

TI 2019-024/V  
Tinbergen Institute Discussion Paper

# An introduction to Participatory Value Evaluation

*Niek Mouter<sup>1</sup>*

*Paul Koster<sup>2</sup>*

*Thijs Dekker<sup>3</sup>*

<sup>1</sup> Delft University of Technology Faculty of Technology, Policy and Management, Transport and Logistics Group

<sup>2</sup> Vrije Universiteit Amsterdam, School of Business and Economics, Department of Spatial Economics and Faculty of Humanities, John Stuart Mill College

<sup>3</sup> Institute for Transport Studies Leeds and Choice Modelling Centre, University of Leeds

Tinbergen Institute is the graduate school and research institute in economics of Erasmus University Rotterdam, the University of Amsterdam and VU University Amsterdam.

Contact: [discussionpapers@tinbergen.nl](mailto:discussionpapers@tinbergen.nl)

More TI discussion papers can be downloaded at <https://www.tinbergen.nl>

Tinbergen Institute has two locations:

Tinbergen Institute Amsterdam  
Gustav Mahlerplein 117  
1082 MS Amsterdam  
The Netherlands  
Tel.: +31(0)20 598 4580

Tinbergen Institute Rotterdam  
Burg. Oudlaan 50  
3062 PA Rotterdam  
The Netherlands  
Tel.: +31(0)10 408 8900

## Title: An introduction to Participatory Value Evaluation

**Authors:** Niek Mouter<sup>1\*</sup>, Paul Koster<sup>2,3</sup>, Thijs Dekker<sup>4</sup>.

<sup>1</sup> Delft University of Technology Faculty of Technology, Policy and Management, Transport and Logistics Group. Email: n.mouter@tudelft.nl.

<sup>2</sup> Vrije Universiteit Amsterdam, School of Business and Economics, Department of Spatial Economics. Email: p.r.koster@vu.nl.

<sup>3</sup> Vrije Universiteit Amsterdam, Faculty of Humanities, John Stuart Mill College. Email: p.r.koster@vu.nl.

<sup>4</sup> Institute for Transport Studies Leeds and Choice Modelling Centre, University of Leeds. Email: t.dekker@leeds.ac.uk.

\* Corresponding author: Niek Mouter: n.mouter@tudelft.nl

**Abstract:**

Cost-Benefit Analysis (CBA) for public policies assumes ‘consumer sovereignty’, implying that impacts of government projects can be valued by aggregating individuals’ private willingness to pay. However, individuals’ private willingness to pay might not reflect their preferences towards public policies. Participatory Value Evaluation (PVE) is a novel evaluation approach which rectifies this limitation of CBA. PVE establishes the social welfare effects of government projects through the elicitation of individuals’ preferences over the allocation of public budgets as well as their net income. The most important innovation of PVE is therefore that the approach goes beyond the paradigm of ‘consumer sovereignty’ by starting from the assumption of ‘citizen sovereignty’. This paper positions PVE relative to past innovations in applied welfare economics and illustrates the potential of the approach through a case study on flood protection schemes in the Netherlands.

**1. Introduction**

In western countries, Cost-Benefit Analysis (CBA) is nowadays considered the gold standard for supporting public decision-making (e.g. Boardman et al. 2013). In virtually all western countries CBA is mandatory when national funding is required for large transport projects (Mackie et al., 2014). CBA is also widely applied to governmental decisions on environmental, health and safety regulation (e.g. Hahn and Tetlock, 2008). The theoretical foundations of CBA are rooted in welfare economics which is a branch of economics that investigates the social desirability of alternative economic outcomes (e.g. Boadway and Bruce, 1984). A CBA is built on the Kaldor-Hicks efficiency criterion (e.g. Boadway, 2006), which recommends projects where the sum of monetary gains outweigh the sum of monetary losses and winners can potentially compensate the losers. In a CBA, positive and negative impacts of government projects are valued by estimating private willingness to pay (WTP) and by assuming that private preferences should be respected. This paradigm is called ‘consumer sovereignty’ (e.g., Boadway, 2006). The paradigm of consumer sovereignty is fiercely criticized in the literature (e.g. Ackerman and Heinzerling, 2004; Sagoff, 1988). Several scholars argue that ‘consumer sovereignty’ takes a too narrow perspective when evaluating government projects arguing that individuals’ private choices might not reflect their preferences towards public policy (e.g. Ackerman and Heinzerling, 2004; Sen, 1995).

Participatory Value Evaluation (PVE) is a novel evaluation approach specifically designed to go beyond the paradigm of ‘consumer sovereignty’ by starting from the assumption of ‘citizen sovereignty’. PVE infers the social welfare effects of public policies through eliciting individuals’ preferences over the allocation of public budgets as well as their net income. In a PVE, individuals are conceptualized as co-owners of the government instead of consumers of public goods. Citizens are then asked to choose the best portfolio of projects with corresponding impacts for society and themselves given a governmental budget constraint. Subsequently, PVE establishes the social welfare effects of government projects through advanced behavioral choice modelling (Dekker et al., 2019). This paper positions PVE relative to past innovations in applied welfare economics and illustrates the potential of the approach through a case study evaluating the social welfare effects of flood protection schemes in the Netherlands. In this case study, two PVE experiments were conducted. First, a ‘fixed budget PVE’ in which citizens were asked to select their optimal portfolio of projects given a governmental budget constraint of 700 million euros. Second, a ‘flexible budget PVE’ in which citizens could adjust the governmental budget by increasing the tax per household or by selecting a rebate. In total 2,900 respondents

participated in the experiments. In both experiments participants were not forced to decide, but had the option to delegate their choice to an expert or a group of fellow citizens.

## **2. Participatory Value Evaluation: the next step in the evolution of applied welfare economics**

PVE can be conceived as a major advancement in the evolution of applied welfare economics. To illustrate this, we highlight the innovations of PVE in relation to past innovations in applied welfare economics.

The first examples of CBA can be found in the work of French engineers whose cost-benefit computations stretch back to before the French Revolution and flourished in the mid-nineteenth century with contributions of Jules Dupuit (Persky, 2001). In the early years, a CBA only investigated social costs and benefits of government projects based on the WTP of affected individuals (Persky, 2001). Over the course of time, also the WTP of citizens who are not directly affected by a government policy was included in CBA (Arrow et al., 1993). For instance, a recent CBA regarding regulation involving building access for people who use wheelchairs, also includes the WTP of nondisabled Americans for such access (Posner and Sunstein, 2017). Typically, analysts derive estimates of the monetary impacts of government projects directly from market behaviour. Impacts of government projects are, amongst other things, evaluated through investigating the private decisions people make when buying a house. For example, Koster and van Ommeren (2015) estimate the impact of earthquakes on housing prices and use these estimates to draw conclusions about the non-monetary costs of being exposed to the risk of earthquakes resulting from gas extraction. However, when market information is absent, the value of public goods can be estimated using survey techniques such as contingent valuation (e.g. Carson, 2012).

The most prominent critique on the established approach is that individuals' private WTP may not reflect how they want public policies to change (Sen, 1995; Lusk and Norwood, 2011). For instance, in the case of animal welfare, people may not be willing to contribute individually to the public good because they view the impact of their individual contribution as negligible. People may, however, be willing to contribute when the whole community does so because the impacts of coordinated efforts can be substantial (Kling et al., 2012; Sen, 1995). An explicit example provided by Lusk and Norwood (2011) describes how Californians voted overwhelmingly in support of a ballot prohibiting battery-produced eggs, which at the time of the vote were the most popular type of eggs purchased and consumed in California. Scholars also argue that individuals' private consumer choices might not reflect their preferences towards public policy because moral considerations might be more salient in the latter context (e.g. Sagoff, 1988; Sunstein, 2005). Sunstein (2005, p.355) states: "willingness to pay is sometimes an inappropriate basis for environmental policy. Human beings are citizens, not merely consumers, and their consumption choices, as measured by willingness to pay, might be trumped by their reflective judgments as citizens." Sagoff (1988, p. 48) asserts that: "many of us are concerned, for example, that the workplace be safe and free of carcinogens; we may share this conviction, even if we are not workers. And so, we might favour laws that require very high air-quality standards in petrochemical plants. But as consumers, we may find no way to support the cause of workplace safety. Indeed, if we buy the cheapest products, we may defeat it. We may be concerned as citizens, or as members of a moral and political community, with all sorts of values – sentimental, historical, ideological, cultural, aesthetic, and ethical – that conflict with the interests we reveal as consumers, buying shoes and choosing tomatoes. The conflict within

individuals, rather than between them, may be a very common conflict. The individual as a self-interested consumer opposes himself as a moral agent and a concerned citizen”.

In an attempt to ameliorate the issue discussed above, impacts of government projects have been evaluated through individuals’ collective WTP. Nyborg (2000, pp. 311) describes the valuation question in such experiments as: “what is the maximum amount, that I believe, everybody should pay, to ensure this government project?” Various authors also recommend inferring collective WTP through referendum-style experiments, where the implied implementation criteria would be the majority rule (e.g. Arrow et al., 1993). These referendum-style experiments concern impacts for the entire community which solves the coordination problems from which private WTP suffers. Moreover, such experiments facilitate people to include (moral) considerations regarding the way government should trade off burdens and benefits of public policies because they are asked to answer the WTP question in a voting booth setting.

Despite its virtues, the shift from private WTP to collective WTP does not solve all criticism in the literature regarding WTP-based CBA. A remaining criticism relates to CBA’s postulation of ‘consumer sovereignty’ which involves that the utility individuals derive from effects of government projects financed using general revenues can be measured through the number of euros that households are willing to pay from their after-tax income (e.g. Boadway, 2006). Consumer sovereignty is only a defensible principle for the evaluation of such projects when it does not matter whether governmental projects are financed with private or public euros. The implicit assumption is then that both types of budgets cannot have a different purpose. A crucial issue is that ‘complete fungibility’ does not fit with what is observed in reality (e.g. Thaler, 1999; Tversky and Kahneman, 1981). When private euros and public euros can have different purposes, WTP-based valuation is no longer useful for the evaluation of government projects that are financed from public revenues.<sup>1</sup> Instead, the welfare effects of such projects should be inferred from individuals’ preferences regarding the expenditure of public euros thereby replacing the postulation of ‘consumer sovereignty’ by ‘citizen sovereignty’ which could be elicited in a context in which individuals make choices when faced with effects accruing from alternative allocations of government budget (e.g. Mouter et al., 2017, 2018).

This so-called ‘willingness to allocate public budget’ approach (WTAPB) also alleviates four other critiques regarding WTP-based valuation. A first criticism is that WTP-based valuation violates the democratic principle of one-person-one-vote (OPOV) involving that every citizen receives the same weight in public decision-making (Nyborg, 2014; van Wee, 2012). A WTP-based CBA requires that everything is counted in money resulting (all else being equal) in a higher weight for people with higher incomes (Nyborg, 2014). Posner and Sunstein (2017) reply to this critique through arguing that this one-euro-one vote (OEOV) aggregation schedule aligns with how a market economy works. Nyborg (2014) states, however, that OEOV is an acceptable principle in the market place, but in her view, the fact that OEOV may result in a systematic bias in favor of those with high incomes is a rather strange ethical position in democratic societies, especially in the absence of redistribution of the net benefits of public policies. Theoretically, this problem can be rectified within a WTP-based framework through deriving individuals’ marginal utility of income and incorporate distributional weights in the

---

<sup>1</sup> Importantly, government policies which only impose costs on the private sector (and not on public revenue) should be evaluated using WTP-based valuation. One example is the Dolphin Protection Consumer Information Act which provides labelling standards by which companies may label their tuna products “dolphin safe” (Posner and Sunstein, 2017).

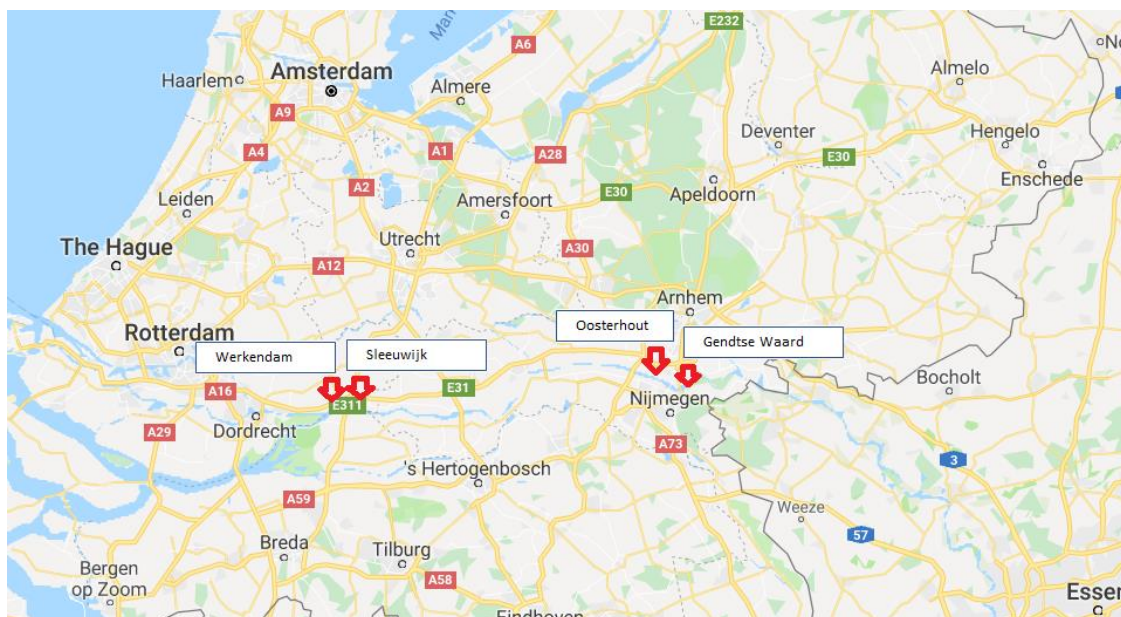
analysis, but this is almost never done in practice except in climate change economics where weights have been used to account for different income levels across countries (see Nurmi and Athianen, 2018 for a recent overview). A virtue of the WTAPB approach is that citizens' social welfare functions are directly measured and that preferences can be aggregated using OPOV (Dekker et al., 2019). The direct measurement of social welfare functions gives the opportunity to rank public projects. This circumvents the criticisms raised against the 'potential compensation principle' underlying CBA (Nyborg, 2014; Sen, 2017). Second, WTAPB bypasses the concerns that WTP-based valuation is an unsuitable way to value impacts of government projects that are incommensurable with private income (Aldred, 2006). For instance, Sunstein (1993) argues that values that are not traded in a real-life market setting, such as free speech, biodiversity and landscape might be valued in the wrong way when they are expressed in private income. Raz (1986) argues that values such as friendship and our relationship with the natural world, cannot be valued in terms of private income without somehow corroding or degrading them. Crucially, WTAPB does not require translation of government project impacts into private income. Instead, an impact of a government project is valued through the extent to which individuals are willing to sacrifice other impacts of government projects. For instance, in a WTAPB experiment, individuals are asked to trade-off environmental impacts against other impacts of governmental policy (e.g. reduction of mortality risk) which contrasts the WTP approach in which individuals are asked to trade-off environmental impacts against private income. Third, WTAPB does not suffer from protest responses of individuals who report a zero WTP because they believe that the public good should be financed from (a re-allocation of) existing governmental budget which is a well-known problem with WTP-based stated preference studies (e.g. Howley et al., 2010; Stevens et al., 1991). In a WTAPB experiment, respondents are asked to make choices when faced with effects accruing from alternative allocations of existing budgets. Hence, the problem that respondents protest because they think that the government should pay from (a re-allocation of) existing revenue is non-existent. Fourth, the WTAPB approach might decrease hypothetical bias which is a longstanding issue of stated preference studies (Hausman, 2012; Kling et al., 2012). There is an increasing literature which establishes that hypothetical bias can be circumvented when respondents believe that their choices in a survey might have consequences in real life (e.g. Vossler and Evans, 2009; Zawojka and Czajkowski, 2017). In our view, it is easier to convince respondents, in a WTAPB experiment, that the government will use the results of the experiment in their decisions concerning the (re)allocation of public budget than that government policy will be influenced by filling-out a questionnaire based on private willingness to pay with (hypothetical) payments from their after-tax income.

Even though WTAPB solves some critiques, advancements can still be made by establishing the value of impacts of government projects through a Participatory Value Evaluation (PVE). The first strength of PVE over WTAPB is that individuals are enabled to evaluate impacts for themselves and impacts for others in one experiment. PVE gives individuals the opportunity to sacrifice own benefits for the common good. Second, PVE facilitates far-reaching participation of citizens in the evaluation and design of collective policies which can improve procedural justice (Frey et al. 2004). Third, participants in a PVE can select a portfolio of projects among the many portfolios that are possible within the budget, including the option of doing nothing, and adjust the governmental budget by adjusting taxes. This contrasts with WTAPB experiments in which respondents can only choose between two or three alternative allocations of tax (Johansson-Stenman and Martinsson, 2008; Mouter et al., 2017). Fourth, PVE

experiments are more realistic than WTAPB experiments because the latter approach requires that respondents choose between tax allocations which demand the same investment of public budget which is not a requirement in a PVE. Fifth, participants of a PVE are not forced to make a choice but can also delegate their vote to an expert or to other citizens. Therefore direct democratic decision making is not imposed by the researcher resulting in a mixture of direct democracy and representative democracy. Finally, participants in a PVE are asked to motivate their choices for each project they select. The qualitative statements can uncover impacts and considerations which drive citizens' preferences regarding a project, that policy makers were unaware of prior to the completion of the PVE. Policy makers can also use citizens' qualitative statements when communicating their decisions.

### 3. Case study: A PVE for the Dutch Ministry of Infrastructure and Water Management

The first application of PVE worldwide investigates the societal costs and benefits of a flood protection scheme of the Dutch Ministry of Infrastructure and Water Management. The scheme focused on a trade-off between two types of projects to mitigate flood risks at locations along the Dutch river 'de Waal' which do not meet the prescribed safety standards. The first type of project is simply strengthening the dikes (henceforth: 'classical project'). The second type of project involves strengthening the dikes to some extent combined with measures to give the river space to flood safely (henceforth: 'combination project'). The two types of projects have an equal impact on mitigating flood risks and are characterized by several societal impacts (e.g. costs, impact on biodiversity, impact on recreation and number of households that need to relocate). The combination project increases recreation opportunities and biodiversity but is more expensive. In the PVE, citizens are asked to allocate a budget of 700 million euros. On four locations alongside the river 'de Waal' citizens must choose between a 'classical project' and a 'combination project' (Figure 1 depicts these four locations). A demo version of this PVE can be found online: [pve.splicedgene.com/pve-flood-protection](http://pve.splicedgene.com/pve-flood-protection). In case there is governmental budget left, they can spend it on six other projects that fall within the remit of the Dutch Ministry of Infrastructure and Water Management (two road projects, two projects mitigating damage from heavy rainfall, and two projects reducing flood risks beyond current safety standards).

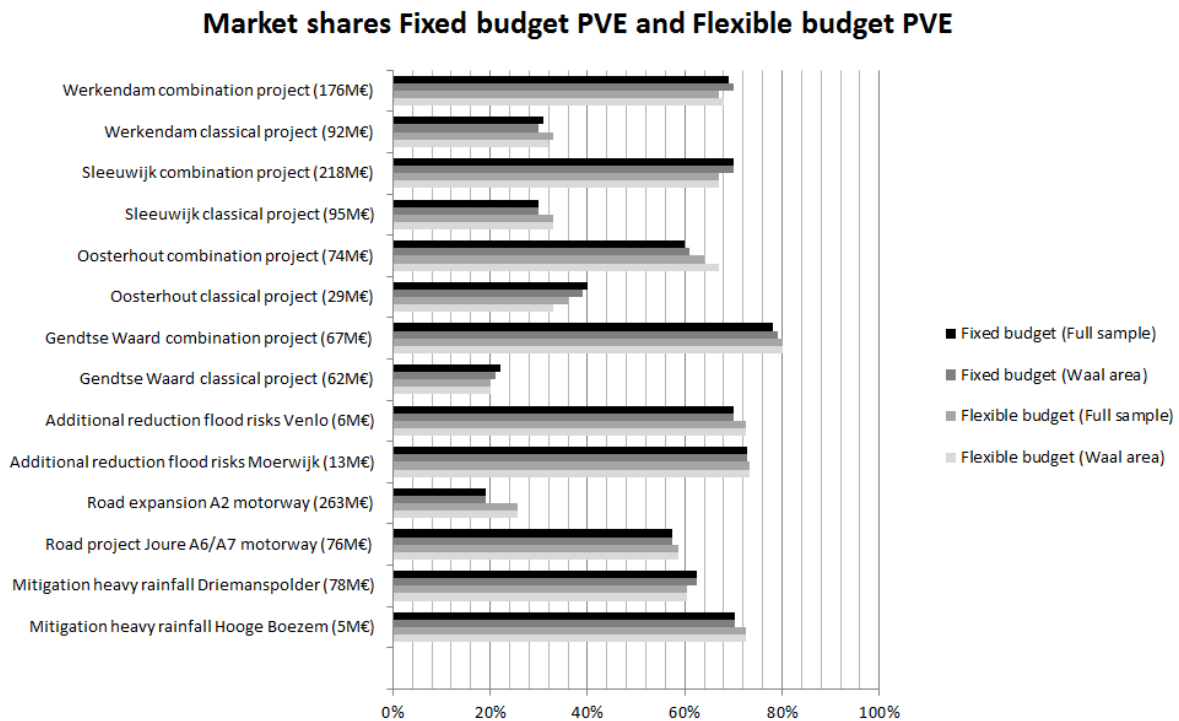




**Figure 1: The four locations on which respondents have to choose between a ‘classical project’ and a ‘combination project’.**

Two PVE experiments were conducted. First, a ‘fixed budget PVE’ in which citizens were asked to choose the optimal portfolio of projects given a governmental budget constraint of 700 million euros. Any remaining budget was shifted forward to the next year. Second, a ‘flexible budget PVE’ in which citizens could adjust the governmental budget by increasing the tax per household or by selecting a rebate. Both experiments were conducted in a web-based environment.<sup>2</sup> In this environment, respondents could sort and compare the projects by one of the impacts, and find out more about the (impacts of) projects through clicking on an information button. Respondents could delegate their decision to an expert. In the flexible budget PVE respondents could also delegate their choice to a representative group of Dutch citizens or a group of representative citizens from the villages at the four locations. In case respondents delegated their choice, they received a lower financial compensation from the survey company. The delegates also conducted the experiment. When citizens delegated, their choice was replaced by the choice of the selected delegate.

2,900 respondents participated in the experiments out of which 937 respondents were specifically recruited in the areas adjacent to the river ‘de Waal’. Around 20% of the respondents delegated their choice. Figure 2 presents the market shares of the different projects for the other 80% of the sample. To check for spatial differentiation in project choices, both the market shares for the sample (The Netherlands), and for the respondents recruited in the Waal area are reported. For each alternative the average project costs of the sample are displayed.



**Figure 2: Percentage of respondents which selects the classical projects, the combination projects and the six other projects.**

<sup>2</sup> A demo version can be accessed through: [ienw.participatie-begroting.nl](http://ienw.participatie-begroting.nl)

In all four locations the majority of respondents selected the ‘combination project’. Strikingly, the results did not differ very much between the respondents living close to the river ‘Waal’ and the full sample. After respondents submitted their preferred portfolio, they were asked to motivate their choices for each project they selected. These qualitative responses show that improved recreational opportunities and variety in biodiversity are the main reasons for choosing the combination projects. This is a surprising result as these impacts generally only play a marginal role in the Dutch CBA practice (Mouter et al., 2015). A substantial number of respondents argues that they choose the classical project at the location ‘Oosterhout’ because households need to relocate in case the government pursues the combination project at this location.

To establish how citizens value the portfolios, the choices are quantitatively analysed using discrete-continuous choice models.<sup>3</sup> We estimate taste parameters in order to derive the relevance of societal impacts for which participants received explicit information in their choices. This analysis revealed that participants particularly preferred the combination projects over the classical projects when the former projects would positively influence biodiversity and recreational opportunities. From the qualitative motivations we inferred that participants also favour combination projects because they believe that this solution to mitigate flood risk is aesthetically superior and is more ‘future proof’. Hence, we estimate project specific valuations for each project which captures the utility individuals derive from a project irrespective of the level of the impacts included explicitly in the PVE.

The obtained results can be used for welfare analysis starting from the democratic one-person-one-vote assumption (see Dekker et al., 2019 for a detailed discussion of conducting such a welfare analysis). A first output of the welfare analysis is the derivation of the probability that a project improves societal value compared to shifting the money to the next period, i.e. whether the project provides value for money. This is a key step in the policy evaluation since participants in the PVE always have the fallback option to choose the null portfolio in case they think that all the projects are undesirable. To illustrate, in case all the participants in the PVE would have selected the null portfolio thereby recommending to shift the entire public budget to the next year, the probability that one of the combination projects improves societal value compared to shifting the money to the next period would be (very close to) 0%.

Figure 3 shows that all the combination projects provide value for money. For instance, choosing the combination project at Gendtse Waard has a 86% probability to improve societal value compared to choosing for the classical project at this location and shifting the difference in costs (in this case 5 million euro) to the next year. The project desirability of the road expansion of the A2 motorway is 31% which means that this project has a 31% probability to improve societal value compared to shifting public budget to the next year. This project should not be implemented, irrespective of the available budget.

---

<sup>3</sup> We model portfolio utility as the sum of random project utilities and assume citizens choose the best portfolio given the governmental and private budget constraints using multiple discrete-continuous modelling approaches in the spirit of Bhat (2008, 2018). More information on modelling can be found in Dekker et al (2019).

<b>Combination project versus classical project</b>	<b>Project desirability</b>	
Gendtse Waard combination project (67M€)	86%	✓
Gendtse Waard classical project (62M€)	--	✗
Sleeuwijk combination project (218M€)	75%	✓
Sleeuwijk classical project (95M€)	--	✗
Werkendam combination project (176M€)	75%	✓
Werkendam classical project (92M€)	--	✗
Oosterhout combination project (74M€)	67%	✓
Oosterhout classical project (29M€)	--	✗
<b>Other projects</b>		
Additional reduction flood risks Moerwijk (13M€)	75%	✓
Additional reduction flood risks Venlo (6M€)	74%	✓
Mitigation heavy rainfall Hooge Boezem (5M€)	74%	✓
Mitigation heavy rainfall Driemanspolder (78M€)	70%	✓
Road project Joure A6/A7 (76M€)	61%	✓
Road expansion A2 motorway (263M€)	36%	✗

Figure 3: Probability that a project improves societal welfare

A second output of the welfare analysis is the ranking of portfolios of projects in terms of expected social utility. When the public budget is unlimited policy makers should opt for all projects with a desirability probability of higher than 50%: the combination projects at all four locations and the projects Moerwijk, Venlo, Hooge Boezem, Driemanspolder and Joure. However, in reality policy makers are faced with limited budgets and PVE allows for the identification of the optimal selection of projects (i.e. the optimal portfolio) for a given budget. Figure 4 shows the top 10 of portfolios within a budget constraint of 688.36 million euros.<sup>4</sup>

<sup>4</sup> We used the average budget recommended in the flexible budget experiment (688.36 million euros) as the budget constraint.

	Top 10 portfolio's									
	1	2	3	4	5	6	7	8	9	10
Gendtse Waard classical project (62M€)	0	0	0	0	0	0	0	1	0	0
Gendtse Waard combination project (67M€)	1	1	1	1	1	1	1	0	1	1
Oosterhout classical project (29M€)	0	1	0	0	1	1	0	0	1	0
Oosterhout combination project (74M€)	1	0	1	1	0	0	1	1	0	1
Sleeuwijk classical project (95M€)	0	0	0	0	0	0	0	0	0	0
Sleeuwijk combination project (218M€)	1	1	1	1	1	1	1	1	1	1
Werkendam classical project (92M€)	0	0	0	0	0	0	0	0	0	0
Werkendam combination project (176M€)	1	1	1	1	1	1	1	1	1	1
Mitigation heavy rainfall Hooze Boezem (5M€)	1	1	1	0	1	0	0	1	0	1
Mitigation heavy rainfall Driemanspolder (78M€)	1	1	1	1	1	1	1	1	1	1
Road project Joure A6/A7 (76M€)	0	1	0	0	1	1	0	0	1	0
Road expansion A2 motorway (263M€)	0	0	0	0	0	0	0	0	0	0
Additional reduction flood risks Moerwijk (13M€)	1	1	1	1	1	1	1	1	1	0
Additional reduction flood risks Venlo (6M€)	1	1	0	1	0	1	0	1	0	0
Costs (in millions of euros)	641	671	635	635	665	665	629	636	659	627

Figure 4: 10 portfolio's which result in the highest expected social utility

Based on these results we can draw three main conclusions: 1) the large road project (road expansion A2 motorway) is not included in all the top 10 portfolio's; 2) at the locations Sleeuwijk and Werkendam the combination project is included in all the top 10 portfolio's; 3) the optimal portfolio opts for the combination project in all four locations. In order to see whether these conclusions are robust to changes in assumptions concerning the level of the social impacts included in the experiment (e.g. costs and impact on biodiversity) we performed various sensitivity analyses (see Dekker et al., 2019). These sensitivity analyses reveal that the first two conclusions are highly robust to changes in assumptions. However, when we assume a very low impact of the combination projects on biodiversity and recreational opportunities, the combination project is not included in the optimal portfolio at the location 'Oosterhout'.

We expect that PVE can substantially improve decision support for public policy investments. In our case study policy makers could use the results of the PVE for undergirding the choices they need to make on the four locations along 'de Waal' river. A useful insight for policy makers is that citizens particularly prefer the combination projects over the classical projects when the former projects positively influence biodiversity and recreational opportunities. Moreover, policy makers learn which type of projects citizens are willing to sacrifice to enable them to choose for the more expensive combination project instead of the cheaper classical project. For instance, citizens are willing to sacrifice the large road project (road expansion A2 motorway) to make way for more expensive combination projects which foster biodiversity and recreation. Moreover, sensitivity analyses can provide policy makers with insights regarding the conditions under which citizens prefer combination projects over classical projects. Finally, policy makers acquire new insights from the qualitative motivations of respondents for their choice for either a classical project(s) or a combination project(s). For instance, they learn that citizens also favour combination projects because they believe that this

solution to mitigate flood risk is aesthetically superior and is more ‘future proof’. These insights can be used to enrich the underpinning of their policy choices.

**Acknowledgements** the first and second author wish to thank the Netherlands Organisation for Scientific Research for financial support (NWO Responsible Innovation grant – 313-99-333). The third author acknowledges financial support by the European Research Council through 535 consolidator grant 615596-DECISIONS. Moreover, the authors wish to thank the Dutch Ministry of Infrastructure and Water Management for financing the data collection and the design of the PVE.

## References

- Ackerman, F., Heinzerling, L., 2004. *Priceless: on knowing the price of everything and the value of nothing*. The New Press. New York.
- Aldred, J., 2006. Incommensurability and monetary valuation. *Land Economics* 82 (2), 141-161.
- Allen, M.T., Austin, G.W., Swaleheen, M., 2015. Measuring highway impacts on house prices using spatial regression. *J. Sustain. Real Estate*, 7 (1), 83-98.
- Arrow, K., Solow, R., Portney, P.R., Leamer, E.E., Radner, R., Schuman, H., 1993. Report of the NOAA panel on contingent valuation. *Federal Register* 58, 4601-14.
- Bhat, C. R., 2008. The multiple discrete-continuous extreme value (MDCEV) model: role of utility function parameters, identification considerations, and model extensions.. *Transportation Research Part B*, 42, 3, 274-303.
- Bhat, C. R., 2018. A new flexible multiple discrete–continuous extreme value (MDCEV) choice model. *Transportation Research Part B: Methodological*, 110, 261-279.
- Boadway, R., Bruce, M. 1984. *Welfare Economics*. Oxford: Basil Blackwell.
- Boadway, R., 2006. Principles of cost-benefit analysis. *Public Policy Rev.* 2(1), 1–42.
- Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L. 2013. *Cost-benefit analysis concepts and practice*. New Jersey: Prentice Hall.
- Carson, R.T., 2012. Contingent valuation: a practical alternative when prices aren't available. *Journal of Economic Perspectives* 26(4), 27-42.
- Dekker, T., Koster, P.R., Mouter, N., 2019. *The economics of Participatory Value Evaluation*. Tinbergen Institute Discussion papers 19-008/VIII
- Frey, B.S., Benz, M., Stutzer, A., 2004. Introducing procedural utility: not only what, but also how matters. *Journal of Institutional and Theoretical Economics*. 160 (3), pp. 377-401.
- Hahn, R.W., Tetlock, P.C., 2008. Has economic analysis improved regulatory decisions? *J. Econ. Perspect.* 22 (1), 67–84.
- Hausman, J., 2012. Contingent valuation: from dubious to hopeless. *Journal of Economic Perspectives* 26 (4), 43–56.
- Hestermann, N., Le Yaouanq, Y., Treich, N. 2018. *An economic model of the meat paradox*. Working Paper.
- Howley, P., Hynes, S., O’Donoghue, C., 2010. The citizen versus consumer distinction: An exploration of individuals' preferences in Contingent Valuation studies. *Ecological Economics* 69, pp. 1524-1531.
- Johansson-Stenman, O., Martinsson, P., 2008. Are some lives more valuable? An ethical preferences approach. *Journal of Health Economics*, 27, 3, 739-752.
- Kling, C.L., Phaneuf, D.J., Jinhua, Z., 2012. From Exxon to BP: Has Some Number Become Better than No Number? *Journal of Economic Perspectives*, 26 (4), 3–26.

- Koster, H.R.A., van Ommeren, J., 2015. A shaky business: natural gas extraction, earthquakes and house prices. *European Economic Review* 80, 120-139.
- Lusk, J.L., Norwood, F.B., 2011. Animal Welfare Economics. *Applied Economic Perspectives and Policy* 33 (4), 463-483.
- Mackie, P.J., T. Worsley and J. Eliasson. 2014. Transport Appraisal Revisited. *Research in Transportation Economics*. Vol. 47, pp. 3-18.
- Mouter, N., Annema, J.A., Van Wee, B. 2015. Managing the insolvable limitations of cost-benefit analysis: results of an interview based study. *Transportation* 42(2), 277–302.
- Mouter, N., van Cranenburgh, S., van Wee, G.P. 2017. Do individuals have different preferences as consumer and citizen? The trade-off between travel time and safety. *Transportation Research Part A* 106, pp. 333-349.
- Mouter, N., van Cranenburgh, S., van Wee, G.P. 2018. The consumer-citizen duality: Ten reasons why citizens prefer safety and drivers desire speed. *Accident Analysis & Prevention* 121, pp. 53 – 63.
- Nyborg, K., 2000. Homo Economicus and Homo Politicus: interpretation and aggregation of environmental values. *Journal of Economic Behavior & Organization*, 42, 305–322.
- Nyborg, K., 2014. Project evaluation with democratic decision-making: what does cost-benefit analysis really measure? *Ecological Economics* 105, 124-131.
- Nurmi, V., & Ahtainen, H. (2018). Distributional Weights in Environmental Valuation and Cost-benefit Analysis: Theory and Practice. *Ecological Economics*, 150, 217-228.
- Persky, J., 2001. Retrospectives. Cost-Benefit Analysis and the classical creed. *Journal of Economic Perspectives* 15 (4), 199-208.
- Posner, E.A., Sunstein, C.R., 2017. Moral commitments in Cost-Benefit Analysis. Coase-Sandor Institute for Law and Economic Working Papers. No. 802.
- Raz, J., 1986. *The morality of freedom*. Oxford, U.K.: Clarendon.
- Sagoff, M., 1988. *The Economy of the Earth: Philosophy, Law, and the Environment*. Cambridge University Press.
- Sen, A., 1995. Environmental Evaluation and Social Choice: Contingent Valuation and the Market Analogy. *The Japanese Economic Review* 46 (1), 23-37.
- Sen, A., 2017. *Collective choice and social welfare: Expanded edition*. (Penguin UK, 2017).
- Stevens, T., Echeverria, J., Glass, R., Hager, T. and More, T., 1991. Measuring the existence value of wildlife: what do CVM estimates really show? *Land Economics* 67, 390–400.
- Sunstein, C.R., 1993. Incommensurability and Valuation in Law. *Michigan Law Review* 92: 779.
- Sunstein, C.R., 2005. Cost-Benefit Analysis and the Environment. *Ethics* 115 (2), pp. 351-385.
- Thaler, R., 1999. Mental accounting matters. *Journal of Behavioral Decision Making* 12, 183-206.
- Tversky, A. Kahneman, D., 1981. The framing of decisions and the psychology of choice. *Science* 211, 453-458.
- Van Wee, B., 2012. How suitable is CBA for the ex-ante evaluation of transport projects and policies? A discussion from the perspective of ethics. *Transport Policy* 19 (1), 1-7.
- Vossler, C.A., Evans, M.F., 2009. Bridging the gap between the field and the lab: Environmental goods, policy maker input, and consequentiality. *Journal of Environmental Economics and Management* 58 (3), 338-345.
- Zawojcka, E., Czajkowski, M. 2017. Re-examining empirical evidence on contingent valuation—Importance of incentive compatibility. *Journal of Environmental Economics and Policy* 6 (4), 374 – 403.