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Appropriate Payment Vehicles in Stated Preference Studies in Developing Economies

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Abstract Selecting appropriate payment vehicles is critical for the perceived consequentiality and incentive compatibility of stated preferences surveys. We analyze the performance of three different payment vehicles in a Malaysian case of valuing wetland conservation. Two are well-known: voluntary donations and income taxes. The third is new: reductions in government subsidies for daily consumer goods. Using donations is common, but this payment vehicle is prone to issues of free-riding. An income tax usually has favorable properties and is commonly used in environmental valuation. However, in Malaysia as well as in many other low- to middle-income economies, large proportions of people do not pay income taxes, putting the validity of this payment vehicle into question. Instead, citizens in Malaysia and many other countries benefit from subsidies for a range of consumer goods. We find that price sensitivity is higher and the unexplained variance smaller when using subsidies rather than donations or income taxes. Importantly, this approach translates into completely different conclusions concerning policy advice. Our results suggest that in developing countries, using reduced subsidies as a payment vehicle may have favorable properties in terms of improved payment consequentiality compared to alternative payment vehicles, thus enhancing the external validity of stated preference surveys.

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Keywords Developing countries · Discrete choice experiment · Incentive compatibility · Payment consequentiality · Random parameter logit model · Wetland conservation

Abbreviations

SP	Stated preference
DCE	Discrete choice experiment
WTP	Willingness to pay
RP	Revealed preference
RPL	Random parameter logit
SD	Standard deviation
SW	Setiu Wetland
CI	Confidence interval

1 Introduction

Stated preference (SP) methods remain an important tool for assessing peoples' preferences and willingness to pay (WTP) for non-marketed environmental goods, particularly for the passive or non-use values that are often associated with preserving ecosystem services. A lingering concern is whether respondents truthfully reveal their preferences in SP surveys, which poses a challenge regarding the surveys' external validity. Recent theoretical and empirical evidence suggests that incentive compatibility and truthful demand revelation are possible, but they depend crucially on survey design. One important design consideration concerns the choice of payment vehicle, as respondents must perceive that they will be forced to pay if a policy or project is implemented. In our study, we use a split-sample approach to compare the effects of three payment vehicles—donations, an income tax, and a reduction in subsidies. Using subsidy reductions is new to the literature, and we argue that this payment vehicle has advantages for SP studies conducted in developing economies.

Recent theoretical work has identified certain sets of assumptions that are together sufficient for incentive-compatible elicitation in an SP survey (Flores and Strong 2007; Carson and Groves 2007; Vossler et al. 2012; Carson et al. 2014; Zawojska 2016). Among these conditions, survey participants must perceive that their responses can potentially influence whether a policy is implemented ("policy consequentiality") and further that they actually have to pay upon policy implementation ("payment consequentiality"). Most of the attention in empirical work has been on policy consequentiality. Empirical studies such as Vossler and Watson (2013) and Vossler et al. (2012) find differences in WTP estimates between respondents who state that they believe the survey is policy consequential and those who state the opposite. However, other empirical investigations find no effects of consequentiality on WTP (e.g., Broadbent 2012).

In this study, we focus on payment consequentiality, specifically by exploring the effects of the chosen payment vehicle. Payment consequentiality is reliant on respondents finding the presented bid level(s) reasonable and realistic for the payment vehicle. An important consideration in this regard is whether the payment vehicle has sufficient coverage of the targeted population. As an example of inadequate coverage, Morrison et al. (2000) mention using water rates as a payment vehicle in an SP survey conducted in an area where most people get their water from their own bores or rainwater tanks. Obviously, in this example,

the payment vehicle would not fulfill the payment consequentiality condition, thus hampering incentive compatibility and the external validity of the results.

We investigate payment consequentiality in a setting where appropriate payment vehicles are not easily identifiable, namely, Malaysia, which is one of the emerging economies of Southeast Asia. Malaysia plans to be a developed economy by 2018, but many governance aspects, including its security and tax systems, are still under development (Chen 2012). In this way, Malaysia is comparable to many developing countries. Various payment vehicles have been evaluated in developed country settings. However, very few studies have evaluated alternative payment vehicles in the context of developing countries; additionally, Whittington and Pagiola (2012) note that many SP studies in developing countries do not specify a payment vehicle at all, nor do they outline a method for payments to be collected. This is clearly at odds with payment consequentiality.

Convergent validity tests were used to analyze the performance of three different payment vehicles in a discrete choice experiment (DCE) survey addressing wetland conservation in Malaysia. Two of these are well-known payment vehicle types, an income tax and voluntary donations, whereas to the best of our knowledge, the third presents a novel contribution to the literature, namely, reductions in current government subsidies for daily consumer goods. As this type of consumer-oriented subsidy is a very common measure to increase food security across a wide range of developing countries and emerging economies (Demeke et al. 2009), this payment vehicle could have widespread potential in practical applications in these countries.

An income tax usually has favorable properties in most developed countries. However, many people in Malaysia do not pay income taxes, which will likely reduce the perceived payment consequentiality of a survey. Although voluntary donations are not a coercive vehicle due to well-known free-riding issues, they are commonly used in developing countries (Whittington and Pagiola 2012). In Malaysia, however, there is a strong culture of donating (Othman et al. 2004; Khamis et al. 2011), and many non-governmental organizations and institutions are trusted by Malaysians to distribute donations for the purposes claimed during collection. For that reason, the free-riding incentive could be less of an issue in this specific cultural context. Turning to subsidies, all Malaysians benefit from government subsidies for daily consumer goods such as cooking oil, sugar, flour, fuel and liquid gas for stoves, and the government is currently discussing whether these subsidies should be reduced. Were such reductions to take place, this bundle of subsidized goods is sufficiently large to make it virtually impossible for consumers to avoid their effects. Therefore, a payment vehicle described as reduced subsidies should be both credible and coercive and should adequately cover the population, thereby enhancing perceived payment consequentiality.

Carson and Groves (2007) argue that using donations leads to the over-revelation of demand, as they are not payment consequential. Assuming that payments through subsidy reductions will be perceived as more consequential, we hypothesize that this payment vehicle will produce lower WTP estimates than when using donations as the payment vehicle. We furthermore assume that (more) people in the income tax treatment will not perceive the elicitation as payment consequential, e.g., because they do not pay income taxes, thus driving up their stated WTP. The Carson et al. (2014) experiment supports this hypothesis. We thus hypothesize that WTP estimates will be higher in the income tax treatment than in the subsidy reduction treatment. We propose no *a priori* hypotheses regarding how an income tax will fare relative to donations.[1]

[1] For simplicity, we assume that our respondents perceive the elicitation as policy consequential, or at least that the perceptions of policy consequentiality do not differ across payment vehicle treatments.

It is difficult to make firm predictions about error variances across the treatments. However, Cameron and DeShazo (2010) and Carson et al. (2014) argue that survey elements that reduce aspects of consequentiality may also reduce costly attention to attribute variation and hence increase the variance of the error component. While the latter study does not find such effects in the authors' simple experiment, they warn that it may be present in other contexts (Carson et al. 2014). This suggests that the error variance may be smaller under the subsidy treatment, where higher perceived payment consequentiality makes respondents' costly attention worthwhile.

In the following section, we briefly review several studies that address and compare payment vehicles. Section 3 presents the econometric specification and Sect. 4 the study design. The results are reported in Sect. 5 and discussed in the concluding Sects. 6 and 7.

2 Previous Literature on Payment Vehicles

Income and property taxes are familiar to people in most developed countries, where such taxes have high coverage, are enforced and fund public goods, which gives credibility to the use of these types of payment vehicles in such cases (Jacobsen et al. 2012). Nevertheless, the use of increased taxes of some form could pose challenges if the respondents are opposed to paying more taxes or they do not trust that the taxes collected will be directed to providing the good in question (e.g., Blamey 1998; Morrison et al. 2000). The latter reflects low perceived policy consequentiality.

Voluntary donations are usually considered a much less coercive payment vehicle (Carson and Groves 2007). Respondents could state any WTP in the hypothetical market described, knowing that if ever actually implemented they could choose not to donate and still enjoy the good if provided. This lack of coerciveness may unintendedly invite, e.g., free-riding and strategic bidding, which could lead to either downward- or upward-biased WTP estimates (Wiser 2007; Stithou and Scarpa 2012). This may be particularly true in countries where people are not familiar with relying on donations for the provision of public goods. Some early studies find no differences when comparing voluntary donations to more coercive payment vehicles (e.g., Milon 1989; Ajzen et al. 1996). A few studies find higher WTP estimates (e.g., Taylor 1998; Stithou and Scarpa 2012), while several others find that voluntary payments produce lower WTP estimates than more coercive payment vehicles (e.g., Champ et al. 2002; Wiser 2007; Ivehammar 2009; Lyssenko and Martínez-Espiñeira 2012; Carneiro and Carvalho 2014). This could be a result of free-riding due to low perceived coerciveness and low payment consequentiality or perhaps of a form of strategic underbidding, as sometimes found in marketing surveys concerning market goods (e.g., Lusk et al. 2007).

In developed countries, applying various forms of user fees as payment vehicles has been investigated by, e.g., Campos et al. (2007), in relation to recreational sites. Such payment vehicles are clearly only consequential for current or potential future users of the recreational sites.

The payment vehicles typically used in developed country settings need to be reconsidered for suitability when conducting stated preference studies in developing country contexts. Whittington and Pagiola (2012) find that several studies in developing countries do not adequately specify a payment vehicle or method of payment collection. However, others do specify their payment vehicles clearly. For instance, Ndunda and Mungatana (2013) apply a municipal tax as a payment vehicle in a study addressing the improved treatment of wastewater in Nairobi, Kenya. Similarly, in Brazil, a property tax is proposed in a study of urban coastal

nature reserve conservation (Carneiro and Carvalho 2014). A surcharge on water services is applied as a payment method in studies in China and Malaysia (Yang et al. 2008; Yacob et al. 2011). While having the advantage of being clear and intuitive, the payment consequentiality of several of these vehicles hinges on, e.g., the population coverage.

The use of voluntary donations may be more relevant in countries where the use of donations is considered a social norm (Othman et al. 2004; Do and Bennett 2009). Voluntary annual donations are often used in studies in developing and emerging economies, e.g., in studies addressing the preservation of cultural heritage in Chile (Báez-Montenegro et al. 2012) and wetlands in Iran (Kaffashi et al. 2013). In subsistence-type economies where cash is rare, it is relatively common to use labor donations as a payment vehicle (Hung et al. 2007; Casiwan-Launio et al. 2011; Schiappacasse et al. 2013; Gibson et al. 2016). While having the obvious advantage of being available, this vehicle has problems of its own, including how to assess the opportunity cost of labor for households. See Gibson et al. (2016) for a test of this type of payment vehicle relative to money donations.

Given the sparse information available in most of these papers, it is difficult to assess the perceived consequentiality and appropriateness of the chosen payment vehicles. Nonetheless, it is clear that a wide range of payment vehicles have been used, with little uniformity across surveys. In many cases, the use of donations or user or owner charges may suffer from a lack of coverage, free-riding or strategic bidding. Added to this are the several studies with unclear or even without payment vehicle specifications (Whittington and Pagiola 2012).

Note, however, that there is a difference between an unclear specification of a payment vehicle and method of payment collection and a clear specification of a vehicle with low perceived payment consequentiality. In the first case, respondents may substitute the vague statement with their own assessment of a likely or suitable payment method (Kahneman and Knetsch 1992), thus inducing consequentiality or the opposite.

3 Econometric Specifications

We use a random parameter logit (RPL) model, which relies on random utility theory (McFadden 1974). Utility is assumed to consist of a deterministic, observable component and a random component described by a distribution only. We denote respondents by i and the choice of alternatives by j organized in choice sets, n. The derived utility U for i is given by the attributes captured in the vector x of each choice alternative j, and the preferences of i are captured in the associated parameters β and $\tilde{\beta}_i$. We gather these observable parts of the utility function in V and assume that the random component ε_{ijn} is i.i.d. with mean zero. As each individual, i, is assumed to choose the alternative k that yields the maximum utility among the J alternatives in a choice set n, we have the relation to explore econometrically:

$$U_{kn} > U_{jn} \rightarrow V_{kn} + \varepsilon_{kn} > V_{jn} + \varepsilon_{jn} \quad \forall j \neq k; k, j \in J \tag{1}$$

We note that in V, we include an alternative that is specified for the status quo (SQ). This captures the systematic component of a potential status quo effect (Scarpa and Thiene 2005; Lundhede et al. 2009). Furthermore, to account for preference heterogeneity (Train 1998), we assume a normal distribution for the random preference parameters $\tilde{\beta}_i$, including all attributes except for the price parameter. For simplicity, we assume the price parameter to be non-random within each treatment sample. Revelt and Train (1998) show that by fixing the price parameter, the implicit price for each attribute will be distributed in the same way as the attribute's coefficients.

Assuming that ε_{ijn} is i.i.d. extreme value distributed, the RPL choice probability can be described as integrals of standard conditional logit functions evaluated at different β s with a density function as the mixing distribution (Train 2003). This specification can be generalized to allow for repeated choices by the same respondent, i.e., a panel structure, by letting k be a sequence of alternatives, one for each choice occasion, $k = \{k1, \ldots, kN\}$. Thus, the utility coefficients vary across people but are constant across the N choice occasions for each individual. The choice probabilities are formally described as:

$$\Pr(ik) = \left(\prod_{n=1}^{N} \left[\frac{\exp^{\lambda_{ikn}\beta' x_{ik_n n}}}{\sum_j^J \exp^{\lambda_{ikn}\beta' x_{ijn}}} \right] \right) \Phi(\beta|b, W)\, d\beta \tag{2}$$

where $\Phi(\beta|b, W)$ is the distribution function for β, with mean b and covariance W. It has been commonly found that different experimental treatments can impact both the utility parameters as well as the error variance. Pooling the data from the different treatment samples, we use the logit scaling approach to allow for differences in unexplained variances across the sub-samples (Bradley and Daly 1994). We test for scale differences across our payment vehicle treatment datasets using the method suggested by Swait and Louviere (1993). A general parametrization of the scale function is (Hensher et al. 2005; Lundhede et al. 2009):

$$\lambda_{ikn} = \exp(\gamma_w Z_{ikns}) = \frac{\pi}{\sqrt{var(\mu_{ikn})}\sqrt{6}} \tag{3}$$

where Z_{ikns} is a vector of covariates that covers respondents' socio-demographic traits, survey characteristics or other aspects that may affect the scale. The various elements in Z are indexed by s. Finally, γ_w is a row vector for the corresponding scale function parameters. The exponential form of the scale function ensures non-negative estimates of the model variance, as the scale parameter is inversely related to the standard deviation of the unobserved component μ_{ikn} (Ben-Akiva and Lerman 1985). Given an estimate of the scale, it is then possible to test whether the parameter vectors are the same up to a scaling constant. A relatively larger scale factor is indicative of a smaller unobserved variance, which, in turn, implies less noise and more consistent choices.

4 Study Design

4.1 Study Area

The Setiu Wetland (SW) is located in the state of Terengganu in Malaysia. According to a recent census by the Statistics Department, Malaysia (DOSM 2010), the state's population was 993,061. The SW is recognized as an Environmentally Sensitive Area (ESA) Rank 1 under the Malaysian National Physical Plan, which to some degree protects the area from development. In 2009, approximately 1000 hectares of the wetland's area was converted into aquaculture ponds to boost the local economy. Kamil (2008) focuses on the potential of SW to support sustainable livelihoods and concludes that under the current system of management, the ecosystem services currently provided by the SW to local communities cannot be sustained.

The ecosystem in SW has several functions in addition to being a source of marketed goods and services. We incorporate some of these, as we focus on the ecosystem's functions as a potential safe harbor for biodiversity, its potential for increased recreational services and the role of the mangrove forest and natural habitats in reducing storm water floods

in the surrounding backlands. Many different conservation measures can be implemented in the SW to further these functions, including increasing the area protected, e.g., through implementation of a buffer zone.

4.2 Questionnaire Design

A DCE survey questionnaire was designed to determine respondents' preferences for attributes associated with conservation of the SW. The choice of wetland attributes was based on a literature review and on advice from experts in landscape planning, conservationists, and researchers working on the SW. The attributes and the questionnaire were further improved and validated in three different focus group interviews with the general public, villagers from the SW area, and professionals who were involved in the planning and development of the SW. Based on a pilot test with 68 respondents from five villages adjacent to the wetland, information priors were obtained that were used to construct a Bayesian updated experimental design optimized for D-efficiency using the Ngene software (ChoiceMetrics 2012). Each respondent was asked to evaluate 12 choice sets, where every set consisted of two experimentally designed wetland management scenario profiles and a status quo option. Having the latter SQ option in the choice sets is crucial to obtaining welfare measures that are consistent with demand theory (Louviere et al. 2010). The final set of attributes and levels is presented in Table 1, and an example of a choice task is provided in Fig. 1.

4.3 Experimental Setup for Payment Vehicles

We employed a split-sample experimental setup to test our hypotheses. Respondents were randomly assigned to three different treatments, each with a specific version of the payment vehicle description. All three treatments involved a DCE that was identical in all respects other than the payment vehicles. Given the hypothetical nature of the survey, it is not possible to assess which treatment most accurately reflects the 'true' WTP. In the following, each payment vehicle treatment is briefly described and discussed in the context of the case study. The actual descriptions presented to respondents are available in the "Appendix".

4.3.1 Individual Income Tax

The most general tax in Malaysia is the personal income tax. Beginning in 2012, the tax rate levied for the highest income bracket (above RM 400,000 per month) was 25%, whereas the lowest bracket was 1% for taxable income over RM 5000 per month. According to the census reports of the Economic Planning Unit (EPU 2013), 33.6% of all Malaysian households earned over RM 5000 per month, but some of them were eligible for tax deductions for, e.g., medical expenses, the purchase of books, computers, or sports equipment and education fees. In other words, at the national level, approximately two out of three households essentially did not pay income taxes in recent years.

4.3.2 Voluntary Donations

Various trust funds exist in Malaysia, including the government-initiated Environmental Trust Fund and the Poverty Alleviation Fund, to which the public is encouraged to make contributions. At the local level, it is also common for places of worship throughout the country to establish their own Community Welfare Fund to finance activities for the well-being of their members. In rural communities, particularly among Malays, there is a long

Table 1 Attributes and levels used in the survey, where SQ indicates the current level of the attributes

Attributes/Level	High	Medium	Low
Environmental Conditions (Buffer zone[a])	Up to 200 m buffer zone to protect the wetland habitat	Up to 50 m buffer zone to protect the wetland habitat	No buffer zone to protect the wetland habitat and vegetation (SQ)
Biodiversity	High population levels of several species in the area	Moderate population size and number of species in the area	A limited number of wetland species left in the area (SQ)
Recreational Services	The recreation facilities are regularly maintained, and there are many possible recreational activities in the area	The recreation facilities are reasonably maintained, and there are a few different recreation activities in the area	The recreation facilities are not maintained, and there are only limited recreational activities in the area (SQ)
Flood Control	Higher risk of a dangerous increase in water levels where evacuation of residents is needed and significant property damage/losses (SQ)	Medium risk of storm flood water levels where no evacuation of residents is needed and limited property damage/losses	Low risk of storm flood water levels where no evacuation of residents is needed and no serious property damage/losses
Conservation cost per year and household (Ringgit Malaysia, RM[b]): 0, 5, 10, 30, 90, 210, and 400			

[a]Buffer zone width for wetlands as suggested by Newtown (2012)
[b]At the time of data collection, the currency exchange rate was USD 1 = RM 3.20 (2014)

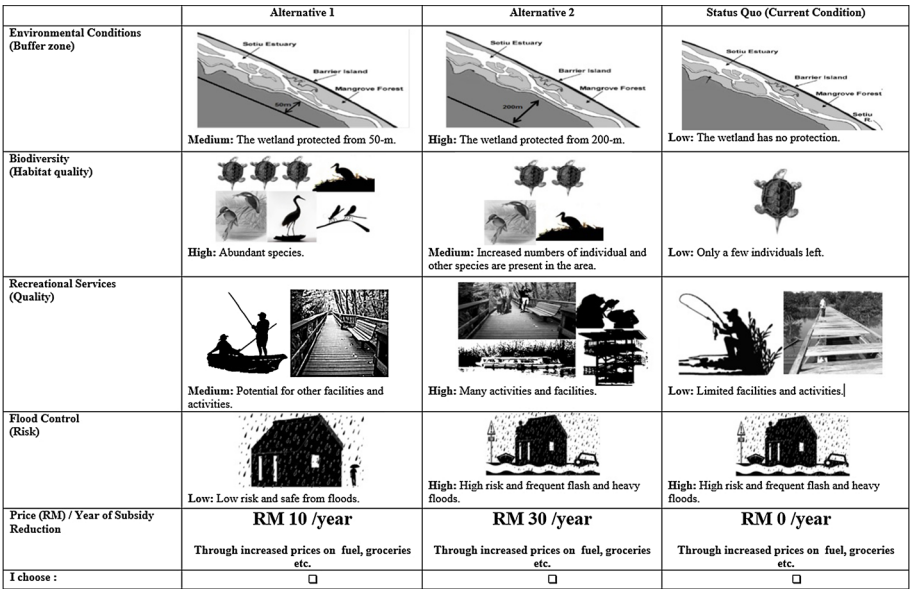

Fig. 1 An example of a choice task, where the payment vehicle is specified as higher prices (lower subsidies for) daily consumption goods

tradition of households contributing a fixed payment annually to a 'Charity Fund' to help local families in need. Hence, if actually perceived as somewhat compulsory rather than voluntary, donations may potentially be considered a suitable payment vehicle for stated preference applications in this country (Othman et al. 2004; Carson and Groves 2007). Nevertheless, by construction, voluntary donations do not ensure payment consequentiality, particularly because the context for the donation may be unusual for the respondents.

4.3.3 Subsidy Reduction

In Malaysia, the government provides subsidies for necessities such as rice, cooking oil, flour, fuel, liquid petroleum gas, and electricity. The subsidized items are also known as 'controlled goods',[2] and the prices of these goods are consistently monitored by the government and fixed throughout the country, thus reducing market influences on prices. The prices of these items therefore directly react to changes made by the government in the amount of subsidies for the various goods. A subsidy reform measure in 2013 affected most households in Malaysia because these daily necessities are difficult to substitute with other goods (Solaymani and Kari 2014), and the reform directly impacted household expenses and transportation costs (Bridel and Lontoh 2014). Thus, describing a payment vehicle as a reduction in subsidies is considered realistic as well as coercive by most respondents in our case study.

[2] Controlled goods were declared in Malaysian law under the Control of Supplies Act 1961. The list of controlled goods can be retrieved from the official website of the Ministry of Domestic Trade, Co-operatives, and Consumerism Malaysia (http://www.kpdnkk.gov.my/index.php/en/list-of-controlled-goods/28-pengguna/194-).

4.4 Sampling and Data Collection Method

The full-scale survey was carried out from July 2014 until September 2014 using face-to-face interviews with people living in villages and towns in the areas adjacent to the SW. We chose this mode of administration because a web-based survey would suffer heavily from coverage and selection problems in this area. Furthermore, complete telephone and address listings were not available, essentially preventing the use of postal surveys. Furthermore, the respondents' concerns, questions or requests for clarification could be addressed on the spot by the trained interviewers. A systematic random sampling method was used to select the sample of respondents. The target population included households residing in the rural and urban areas of selected areas in Terengganu. Since detailed spatial and socio-demographic information on households was not available for sampling purposes, a systematic random geographic sampling procedure was applied. These particular locations for sampling were chosen based on time and cost constraints as well as accessibility factors. We selected ten areas: four urban and six rural. In each area, we determined a random starting point for the sampling. The interviewers then selected a household at the starting point and moved on from there to the next house along a line laid out in the chosen area. If the household was not interested or not available, the interviewer would move on to the next house on the line assigned to him/her in pursuit of the desired sample size. We note that the sample is not representative of Malaysia nor the state of Terengganu, but it provides a fairly good representation of the local views and certainly suffices for our purpose.

5 Results

5.1 Demographic Statistics

Table 2 reports descriptive statistics for key demographic characteristics within each of the three payment vehicle treatment split samples, which totaled 1137 respondents. Despite the random assignment of respondents into samples, chi-square tests indicate that there are some significant differences concerning area of residence area and level of education. All three sub-samples have more respondents from urban areas than from rural areas, but this imbalance is significantly less pronounced in the income tax sample.[3] Furthermore, it seems that the educational level in the donation sample is slightly below that of the other two sub-samples. There are no significant differences in the gender and income distributions across treatments. The latter is of particular importance, since theory prescribes that income should affect WTP. However, using a propensity-based weighting procedure in the estimations, we weighted the observations from the income tax and the donation samples to ensure that they reflected the same distribution for resident area and education level as the subsidy sample (Mørkbak et al. 2014).

[3] The data collection was undertaken with the help of trained research assistants under the instruction of the lead author. The assistants were instructed to randomly assign respondents to payment vehicle treatments. However, in the initial phase of the data collection, a couple of assistants misunderstood this instruction, which unfortunately led them to assign only two of the treatments. Despite the fact that this mistake was quickly identified and corrected, it did cause a small imbalance in the sub-samples, as is evident from Table 2.

Table 2 Distribution of socio-demographic characteristics across payment vehicle sub-samples

	Donation		Subsidies		Income Tax		χ^2	p value
	No.	%	No.	%	No.	%		
Number of respondents	411	36.1	403	35.4	323	28.4		
Residence area							20.68	0.00***
Urban	296	72.0	299	74.2	192	59.4		
Rural	115	28.0	104	25.8	131	40.6		
Gender							0.38	0.98
Male	202	49.1	200	49.6	161	49.8		
Female	209	50.9	203	50.4	162	50.2		
Education level							6.18	0.04**
Low level	296	72.0	258	64.0	215	66.6		
High level	115	28.0	145	36.0	108	33.4		
Income							2.64	0.85
< RM 12,000	180	43.8	174	43.2	156	48.3		
RM 12,000–RM 24,000	132	32.1	130	32.3	96	29.7		
RM 24,000–RM 36,000	52	12.7	52	12.9	34	10.5		
> RM 36,000	47	11.4	47	11.7	37	11.5		

***, **, and *parameters that are significantly different from zero at the 1, 5, and 10% significance levels, respectively

5.2 Parametric Results

We estimate the RPL model using Biogeme version 2.3 (Bierlaire 2003). Simulations in the maximum likelihood estimation are based on 1000 Modified Latin Hypercube Sampling (MLHS) draws, which was found to be sufficient for stable results. As mentioned above, we assume that all the random parameters are normally distributed. 'Cost' and the interaction terms of payment vehicle and 'Cost' are kept fixed. Thus, we focus on the heterogeneity in cost sensitivity that can be explained by the different treatments.

We first pool all the data from the three treatment samples. After testing various models and modeling choices,[4] we found that the four RPL models in Table 3 provide the best fit to the data as well as interesting results for interpretation. Model 1 includes the primary attributes only, Model 2 incorporates the payment vehicle dummies as interactions with the 'Cost' parameter, Model 3 introduces the payment vehicle dummies through a parameterization of the scale function, and Model 4 combines Model 2 and Model 3.

The results show that almost all attributes at all levels significantly affect respondents' choices, with the exceptions of the medium levels of the biodiversity and environment attributes. For all attributes, the results indicate significant taste heterogeneity across respondents. The status quo alternative is positive and significant, indicating that respondents tend to choose the status quo alternative more often than can be explained by differences in attribute

[4] We initially estimated separate models, but we found the attribute parameter estimates to be quite similar in terms of signs and significance. However, due to the confounding scale parameter (which Table 3 shows to differ across samples), comparing the parameter estimates across samples would be inappropriate. The model using the pooled data in Table 3 enables a direct test of our hypothesis concerning the price parameters and scale differences in a single model. However, the WTP estimates presented in Table 4 are based on separate models estimated on the individual payment vehicle samples, and the patterns there support our choice.

levels (Meyerhoff and Liebe 2009). Not all signs in the model are as expected from a usual conservation benefit viewpoint, although there are no firm theoretical predictions about their sign (Jacobsen et al. 2012). For the 'high environment' and 'high recreational' levels, we find negative mean parameter estimates, which, given the assumed normal distribution, suggests that the majority of respondents dislike these high levels. According to a study by Bakhtiari et al. (2014), people may find that crowded areas reduce the quality of their recreational experience, and furthermore, several respondents live in or quite close to the policy area. The focus group interviews indicated that not everyone would be happy about improving the recreational facilities to attract many more non-locals to the area. These concerns could explain why many respondents seem to have a negative view on the high recreational level. The negative utility on high levels of the environment attribute, involving a wide buffer zone, may be due to some respondents' concern that land would possibly be taken by the government for the conservation project. Considering again that a considerable proportion of the sample is local to the area, for some respondents, setting aside a 200-meter buffer zone might mean that they would personally have to give up land or at least accept some restrictions on their future land use and resource access. Note also the considerable heterogeneity in preferences for these two attribute levels. In fact, given the assumed normal distribution of the heterogeneity, we find that approximately 40% of the respondents may hold positive preferences for a high level of recreation and similarly for a high level of the environment attribute's buffer zone.

It is also somewhat surprising that 'low flooding' is not preferred over 'medium flooding', indicating that respondents on average appear not to prefer the lowest level of risk over the medium risk level. A possible explanation for this result may be found in comments by some of the respondents living near the wetland area. Based on their past experiences, coastal flooding may increase their chances of catching fish close to the coastline (as opposed to having to catch them in the deeper sea areas further away) immediately after the monsoon season. Thus, drastically reducing the frequency of flooding might directly reduce their income, as they would either experience a reduced catch or would have to sail further out to sea to maintain their prior catch levels.

Turning to the monetary attribute (Cost), we first note that it is significant and negative, indicating that respondents are responsive to the costs, in accordance with economic theory. To test the possible effect of the different types of payment vehicles on the probability of choosing different alternatives, we interact the 'Cost' attribute with dummy variables for the types of payment vehicle in Model 2. Both the interaction terms of 'Cost*Donation' and 'Cost*Tax' are positive and significant, indicating that respondents are significantly less sensitive to the cost attribute in these two samples compared to the reference sample, where the payment vehicle is described as a reduction in subsidies. Relating back to our hypothesis, this result implies that in Model 2, WTP is indeed lower for the subsidy vehicle than for either of the other two vehicles. This finding serves as the first confirmation of our hypothesis that the subsidy payment vehicle is perceived as being more consequential and coercive and hence more incentive compatible than the income tax and donation payment vehicles. Furthermore, contrary to the typical expectation in studies undertaken in Western cultures and societies, there is no significant difference between the donation and the income tax payment vehicles. We can only conjecture whether this result is due to donations being traditionally more prevalent in Malaysia or income taxes being much less coercive or a combination of the two.

5.3 Effects of Payment Vehicle on Scale

We tested the differences in the unexplained variance of the sample using the scale function, as shown in the results for Model 3 and Model 4 presented in Table 3. In Model 3, the scale function parameter estimates for the donation and tax payment vehicle dummies are significantly lower than the subsidy sample reference level normalized to 1. A relatively lower scale parameter implies a relatively higher variance of the error term and consequently a relatively lower degree of precision in the estimates (Swait and Louviere 1993). The unobserved error variance[5] in Model 3 is thus 61% higher for the donation sample and 32% higher for the income tax sample than for the subsidy sample. Similarly, in Model 4, which also allows for observed effects on the 'Cost' parameter as captured by the interaction terms explained for Model 3, the unobserved variance is significantly higher in the donation (44%) and the income tax (20%) samples relative to the subsidy sample. As noted by LaRiviere et al. (2014), a higher unexplained variance implies a lower ratio of the deterministic to random components in the respondents' utility function. This result supports the arguments by Cameron and DeShazo (2010) as well as Carson et al. (2014) and our expectation that the unobserved variance will be larger when the payment consequentiality is low for some or most respondents. In the most sophisticated Model 4, we again find that both the interaction terms of cost and payment vehicle are positive and significant, implying a higher mean WTP for respondents in these treatments. Comparing the likelihood of the different models, the LR tests show that the scaled models (Model 2 and Model 4) provide a better fit than the restricted models, Model 1 and Model 3, with $p-$values of the null below 5%.

5.4 Welfare Measures

In Table 4, we present the mean WTP estimates and the associated confidence intervals obtained from RPL models run separately on each treatment sample. For the sake of brevity, we omit the associated preference heterogeneity parameters here. The WTP estimates largely confirm the findings from the models above based on the pooled data. In accordance with the higher sensitivity to cost found in Table 3, the mean WTP estimates are lowest for the subsidy treatment across all attributes. The donation treatment leads to the highest WTP estimates and the income tax treatment generally leads to WTP estimates between the two other treatments. While most of the WTP differences are not significant from a statistical point of view, e.g., as indicated by the overlapping confidence intervals, they may be considered significant from a policy point of view. In several cases, the WTP differences between treatments are so large that they lead to different conclusions concerning whether the mean WTP is significantly different from zero.

To further assess the possible impacts on policy evaluations, Table 5 presents compensating surplus welfare measures obtained for two different policy scenarios for the SW. While numerous policy scenarios could be considered, the scenarios presented below serve as examples that illustrate the importance of our findings for policy advice. Scenario 1 describes the policy that the majority of respondents would prefer according to the attribute rankings identified above. This policy involves improving biodiversity to a high level, flood risk to a medium level, and recreation to a medium level while not changing the environmental conditions (i.e., no buffer zone). Scenario 2 describes a policy that may be desired by politicians or organizations that aim to attract more tourists while at the same time protecting the wetland habitat and ensuring a high level of protection against flooding. This scenario thus entails achieving

[5] Due to normalization, the relative error term variance is calculated as $\sigma^2 = 1/\lambda^2$.

Table 3 Parameter estimates of random parameter logit model with standard errors in parentheses

Attributes	Model 1 All attributes	Model 2 Interaction (cost and payment vehicle)	Model 3 Scaled Model 1	Model 4 Scaled Model 2
Random parameters				
High biodiversity				
Mean	0.424*** (0.071)	0.417*** (0.071)	0.471*** (0.081)	0.453*** (0.078)
SD	1.780*** (0.081)	1.790*** (0.082)	2.020*** (0.105)	1.950*** (0.104)
Medium biodiversity				
Mean	0.097 (0.068)	0.093 (0.068)	0.115 (0.077)	0.106 (0.075)
SD	1.510*** (0.083)	1.49*** (0.082)	1.690*** (0.102)	1.630*** (0.100)
High environment				
Mean	− 0.277*** (0.064)	− 0.275*** (0.063)	− 0.326*** (0.072)	− 0.313*** (0.070)
SD	1.130*** (0.0730)	1.120*** (0.073)	1.270*** (0.088)	1.230*** (0.086)
Medium environment				
Mean	0.046 (0.056)	0.045 (0.056)	0.049 (0.063)	0.046 (0.061)
SD	0.893*** (0.070)	0.888*** (0.069)	0.974*** (0.083)	0.949*** (0.081)
Low flooding				
Mean	1.000*** (0.076)	1.010*** (0.076)	1.130*** (0.090)	1.100*** (0.089)
SD	1.65*** (0.076)	1.65*** (0.076)	1.89*** (0.101)	1.820*** (0.100)
Medium flooding				
Mean	1.040*** (0.064)	1.040*** (0.064)	1.160*** (0.077)	1.130*** (0.076)
SD	1.280*** (0.070)	1.280*** (0.071)	1.490*** (0.092)	1.420*** (0.091)
High recreational				
Mean	− 0.341*** (0.066)	− 0.338*** (0.066)	− 0.385*** (0.076)	− 0.371*** (0.074)
SD	1.450*** (0.070)	1.450*** (0.070)	1.630*** (0.089)	1.580*** (0.089)

Table 3 continued

Attributes	Model 1 All attributes	Model 2 Interaction (cost and payment vehicle)	Model 3 Scaled Model 1	Model 4 Scaled Model 2
Medium recreational				
Mean	0.164*** (0.067)	0.165*** (0.067)	0.188*** (0.076)	0.181*** (0.074)
SD	1.290*** (0.073)	1.290*** (0.073)	1.450*** (0.089)	1.400*** (0.088)
Fixed parameters				
SQ	0.489*** (0.053)	0.485*** (0.053)	0.547*** (0.061)	0.529*** (0.060)
Cost	− 0.0093*** (0.0002)	− 0.0110*** (0.0004)	− 0.0105*** (0.0004)	− 0.0110*** (0.0004)
Cost * donation		0.0020*** (0.0004)		0.0014*** (0.0005)
Cost * tax		0.0015*** (0.0005)		0.0012** (0.0005)
Scale parameter				
Scale donation			0.788*** (0.035)	0.834*** (0.041)
Scale income tax			0.871*** (0.041)	0.913* (0.046)
Final log-likelihood	− 11345.76	− 11333.97	− 11331.35	− 11327.16
Adjusted R^2	0.242	0.243	0.243	0.243
Observations	1137	1137	1137	1137

***, **, and * parameters that are significantly different from zero at the 1, 5, and 10% significance levels, respectively

Table 4 Mean WTP estimates for the three treatments with 95% confidence intervals reported in parentheses

Attributes	Donation	Income tax	Subsidy
SQ	50.82***	33.68***	63.08***
	(30.82, 70.82)	(12.51, 54.85)	(42.78, 83.38)
High biodiversity	67.65***	44.70***	20.68
	(45.03, 90.27)	(16.78, 72.62)	(− 10.35, 51.70)
Medium biodiversity	29.07**	10.37	3.89
	(5.65, 52.49)	(− 17.15, 37.88)	(− 19.36, 27.14)
High environment	− 3.18	− 35.05***	− 50.74***
	(− 24.45, 18.09)	(− 60.57, − 9.53)	(− 74.77, − 26.71)
Medium environment	28.74***	− 8.98	− 15.82
	(8.54, 48.95)	(− 30.36, 12.40)	(− 37.13, 5.48)
Low flooding	132.24***	104.93***	87.76***
	(109.34, 155.14)	(74.66, 135.20)	(57.11, 118.42)
Medium flooding	115.85***	130.12***	91.98***
	(94.63, 137.06)	(104.18, 156.05)	(66.52, 117.45)
High recreational	− 17.05	− 48.69***	− 71.52***
	(− 38.84, 4.74)	(− 73.85, − 23.53)	(− 99.09, − 43.95)
Medium recreational	33.99***	19.83	0.50
	(11.98, 56.00)	(− 5.10, 44.77)	(− 29.32, 30.32)

***, **, and * parameters that are significantly different from zero at the 1, 5, and 10% significance levels, respectively. The confidence intervals are obtained using the Krinsky–Robb procedure. WTP estimates are in Ringgit Malaysia (RM) per household per year

Table 5 Welfare estimates for policy scenarios with 95% confidence intervals reported in parentheses

	Donation	Income tax	Subsidy
Policy scenario 1	183.06***	160.97***	50.08**
	(151.22, 214.90)	(121.95, 199.98)	(8.96, 91.20)
Policy scenario 2	73.87***	− 2.12	− 93.68***
	(40.18, 107.55)	(− 48.07, 43.83)	(− 140.09, − 47.27)

***, **, and * estimates that are significantly different from zero at the 1, 5, and 10% significance levels, respectively. The confidence intervals are obtained using the Krinsky–Robb procedure. Welfare measures are in Ringgit Malaysia (RM) per household per year

a medium level of biodiversity, a low level of flood risk, a high level of recreation, and a high level of environmental protection (i.e., 200-meter buffer zones).

It is evident from Table 5 that the choice of payment vehicle can significantly affect the policy advice obtained from a DCE survey. For scenario 1, the welfare estimates obtained using donations or an income tax are more than 200% higher than that of the subsidy treatment. While all three are significantly positive, i.e., indicating that the scenario would improve the welfare of respondents, the numerical differences could clearly have implications if, e.g., used in a cost-benefit analysis. For scenario 2, the impacts of the different payment vehicles become even more pronounced, such that the three different payment vehicles lead to three different conclusions. In the donation treatment, this policy on average has a positive impact

on the welfare of respondents. If using an income tax as the payment vehicle, the conclusion would be that the policy has no impact on respondents' welfare, whereas in the subsidy treatment, the conclusion would be that the policy will lead to a significant reduction in respondents' welfare.

6 Discussion

The main objectives of this paper have been to introduce a new proposal for a payment vehicle that could potentially be useful in environmental valuation research in emerging and developing economies and to discuss and evaluate its theoretical properties and empirical performance against well-known and relevant alternatives.

Suitable payment vehicles for DCE surveys in developing countries can be difficult to identify and are scarce in the literature (Whittington and Pagiola 2012). As noted by Carson and Groves (2007) and Carson et al. (2014), payment consequentiality requires vehicles to be perceived as coercive and relevant for all respondents; otherwise, incentive compatibility may be lost for some, and others might protest bid. In developed country settings, income taxes are often used as payment vehicles in DCE surveys, since taxes are generally considered coercive (Carson and Groves 2007). However, in emerging economies and developing countries, taxes often apply to only a small proportion of the population, and the monitoring and enforcement of tax policies might be limited (Gordon and Li 2009).

In our Malaysian case study, we faced exactly these challenges when selecting a payment vehicle for our DCE survey, since only a small proportion of the population effectively pays taxes. Looking for another payment vehicle with broader coverage, we relied on the fact that a broad range of essential consumer goods (e.g., rice, cooking oil, flour, and fuel) in Malaysia are currently subsidized. Since most people in Malaysia would be affected directly by a reduction in these subsidies, we thus hypothesize that using subsidy reductions as a payment vehicle increases perceived payment consequentiality compared to more typical payment vehicles such as donations and income taxes. We formalize this in the form of two testable hypotheses, namely, that price sensitivity will be larger when using subsidy reductions are used as the payment vehicle compared to using donations or an income tax, respectively. Relating to Cameron and DeShazo (2010) and Carson et al. (2014), we further hypothesize that the unexplained variance in the choices is lower when using subsidy reductions. Our findings generally support our hypotheses. We find significantly lower sensitivity to costs in the samples subjected to donation or income tax payment vehicles compared to the sample subjected to subsidy reductions. This result translates into generally lower WTP estimates when using subsidy reductions. More importantly, we show that this might have severe consequences for conclusions concerning policy advice. Furthermore, we find a significantly lower unexplained variance in the subsidy reduction sample. The fact that the choices in this sample are more consistent (i.e., less random) than in the other samples could indicate that the respondents exerted a greater amount of cognitive effort when making their choices. While we did not obtain independent measures of the perceived consequentiality of the payment vehicles and the evidence above can only be considered circumstantial in this regard, we do note that the results are very well aligned with the expected differences in perceived payment consequentiality, given the Malaysian context.

A short comment may be in order regarding comparing the results from the donation and the income tax samples. In the Malaysian context, each of these payment vehicles has its own challenges, and therefore it is not given that we should expect voluntary payments to result in

lower WTP levels than more coercive options, as found in earlier studies (e.g., Wiser 2007; Ivehammar 2009; Lyssenko and Martínez-Espiñeira 2012; Carneiro and Carvalho 2014). Donations may work better in Malaysia compared to many developed countries, as the social norms and culture around giving donations are fairly well-developed in Malaysia. Income taxes, on the other hand, have limited applicability in Malaysia, which likely reduces payment consequentiality. We did not find significant differences between these two samples when measuring price sensitivity or the unexplained variance (cf. Table 3), but we show that the generally lower WTP levels in the income tax sample may translate into significantly lower welfare measures when considering specific policy scenarios. While we have no measure of the "true" preferences to benchmark our results against, we do note that the income tax treatment produces welfare measures that are somewhat closer to another benchmark, namely, those obtained in the subsidy reduction treatment.

The main caveat with this study is that the results may be context dependent in the sense that the option to use subsidy reductions as a payment vehicle was available as a credible option. Subsidies for fuel and other consumption goods are widespread in low- to middle-income economies and developing countries (Demeke et al. 2009), which might suggest a general applicability for this payment vehicle. Nevertheless, there will be places where this is not the case; particularly in subsistence economies, sensitivity to such a vehicle may be limited.

Payments were stated as specific to the respondents' household. Nevertheless, we cannot rule out that the respondents perceived them as "typical" and that they perhaps believed that the actual reduction in subsidies for them specifically would be higher or lower than the amount stated in the event the policy was implemented. One such case could be households that engage in subsistence production of some consumption goods.

We did consider selecting other types of payment vehicles such as utility bills, e.g., water, sewage, or electricity bills. However, we abstained from using these vehicles because they either do not exist in many households or otherwise suffer from low coverage, as many households have alternatives, e.g., generators for electricity or their own water wells. Electricity is also subsidized in Malaysia under the energy subsidy rules (Solaymani and Kari 2014) and is thus covered by our choice.

We derived our hypothesis about payment vehicle effects on preferences and error variances based on our considerations concerning the likely differences in perceived payment consequentiality. However, we abstained from asking the respondents closed or open questions about how they perceived the payment vehicle in relation to aspects of consequentiality. Such opinion or attitude questions were used in, e.g., the study by Vossler et al. (2012) investigating the role of the perceived consequentiality of surveys with varying designs. In our rural Malaysian context, we found that our respondent group would find it difficult to meaningfully relate to questions about the different payment vehicles because of their subtlety [also compared to the context of the study by Vossler et al. (2012)]. Furthermore, answering such opinion questions before (or after) answering the choice sets would imply that the choices made (or opinions expressed) could be endogenous to the opinions stated (or choices made). This would invalidate the conclusions based on the correlations between such questions and choices. Nevertheless, the lack of answers to such questions or other measures implies that we have no additional individual-level indication of the perceived payment consequentiality of the different payment vehicles.

7 Conclusion

This paper demonstrates that reduced subsidies for daily consumer goods can serve as an appropriate payment vehicle. We believe that this finding has important practical implications, especially for the application of environmental valuation methods in emerging and developing economies. Price-regulating subsidies for many types of consumption goods are widely used in emerging and developing economies (Demeke et al. 2009). At the same time, user fees and even income taxes (Gordon and Li 2009) in such countries may suffer from lack of coverage and coerciveness. In those cases, describing subsidy reductions as the payment vehicle may be a valuable alternative. Thus, we hope that this study can inspire further efforts to test this payment vehicle against others in relevant contexts and hopefully enable applied stated preference studies in developing countries to move past previous struggles specifying valid payment vehicles (Whittington and Pagiola 2012). Our results also demonstrate the potential drawbacks of otherwise well-tested payment vehicles such as voluntary donations and income taxes when applied in a context where even the latter does not have the properties it is often associated with in the broad literature.

Finally, this study also contributes with insights into what aspects of wetland conservation are of importance for the population in the areas around the wetland. We find that first, our respondents are concerned about avoiding high risks of flooding and the associated damages to property—an ecosystem function related to the wetland's capacity to absorb rainwater and protect against the risk of flooding from river and wetland systems. The preferences for most of the other attributes are more mixed, with considerable heterogeneity in the preferences for environmental protection of the SW. Part of this heterogeneity may relate to conflicts between current land uses and the environmental protection measures. The results thus suggest that if public funds are directed away from subsidies and toward the proposed conservation programs, a sufficient focus on flooding risks would be recommended to obtain local support for and gains from the project.

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Appendix

The actual descriptions of the payment vehicles presented to respondents (translated from the Malay language)

Payment Vehicle	Description of conservation cost
Subsidy	(1) A policy to implement a conservation program for this wetland will require funding for the costs of the program. The government is planning to do so by lowering the current subsidies for groceries such as flour, cooking oil, liquid natural gas, and fuel and to use the freed funds to implement the conservation program. Thus, the different alternative policies will incur a necessary yearly cost to your household, as you will have to pay more for these everyday goods that will now be less subsidized (2) The possible amounts that this additional expense may cost your household are stated below: RM 0/year, RM 5/year, RM 10/year, RM 30/year, RM 90/year, RM 210/year, RM 400/year (3) Here, we'd like to ask your opinion about some of these attributes for the conservation of the SW. If adopted, it would be financed through sources that will eventually reduce your household's income (4) We will ask you to compare two alternative management policies along with the current state and to tell us which one you would support in practice (5) Please also consider your choices under the precondition that if implemented, the payments will be made through a reduction in subsidies for fuel, groceries, etc. enjoyed by you and other households. In other words, these goods will become more expensive to buy, so you would have to spend the additional specified amount per year on these goods (6) The results of this survey are advisory. In other words, they will be used to inform policymakers on the opinions and preferences of Malaysians to help them see how important conservation of the SW is and how it can be improved (7) Please think carefully about how much you can really afford through subsidy reductions. You can also choose not to pay if you think that you can't afford it and you prefer to spend your income on other things
Donation	(1) A policy to implement a conservation program for this wetland will require funding for the costs of the program. The government is planning to do so by raising the funds through voluntary donations and using the freed funds to implement the conservation program. Thus, the different alternative policies will incur a necessary yearly cost to your household, as you will have to give some of your income to that fund (2) Similar to subsidy version (3) Similar to subsidy version (4) Similar to subsidy version (5) Please also consider your choices under the precondition that if implemented, the payments will be made through the fund from voluntary donations by your household (and other households) (6) Similar to subsidy version (7) Please think carefully about how much you can really afford if you need to provide a voluntary donation. You can also choose not to pay if you think that you can't afford it and you prefer to spend your income on other things
Income tax	(1) A policy to implement a conservation program for this wetland will require funding for the costs of the program. The government is planning to do so by increasing/charging an income tax and using the freed funds to implement the conservation program. Thus, the different alternative policies will incur a necessary yearly cost to your household, as you will have to pay more in income taxes (2) Similar to subsidy version (3) Similar to subsidy version (4) Similar to subsidy version (5) Please also consider your choices under the precondition that if implemented, the payments will be made by increasing or levying income taxes on your household (and other households) (6) Similar to subsidy version (7) Please think carefully about how much you can really afford if you experience an increase in your income taxes. You can also choose not to pay if you think that you can't afford it and you prefer to spend your income on other things

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