that did not perform valuation, but were simple preference indicators such as for example Testa et al. (2012) or Broekx et al. (2013) that performed an assessment and not pure valuation.

The collected studies have been separated in two tables (Table 1 and Table 2). Table 1 includes web economic valuation studies perusing stated preference techniques, while Table 2 continues with including the same type of studies but with an additional caveat, namely the web studies that are compared with their personal, print, telephone or other survey form counterparts.

Table 1. Review of web stated preference economic surveys

Ref. Nu.	Study	Topic	Country	N	Method	Sampling frame/ web panel (company)	Incentive	Response rate
1	Abildtrup et al. (2013)	Forest recreation	France (Lorraine)	1837	CE	Internet panel of inhabitants in Lorraine	Lottery for 50 USB memory keys	2%
2	Aizaki et al. (2013)	Good agricultural practice label on packaged milk	Japan (Tokyo)	624	CE	Macromill research (company)	n/a	n/a
3	Axsen et al. (2009)	Hybrid-electric vehicles	Canada & USA (California)	535 & 408	CE	Hired company panel with quota sampling	n/a	14% & 2%
4	Bansback et al. (2012)	Health state	Canada	1157	CE	Market research (company)	Entry to prize draws	83%
5	Beville et al. (2012)	Impact of invasive alga on recreational angling	New Zealand	816	CE	Convenience sample from anglers who had provided an Email address	Lottery for fly rod or a 1000 NZ\$ fishing and hunting store gift certificate	n/a

Ref. Nu.	Study	Topic	Country	N	Method	Sampling frame/ web panel (company)	Incentive	Response rate
6	Broch et al. (2012)	Provision of ecosystem services	Denmark	842	CE	Local Danish farmer associations sent the questionnaire to their members	Three prizes of 135€	29%
7	Cai et al. (2011)	Climate change	USA & Canada	1850	CVM	College students recruited by 114 different instructors from classes at 92 different colleges and universities	n/a	n/a
8	Cameron and Deshazo (2013)	Assessment of major health risks	USA	11 & 385	CE	Knowledge Networks (company)	Free internet access plus 10US\$ for completing the survey	79%
9	Hidrue et al. (2011)	Electric vehicle choice	USA	3029	CE	Survey Sampling International (company)	n/a	n/a
10	Jensen et al. (2010)	Corn, switchgrass and wood residues	USA	1425	CVM	Knowledge Networks (company)	Points redeemable for cash	64%
11	Jorgensen et al. (2012)	Water quality improvements	Denmark	754	CVM	Internet panel administered by the GALLUP institute	n/a	37.68%

Ref. Nu.	Study	Topic	Country	N	Method	Sampling frame/ web panel (company)	Incentive	Response rate
12	Kim and Yeo (2010)	Value of personal information from the consumer's point of view	South Korea	985	CVM	Quota sampling	n/a	n/a
13	Loureiro and Loomis (2012)	Assessment of passive use values in large oil spills	Spain,UK & Austria	n/a	CVM	GMI-MR (company)	n/a	n/a
14	Li and Meng (2012)	Supply of urban forestry ecological service	China	n/a	CVM	China's E-government platform	n/a	n/a
15	Litvine and Wustenhagen (2011)	Preferences on renewable energy	Sweden	1163	CVM	Pre-survey by phone	n/a	4.9%
16	Lüthi and Wüstenhagen (2012)	Solar photovoltaic	Worldwide	63	CE	Photovoltaic project developers solicited by phone or e-mail, at a solar industry fair, by means of a solar industry journal	n/a	18%
17	MacKerron	Life satisfaction and air	UK	400	n/a	Convenience sample	n/a	n/a

Ref. Nu.	Study	Topic	Country	N	Method	Sampling frame/ web panel (company)	Incentive	Response rate
	and Mourato (2009)	quality	(London)					
18	McNair et al. (2011)	Overhead low-voltage electricity and telecommunications wires in replaced by new underground wires	Australia	1744	CVM & CE	Homeowners in the Australian capital territory	n/a	70%
19	Morse-Jones et al. (2012)	Tropical wildlife conservation	UK	6065	CE	Survey Sampling International (company)	n/a	35%
20	Moore et al., (2011)	Forest protection programmes	USA	897	CVM	Random digit dialling	10US\$ Amazon.com gift card	10%
21	Mozumder et al. (2011)	Renewable energy	USA	367	CVM	n/a	n/a	27%
22	Saelen and	Fuel taxation	Norway	1147	CE	Synovate (organisation or company) national	Winning one out of 5	45%

Ref. Nu.	Study	Topic	Country	N	Method	Sampling frame/ web panel (company)	Incentive	Response rate
	Kallbekken (2011)					internet panel of representative voter population	gift cards worth 1000 NOK each	
23	Schaafsma et al. (2012)	Environmental valuation with spatial heterogeneity	Netherlands	889	CE	n/a	n/a	n/a
24	Singh et al. (2012)	Health care interventions	UK	1030	CVM	Toluna (organisation or company) online panel	n/a	n/a
25	Solgaard and Yang (2011)	Fish welfare	Denmark	1000	CVM	Selected by chance via an automatically generated telephone number.	n/a	n/a
26	Susaeta et al. (2011)	Woody biomass based electricity	USA	204	CE	Knowledge Networks (company)	Incentives of 5UD\$ and 10US\$ were mailed to the respondents after completing the survey	67%
27	Veisten et al. (2012)	Casualty risk reduction	Norway	9489	CE	Synovate (organisation or company) national internet panel of representative voter	n/a	21.87% and



Ref. Nu.	Study	Topic	Country	N	Method	Sampling frame/ web panel (company)	Incentive	Response rate
						population		75.33%
28	Ward et al. (2011)	Green power Partnership for firms	USA	1395	CE	Knowledge Networks (company)	Points redeemable for cash	n/a

Note: CVM: Contingent valuation methodology; CE: Choice Experiment; n/a: Not available

Table 2. Review of comparisons of web economic surveys with other survey forms.

Ref. nu.	Study	Topic	Country	Modes	N	Methods	Sampling frame/Web panel	Incentive	Response rate
1	Balderas Tores et al. (2012)	Valuation of local forest carbon-services	Mexico	Personal Vs Online	332 & 473, 158	CE	i)Market stall session, ii) online snowball sample and online market research panel sample	Small present	n/a
2	Lacy et al. (2012)	Sustainability on business environment by Chief Executive Officers	Worldwide	Face-to-face Vs Online	100 & 766	n/a	Knowledge Networks (company)	n/a	n/a
3	Landry et al. (2012)	Impact of coastal wind turbines on tourism	USA (North Carolina)	Telephone Vs Online	361& 118	CE	University Research center	\$20 gift card	31% & 10%
4	Li et al. (2009)	Support for reducing reliance on fossil fuels	USA	Online Vs Telephone	916 & 1417	CVM	i)Survey Sampling International (company) ii)Random digital survey	n/a	n/a & 52.7%

Ref. nu.	Study	Topic	Country	Modes	N	Methods	Sampling frame/Web panel	Incentive	Response rate
5	Lindhjem and Navrud (2011)	Biodiversity protection plans	Norway (Oslo)	Personal (CAPI) Vs Online	398 & 645	CVM	TNS Gallup (company)	n/a	75.4% & 59.7%
6	Marta-Pedroso et al. (2007)	Landscape	Portugal	Online Vs Personal	192 & 230	CVM	Telepac internet service (company) subscribers	n/a	5.1% & 84%
7	Mulhern et al. (2013)	Health state	UK	Face-to-face Vs Online	201 & 221	CE	i) Knocking on 1 in every 10 doors ii) Existing internet panel	Lottery voucher (€ 40).	n/a
8	Nielsen (2011)	Gain in life expectancy in the context of air pollution	Denmark	Online Vs Personal	132 & 495	CVM	Individuals aged 30-70 fulfilling sampling quotas	None & Lottery for €40 voucher	40% & 70%
9	Reichl et al.	Assessing economic losses	Austria	Personal Vs	704 &	CVM	Market research center	n/a	n/a

Ref. nu.	Study	Topic	Country	Modes	N	Methods	Sampling frame/Web panel	Incentive	Response rate
	(2013)	caused by power outages		Online	190				
10	Scasny and Alberini (2012)	Mortality risk attributable to climate change	Czech Republic	CAPI Vs CAWI	2400 & 800	CE	IPSOS Tambor (company)	n/a	n/a
11	Van der Heide et al. (2008)	Habitat defragmentation	Netherlands	Personal Vs Online	252 & 301	CVM	Telder B.V. (company)	cash	87% & n/a

The few existent web economic surveys are silent about the particulars of their web set-up or about comparisons of different web formats. The word web taken apart, the studies do not comment on as much web dimensions as expected and their difference from personal or other types of studies does not become explicit. For example Lindhjem and Navrud (2011) mention that they do not use a scrollable design in their web questionnaire. Such details on web design per se would be valuable in future web studies.

In addition to this, to date studies do not explicitly refer to the Dillman (1998) principles for designing web surveys. This does not mean however that they have not followed these principles. It might be the case that they simply do not devote the space and effort to revealing this additional information in their texts. Only MacKerron and Mourato (2009) explicitly state that they have taken into account the Dillman (1998) principles. Also, Cameron and Deshazo (2013) provide reference for a detailed Handbook about their research set up and data analysis. Moreover, the latter report that, where appropriate, they have borrowed survey items from other large-scale surveys that had the opportunity to be well piloted and tested in the past. This option reduces possible errors of a new study and it is indeed a good and cost-efficient example to follow in some situations.

The rest of this section summarizes findings from the collected 39 studies and develops three sub-sections of discussion. The first is concerned with findings regarding the sampling procedures, the second part covers some issues relevant to the survey design and implementation and part three summarizes findings and trends from mixed mode studies.

2.1. The sampling frame, the web panels and the problem of self selection

First, it would be interesting to start from the sampling procedures followed in web economic surveys. How many of the surveys are probability ones and how many are non-probability ones (self selected panels)? With a probabilistic sample, the probability that the represented population is known and hence a decision can be made on whether results can be generalized for the general public. Loureiro and Loomis (2012) acknowledge the limitations of web surveys by stating that it is not unusual for non personal CVM survey samples to not precisely match their underlying populations. Nevertheless, most of the web economic studies at hand peruse web panels purchased from specialised companies, namely online marketing research companies (Aizaki et al., 2013; Bansback et al., 2012; Jensen et al., 2010; Loureiro and Loomis, 2012; Lacy et al., 2012; Li et al., 2009; Morse-Jones et al., 2012; Reichl et al., 2013; Cameron and Deshazo, 2013; Van der Heide et al., 2008; Axsen et al., 2009; Schaafsma et al., 2012; Susaeta et al., 2011; Ward et al., 2011; Hidrue et al., 2011; McNair et al., 2011) that claim to provide balanced and representative samples.

These research companies have automatic online research systems, which collect consumer response data on a variety of issues. They recruit panel members by random-digit dialling or by addressed-based sampling methods and by comparing panel membership to population distributions (Jensen et al., 2010). Panellists take a series of profiling surveys covering aspects such as demographics, house or car ownership, etc. This

information is used to filter matching profiles to the study requirements (Loureiro and Loomis, 2012). Personal and demographic data of panellists are updated at least annually for some companies (Ward et al., 2011) or even at a quarterly basis (Bethlehem and Biffignandi, 2012). A survey weight designed to compensate for non-response to the survey can be calculated for prostratification purposes. This is a method to make the data representative of the population, after they have been collected (Bethlehem and Biffignandi, 2012). Among others, research companies manage a series of research processes from questionnaire design to sampling tailored to the study needs. Other studies have used internet panels of their geographic areas of interest (Solgaard and Yand, 2011; Marta-Pedroso et al., 2007; Veisten et al., 2012; Abildrup et al., 2013; Jorgensten et al., 2012). Van der Heide et al. (2008) report that their panel comprises individuals who are paid to fill out questionnaires. Some other studies (Jorgensen et al., 2012) simply choose to collect an as large as possible number of respondents in order to render their sample as representative as possible.

Apart from the above mentioned surveys which even state the commercial company name to which data collection was assigned, the rest of the studies do not state clearly their data source, but they vaguely refer to some web panel which can be either an ad-hoc construction for the particular survey or an already existent online panel (Mulhern et al., 2013; Balderas Tores, 2012), university databases (Cai et al., 2011), local association databases (Broch et al., 2012; Lüthi and Wüstenhagen, 2012) governmental platforms (Li and Meng, 2012), or a sample based on the snowball technique (Balderas Tores et al., 2012). Other studies simply provide the rule perused for their sampling, e.g. quota sampling (Kim and Yeo, 2010; Nielsen, 2011; Saelen and Kallbekken, 2011) without expanding more on this. Also, Beville et al., (2012) and MacKerron and Mourato (2009), clearly state that they have used a convenience sample for their study, enriched with spatial data though. When the topic of a study is rare and interesting, and there are no other studies about it, even non representative samples can be accepted and welcomed as they produce the only available piece of valuation.

One of the major criticisms against web surveys is due to the fact that a number of people remain computer illiterate worldwide or do not have access to the internet. People with no access to internet are usually different from those who have, namely they are less educated, they are older, poorer or unemployed (Galesic et al., 2006). Therefore, the problem of self-selection (non probability samples) appears. However, there are some studies that appear to cope with this defect. As far as the lack of access to computers is concerned, Jensen et al. (2010) report that their research company provided for computers or specialised software (e.g. webtv) to people who were willing to participate in the survey, but were unable to do so, due to technical difficulties. Marta-Pedroso et al. (2007) also state that they guided their respondents to install a certain cookie that would prevent respondents from completing the questionnaire several times. In another survey (Schaafsma et al., 2012) respondents had been sent a unique link on which they clicked to embark on the survey. This link ensured that the same household could not answer the questionnaire more than once. In Moore et al. (2011), only 10% of respondents was reported not to participate due to lack of internet access. In developed and highly industrialized countries this percentage is very low. For instance in Denmark, 86% of the population has access to the internet (Stubble et al., 2011).

2.2. Topics, design, visualization and implementation

Regarding the valuation topics of the collected studies, most of them concern environmental issues (Balderas Torres et al., 2012; Loureiro and Loomis, 2012; Lacy et al., 2012; Solgaard and Yang, 2011; Cai et al., 2011; Broekx et al., 2013; Scasny and Alberini, 2012; Marta-Pedroso et al., 2007; Broch et al., 2012; Morse-Jones et al., 2012; Li and Meng, 2012; van der Heide et al., 2008; Moore et al., 2011; Schaafsma et al., 2012; Beville et al., 2012; Abildtrup et al., 2013; Jorgensen et al., 2012) and energy issues (Mozumder et al., 2011; Litvine and Wüstenhagen, 2011; Lüthi and Wüstenhagen, 2012; Axsen et al., 2009; Saalen and Kallbekken, 2011; Susaeta et al., 2011; Li et al., 2009; Landry et al., 2012; Reichl et al., 2012; Hidrue et al., 2011; McNair et al., 2011).

Few studies deal with health issues and the value of human life (Mulhern et al., 2013; Singh et al., 2012; MacKerron and Mourato, 2009; Veisten et al., 2012; Cameron and Deshazo, 2013; Bansback et al., 2012). The rest of them focus on a variety of diverse issues such as business sustainability (Lacy et al., 2012), the value of personal information (Kim and Yeo, 2010) and eco labelling (Aizaki et al., 2013; Ward et al., 2011).

As far as the geographical origin of the studies is concerned, it is mostly from Europe and America, except for Africa, from where we have no examples of web economic surveys. One study concerns New Zealand (Beville et al., 2012) and another concerns Australia (McNair et al., 2011).

Few studies (Ward et al., 2011; Marta-Pedroso et al., 2007) encompass reasonably enough information about the questionnaire. Few mention that they provided explanation at the beginning of the survey (Abildtrup et al., 2013) and some mention almost nothing about it (Kim and Yeo, 2010). Also few studies have published examples of their choice cards or photos, e.g. Landry et al., 2010; Schaafsma et al., 2012; while few others vaguely report on photo material which is not explicitly demonstrated in the paper such as in: Litvine & Wüstenhagen, 2011; Beville et al., 2012; Lindhjem & Navrud, 2011; Balderas Torres et al., 2012. Loureiro and Loomis (2012) avoided the inclusion of pictures of oiled species to avoid extreme psychological reactions but they claim to have included pictures of the affected areas.

Web surveys are basically based on a questionnaire hosted on the web but it is also possible to send a questionnaire attached to an Email. Researchers report that they sent an Email with a link to the questionnaire (Abildtrup et al., 2013; Broch et al., 2012; Jensen et al., 2010; Ward et al., 2011). Others telephoned to give the link (Landry et al., 2012), because a telephone survey took place prior to the web one. Moore et al. (2011) and Veisten et al. (2012) perused a phone-web survey and they invited people to participate through a screening phone call. This kind of study is reported less often.

Initial invitations are followed by Email reminders in two and four weeks (Abildtrup et al., 2013), or automatic Email reminders have been reported to be sent after three days (Jensen et al., 2010). In Marta-Pedroso et al. (2007) it is explicitly mentioned that except for the invitation itself, the Email explained that confidentiality would be guaranteed and expands more on the personalization of the invitation. Two reminders

were sent to obtain sufficient responses in Schaafsma et al. (2009). Litvine and Wüstenhagen, (2011) state that they sent their invitation to the survey as an insert to a paper bill.

Few of the economic studies have experimented on the particulars of web administration and the set-up of the questionnaire. This is a void that hopefully will be filled in the future. Regarding the web questionnaire layout, only in Marta-Pedroso et al. (2007) is the questionnaire screen described in more detail “it was a single page and the respondent moved up and down by means of the scroll bar, on the right-hand side of the browser... Drop-down menus were used ...”. Also in McNair et al. (2011) do they study the difference between one and multiple questions, where they find that multiple choice tasks decrease estimated of expected WTP. However, the latter does not exactly describe the web setup, since the same question could have been applicable for examination even through a personal interview. Last, some studies have explicitly attempted to study the order effects of the question posed in the questionnaire (Cai et al., 2011).

In addition to the above, some studies report the remuneration towards the respondent, for having completed a questionnaire: Abildtrup et al. (2013) report the chance to win one of 50 USB memory keys, Broch et al. (2012) state that respondents are eligible for three monetary prizes or receive incentive points redeemable for cash (Jensen et al., 2010; Ward et al., 2011). Also, monetary gift cards to local merchants were used as an incentive for respondents (Landry et al., 2012; Beville et al., 2012). The chance of winning one out of five universal gift cards (Saelen and Kallbekken, 2011; Mulhern et al., 2012), or simply cash incentives (van der Heide et al., 2008; Cameron and Deshazo, 2013; Susaeta et al., 2011; van der Heide et al., 2008), or an Amazon.com gift card (Moore et al., 2011), or entry to prize draws (Bansback et al., 2012;) or other small presents (Balderas Tores et al., 2012).

Few studies report that they explained respondents the usefulness of their answers. For example Cai et al. (2011) state that they explicitly said to respondents: “Your answers on this survey, when combined with those of other participants, will help decision-makers formulate better policies.” Non-response data were reported to be further analyzed in Jensen et al. (2010); Mulhern et al. (2013). Last, only in Marta- Pedroso et al. (2007) is it further explained what measures are taken so that one person cannot complete the questionnaire multiple times.

2.3. Mixed mode effects in economic valuation surveys

A mixed mode survey is a survey that concurrently or sequentially uses at least two of the existent survey modes. The interest in this section lies mostly on studies in which one of the modes is a web based interview. While the term mode refers to both the approach used to contact the respondent and the way the data are collected (Bethlehem and Biffignandi, 2012), here we are mostly interested on the former, although we have also found and included studies falling within the second group (Bansback et al., 2012). The latter use two different elicitation methods to produce health values.

The purpose of a mixed mode can be either simple experimentation, cross validation and an increase of the response rate with decreased costs (Couper and Miller, 2008). Balderas Torres (2012) report the cost of their personal interview to range from 8-20US\$ plus the gift given for remuneration of participation, while the web interview cost is a meagre 3US\$, which means that the cost of the personal interview is at least threefold compared to its web counterpart.

Eleven of the collected surveys in this paper include comparisons of the web survey with another format (Table 2). Comparisons of results from personal surveys and web ones, or telephone surveys with web ones, usually do not report significant differences between them (Berrens et al., 2002; 2003; Marta-Pedroso et al., 2007; Bansback et al., 2012; Lindhjem and Navrud, 2011; Nielsen, 2011; Reichl et al., 2013; Scasny and Alberini, 2012), although there is some research that reports the opposite (Balderas Torres et al., 2012; van der Heide et al., 2008). The former finding applies for most of the surveys we have collected in this review. For example, Li et al. (2009) and Landry et al. (2012) perform a telephone and web survey. The telephone survey takes place prior to the web one and comprises only the respondents who, in their telephone interview, state that they agree to participate in the web survey. Results show no evidence of any survey mode effects (telephone versus web samples) in Li et al. (2009).

Most of the surveys do not state whether they have left the choice of personal versus web interview to the respondent. Only Lindhjem and Navrud, (2011) explicitly state that they have not left this choice to the respondent. Also, some survey modes took place concurrently (Balderas Torres, 2012; Lindhjem and Navrud, 2011; Nielsen, 2011; Marta-Pedroso et al., 2007; Reichl et al., 2013; Scasny and Alberini, 2012; van der Heide et al., 2008) and others had a form of sequential approach with telephone (Landry et al., 2012) or personal interview (Lacy et al., 2012) taking place first.

Response rates in web surveys have been lower than any other mode. Marta-Pedroso et al. (2007) attribute the tremendously lower response rate in their web survey counterpart, to lack of follow up contacts. Some of the collected surveys are explicit about whether a unimode design is applied in questionnaires (Nielsen, 2009; Mulhem et al., 2013). Lindhjem and Navrud (2011) state that they have used an almost identical questionnaire in their two mode survey: "... they were as identical as practically possible". Completion time was reported to be shorter in web interviews (Lindhjem and Navrud, 2011) which can be attributed either to the time saved by not having to read aloud the questions or showing relevant pictures, but also can be attributed to satisficing, namely a situation that respondents answer superficially in order to avoid cognitive effort. Moreover, some of the two mode studies have taken place at the same time to ensure preference stability (Lindhjem and Navrud, 2011).

3. Projections of web economic valuation in the era of the internet boom

After the Exxon Valdez oilspill, a lot of discussion and research started in the USA about placing monetary compensation on passive use value. In the 90s, the NOAA (National Oceanic and Atmospheric Administration) panel through its Blue-ribbon testing protocol had underlined the importance of the personal interview for conservative and reliable estimates to be elicited in environmental or other non-market valuation surveys. The NOAA panel had also acknowledged the advantages of telephone surveys in terms of cost and central supervision (Arrow et al., 1993). However, according to Table 3, at that time, internet access was extremely low worldwide (World Development Indicators, 2012). With such low internet access levels, web surveys would certainly not have been considered at that time as a reliable means of preference elicitation.

Table 3. Internet users and broadband subscribers per 100 people (World Development Indicators, 2012)

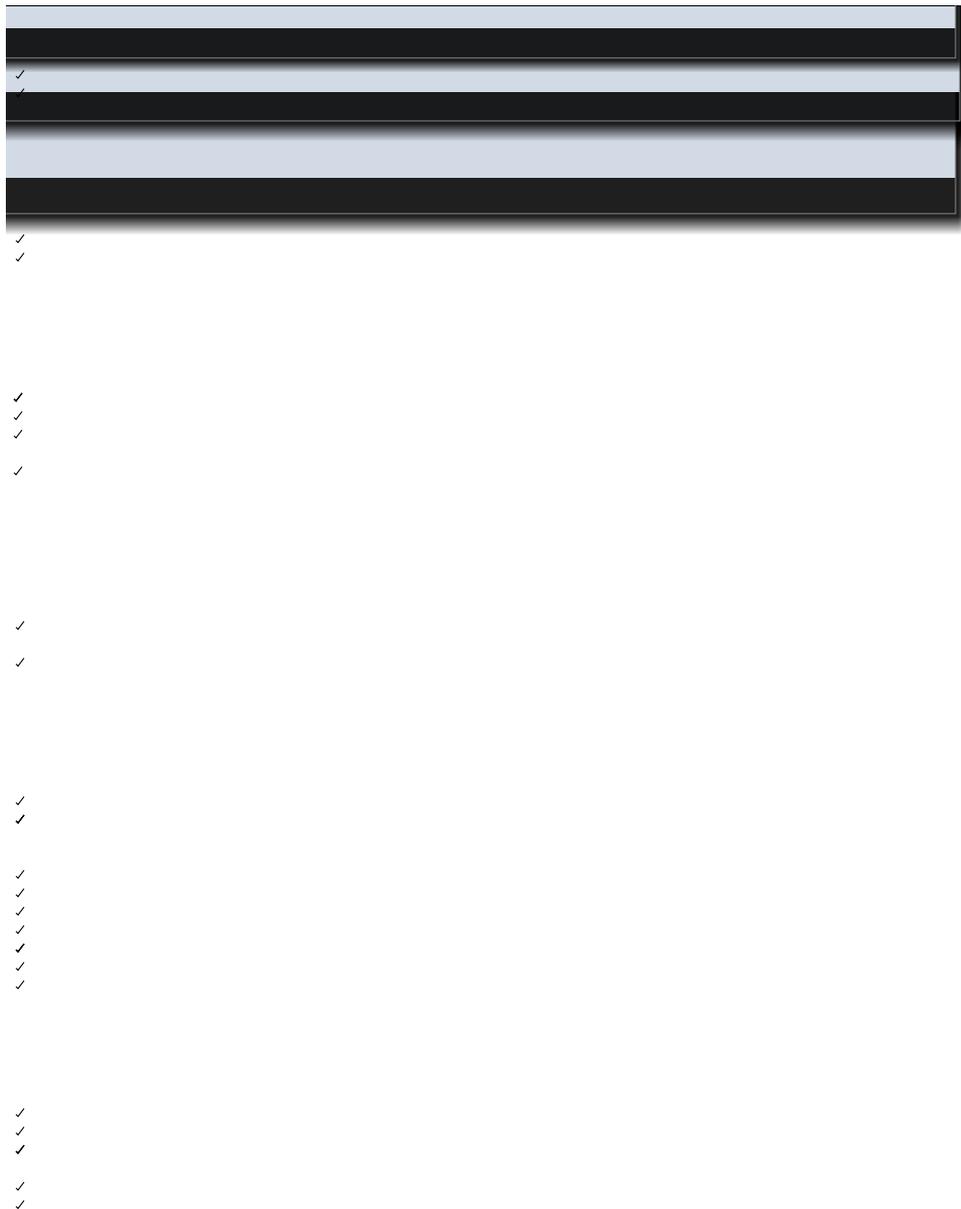
World region	Internet users					Broadband subscribers		
	1990	1995	2000	2005	2010	2000	2005	2010
European Union	0.1	1.6	20.6	51	70.8	0.4	12.2	25.9
Middle East & North Africa	0	0	1.7	9.5	25.2	n/a	0.9	2.4
South Africa	0	0.7	5.4	7.6	12.3	n/a	0.4	1.5
Sub-Saharan Africa	0	0	0.5	2.3	11.3	n/a	0	0.2
North America	0.8	8.7	43.9	68.9	75	2.7	17.7	27.9
Latin America & Caribbean	0	0.1	3.9	16.6	34.1	0	1.5	6.7
East Asia & Pacific	0	0.2	5.6	14.7	35.2	0.3	3.9	9.4
South Asia	0	0	0.5	2.5	8.1	0	0.1	0.7
Australia	0.6	2.8	46.8	63	75.9	n/a	9.9	24.1

New Zealand	0	4.9	47.4	62.7	83	0.1	7.8	24.9
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Broadband access (Table 3) is another factor that influences the propagation and proliferation of web surveys. Broadband access, through its high speed technology, ensures that more complicated downloads that contain even multimedia files, can be achieved. Data on fixed broadband internet subscribers are available only after 2000. Apparently, there is an increasing rate worldwide, but this is much higher in developed countries.

Based on the discussion in section 3, next we are going to summarize the key points on which web surveys are superior to the personal, telephone or mail ones. This is done in Table 4. In particular we would like to emphasize on how the web surveys contribute to solving major points reported in stated preference surveys as emphasized by the NOAA panel (Arrow et al., 1993). Figure 2 encompasses six boxes/groups each containing the advantages of web surveys in the various steps of the personal interview set up.

Figure 2 Web add-ins in the process of a typical economic survey



Generally, the same principles apply for question design between all types of surveys (e.g. length of question, avoid of double questions etc). Apparently, a higher level of detail can be obtained through the web implementation of a questionnaire. Web surveys are ideal when questions are sensitive and enter the private sphere of intimacy. Web surveys are supposed to suffer less from interviewer effects or warm-glow effects where the respondent has the tendency to give socially desirable answers. The web context allows for more and better allocation of information. An uninformed respondent might wish to expand on the information he gets by pressing on various links attached to the information pages. Accordingly, an informed respondent might wish to skip redundant information that will be a waste of time for him/her.

The most important criticism the web survey faces, is the low response rate. This can happen because of respondent absence from home, refusal to participate because of lack of interest, inconvenience or not being able to participate because of lack of access to computers and internet. This problem, also reported as undercoverage problem, can be met in other survey types too. For example telephone surveys suffer from an undercoverage problem, because of the current trend away from fixed landline phones to mobile ones (Galesic et al., 2006). To render a web survey reliable, it means that it must be shown that nonresponse is not selective. Other mechanisms can be employed to prevent or correct for status quo endorsement (when no interviewers are present, respondents tend to select the status quo situation), non-differentiation (respondents have the tendency to give the same answer for a set of questions), indifference to scope or arbitrary answering.

Table 4. Web survey comparison to other modes of survey

Parameter	Face-to-face (personal)	Telephone	Mail	CAPI	Web
Cost	5	2	3	4	1
Response rate	1	3	4	2	5
Design richness	2	3	3	1	1
Representativeness	1	2	2	3	4
Suitability for sensitive topics	5	3	2	4	1
Prone to warm glow effect	5	3	2	4	1
Data handling possibilities (e.g. input, transformation etc)	2	2	2	1	1

Note: Ranking ranges from 1-5, with 1 being the best performing and 5 the worst performing.

In Table 4, we have distinguished seven parameters that characterize survey modes. These parameters are the survey cost, response rate, design richness, representativeness, suitability for sensitive topics, tendency for warm glow effects, and data handling possibilities. The performed ranking is subjective. Starting from the cost parameter, web is the cheapest survey mode, followed by telephone, mail, CAPI and face-to-face interview. The CAPI bears the cost of personal interview, but this is lower than the face-to-face cost, because the CAPI saves the researcher the effort of data handling. Therefore, while face-to-face and CAPI are in essence both personal interviews, the latter enjoys some of the advantages of the web interview. Also, CAPI can be configured in two versions: One when the computer is operated by the interviewer (we will name this CAPIa) and one in which the computer is operated by the respondent with the guidance and supervision of the interviewer (we will name this CAPIb). The latter sub-version will also provide a more discrete framework for the respondent.

As regards the second parameter, namely the response rate, this is the highest for the face-to-face interview and the lowest for the web interview. The CAPI might have a smaller response rate if it is administered as a CAPIb version. Telephone response rate comes after the CAPI and is also higher than the mail rate, because the telephone interview has some of the human interaction also present in the face-to-face interview.

The web framework is innate with design richness (drop down menus and information that is produced instantly with a click) and therefore it is ranked first together with CAPI. Face-to-face interview comes second while telephone and mail come third, since the telephone surveys do not allow visual contact

with the questionnaire. Also, the mail survey does not allow complicate interaction with the survey administrator and burdens the respondent with the responsibility of skipping irrelevant items and preserving the correct series of answers or to seek and understand the information necessary to answer.

Representativeness is currently the lowest in the web survey followed by the CAPI, due to the fact that internet penetration and internet skills level, albeit rising, is still low and not equal in all educational and income levels throughout the world. Face-to-face interview has the highest representativenss, while telephone and mail surveys are positioned in the middle of the ranking scale, because there are still people in the world that do not have a telephone at home or they do not feel the importance and the obligation of filling a questionnaire and to mailing it back to the survey administrator.

Undoubtedly, types of survey that do not demand interaction with the interviewer are the most appropriate for intimate questions. While naturally, web comes first in this ranking, the face-to-face comes last, because there is immediate contact and listening by the interviewer. Mail comes second because it, too, is an impersonal survey mode. Telephone mode comes third, because there is an interlocutor at the other line end. The same ranking might apply for warm glow effect tendency, which is expected to be stronger in survey modes that allow direct contact with the interviewer.

Last, a variety of possibilities opens for data handling when the interview is held in a web context (web or CAPI mode). Web survey answers have direct input to spreadsheets, with minimum time and effort, thus enabling various transformations and handlings for the data. The rest of modes receive the same ranking of this quality. The face-to-face mode provides explicit answers to the interviewer, who after the interview will have to input the answers manually into a spreadsheet. The mail mode might leave the survey administrator with some doubt, when the respondent gives vague answers. This means that the question answer comes as “non-available” or has to be decodified and then classified accordingly by the administrator. This effort is less in the telephone mode, where the interviewer keeps contact with the respondent and might ask further explanation by the respondent, when appropriate.

4. Conclusion

With the number of internet users continually increasing, a serious potential and the advantages of web surveys cannot be overseen. Since their cost is much lower compared to other survey forms, further research that will optimize their performance and solicitation is necessary, since the major criticisms against web surveys are non-coverage and non-response. However, web surveys are reliable in that they cancel out various effects present in personal, telephone or other survey forms such as interviewer effects and warm glow effects which the respondent has the tendency to give socially desirable answers (e.g. health or environmental habits). It is of critical importance to collect not only balanced demographic data but psychological ones as well. Web surveys may allow skipping patterns which reduce respondent fatigue and thus improve data quality. Besides the careful questionnaire design, web delivery issues must be catered for such as the correct sampling frame, contact delivery modes, invitation, reminders and incentives.

Given the declining response rates of the web surveys, it is important to make web surveys a memorable experience for the respondent to participate. The survey must be as good as possible, interesting, not tiring and must be trusted that will bring a change for the good. Tokens of thankfulness such as personalized birthday cards or small objects, e.g. a trinket can increase respondent satisfaction and thus his probability of being a recurring respondent in other surveys. Overall, since most of the drawbacks of web surveys are related to undercoverage and nonresponse, correct recruitment of web panels is vital. For example face-to-face recruitment could enhance and safeguard the quality of a web panel.

While internet access is growing, in most countries it is still at low levels and people have it in workplace rather than at home, which makes it harder to participate in this research. Also respondents have to access internet with dial up connections and sometimes different screen configurations which produce questionnaires in a confusing way versus to broadband connections available at workplace usually with monitors of the latest technology. Mixed mode and triangulated surveys might be a good idea to gauge disputes between web and other forms of survey. Web surveys cannot be altogether condemned because of their undercoverage or nonresponse bias. There are solutions such as launching mixed mode surveys for participants to choose with what mode to participate. Also, some surveys provide respondents with internet access and hotlines for information. After all, given that web survey solicitation strategies have not yet been fully developed, comparisons of web survey response rates with those of other forms of survey would not be fair.

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