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LABOUR AS A UTILITY MEASURE RECONSIDERED

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Labour as a utility measure reconsidered

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Abstract:

In Stated Preference studies for the appraisal of environmental projects in poor countries or regions it often turns out that the stated willingness to pay of people for environmental improvements, which is used as measure of individual welfare changes, is very low. This is often interpreted as the result of extremely tight budget constraints, which make it impossible that people express their true appreciation of an environmental project in terms of their willingness to pay for it. Therefore, it is sometimes suggested to use labour contributions instead of money as a numeraire to measure utility in such studies. In this paper we show theoretically and empirically that this suggestion is not compatible with the principles of welfare theory because of several inconsistencies. We also illustrate the validity of our arguments empirically based on the results of a Contingent Valuation study conducted in a rural area in northern Vietnam.

Keywords: Contingent Valuation, Cost-benefit Analysis, Developing Countries, Public Expenditures, Vietnam, Willingness to work

JEL-Classification: D61, H43, Q51

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1. Introduction

Cost-benefit analysis is an important tool for supporting decisions on the rational use of public funds, especially in the environmental sector. It aims at the assessment of the social benefits generated by some environmental project in order to compare these benefits to the costs of the project or to the social benefits generated by other projects. Thereby it helps to substantiate the decision if an environmental project should be realized or not, and it may also help to pick the best from a variety of alternative projects. Hence, in this application environmental valuation is primarily an instrument to enhance the efficiency of public spending. One of the most popular methods for the economic valuation of environmental projects is the Contingent Valuation Method (CVM). It is an interview-based direct valuation technique aiming at the assessment of people's maximum willingness to pay (WTP) for the realization of a public project (cf. Carson and Hanemann, 2005).

In the course of a CVM survey, interviews with a representative sample of all households affected by a certain public project are conducted in order to elicit their willingness to pay for that project. The WTP is interpreted as the Hicksian Compensating Variation (HCV) for the project in question. The average WTP of the sample is multiplied by the number of all households affected by the project in question in order to determine its "social value" which equals the social benefits accruing from that project. The social benefits can then be compared to the costs caused by the project in order to determine if it is socially desirable in the sense of the Hicks-Kaldor social decision criterion or not (cf. Hicks, 1939 and Kaldor, 1939).

However, the use of CVM is often considered problematic in countries where household incomes are very low and where subsistence economy prevails, so that a considerable part of households' consumption is not bought in markets (see e.g. Gibson et al., 2016). Willingness-to-pay responses in Contingent Valuation studies in such countries are severely limited by tight budget constraints and by the fact that part of households' consumption is not paid for in terms of money. WTP is, therefore, not considered a good utility measure under such circumstances since the trade-off between private good consumption on the one hand and the consumption of a public good on the other, which forms the theoretical basis of the CVM, cannot be expressed adequately in terms of money or income under such circumstances (cf. Ahlheim, 1998).

One suggestion often made in the literature is to use other measuring units than money, especially labour contributions (see e.g. Echessah et al., 1997; Hardner, 1996; Hung et al., 2007; Abramson et al., 2011; Vondolia et al., 2014; Lankia et al., 2014) or staple food (cf. e.g. Shyamsundar and Kramer, 1996) or beehives (Asquith et al., 2008) for the valuation of public goods. Instead of asking people how much money they would be willing to give up in order to obtain a certain public good it is suggested to ask how many working days or working hours they

would be willing to contribute to the provision of that good. Labour as a utility measure has been used not only in CVM studies but also in Choice Experiments (see e.g. Abramson et al., 2011; Rai and Scarborough, 2013; Gibson et al., 2016). In this paper we scrutinize the suggestion to use labour contributions to a public project instead of money as a payment vehicle in CVM studies under theoretical and empirical aspects. From the results of a CVM study conducted in a rural region in northern Vietnam we conclude that labour is not a suitable measuring rod for the utility people expect from an environmental project, since the relation (or "exchange rate") between one hour of labour and the disutility it causes is different not only between different individuals, but also for one and the same individual, depending on the specific circumstances under which the work has to be contributed. This relation depends on the kind of labour to be done (office work, different kinds of physical labour etc.), the opportunity cost of the time spent on the labour contribution (depending on the alternative uses of this time such as paid work, work in one's own business or farm, leisure etc.) and the kind of work an individual is used to from her everyday life and regular job. Therefore, the number of working days an individual is willing to contribute to a public project is not a reliable and uniquely defined indicator of the utility gain the individual expects from that project. Further, a conversion of labour contributions into monetary terms by multiplying working hours by an average wage rate, as is recommended in some publications, may not be appropriate in such poor regions since, typically, there exist no functioning labour markets in such areas. Only 7.5% of the respondents of our survey stated that they would have the possibility to do paid work instead of the community work for the public project. In our survey we ask respondents first to state their WTP in monetary terms, before we open up the possibility to contribute labour to the project, so that their WTP statement should refer to the total utility they expect from the project. We find that stated WTP accounts for less than one-tenth of a percent of respondents' incomes (0.08%) on average. Therefore, we do not find evidence for the assumption that people's "true" WTP for the environmental project in question was limited or truncated by their ability to pay. In most CVM surveys a stated WTP of about one percent or less of households' incomes is found, so that income does not seem to put a serious restriction on people's WTP for environmental projects (s. e.g. Wang et al., 2006; Boman et al., 2008; Yu and Abler, 2010 or Yang et al., 2014). In the light of such results the search for a payment vehicle alternative to money does not seem to be really necessary.

In the next section we describe the problems arising in the context of CVM surveys in very poor societies from a theoretical point of view. Section 3 provides a short overview of the literature related to willingness to pay and willingness to work (WTW) in Stated Preference studies. In section 4 we discuss possibilities of how to handle the problem of tight budgets in poor societies in the context of Stated Preference studies. In section 5 we present an empirical study conducted

in Vietnam in order to test the usefulness and applicability of labour as a numeraire for measuring welfare, and in section 6 we discuss the results of this study. Section 7 contains some concluding remarks.

2. The problem

The economic valuation of changes in environmental quality caused by a public project typically aims at the question whether or not society as a whole is better off after that project has been performed or not. Two steps are necessary to answer this question: first, individual welfare changes of all people potentially affected by the project in question have to be assessed and, second, these individual welfare changes must be aggregated in order to compute the resulting change in social welfare. For practical reasons these welfare changes should be assessed in monetary terms so that they can be compared to the costs of the public project in question.
The first step of the appraisal of a government-financed environmental public project is, therefore, the assessment of the change in individual utility accruing to an individual $j \in \{1, 2, ..., J\}$ from a change in environmental quality from z^0 to z^1 that is caused by that project:

(1) $$\Delta^{01} U_j = U_j^1 - U_j^0 = u_j(x_j^1, z^1) - u_j(x_j^0, z^0)$$

In (1) we describe the state of the environment by a vector z of parameters describing the state of environmental quality (air quality, water quality, ecosystem services etc.). The function $u_j(x_j,z)$ is an individual j's (well-behaved) direct utility function, while U_j^0 and U_j^1 denote the utility levels attained by individual j before and after the project, and x_j^0 and x_j^1 are the market commodity bundles consumed before and after the project in question. Since the utility change ΔU_j cannot be observed empirically, we need an empirical utility indicator IND_j fulfilling the following requirements:

(2) In order to be used in Stated Preference studies an empirical indicator $IND_j(U_j^0, U_j^1)$ of individual utility changes $\Delta^{01}U_j = U_j^1 - U_j^0$ should be

a. computable on the basis of empirically assessable data,

b. strictly monotonically related to utility changes according to

$$IND_j(U_j^0, U_j^1) \geq 0 \quad \Leftrightarrow \quad \Delta^{01}U_j \geq 0 \quad \text{and}$$

$$IND_j(U_j^0, U_j^1) \geq IND_j(U_j^0, U_j^{1'}) \quad \Leftrightarrow \quad \Delta^{01}U_j \geq \Delta^{01'}U_j \ ,$$

c. measured in uniquely defined units to be suited for aggregation over individuals in a welfare theoretically meaningful way,

d. convertible into monetary terms, so that it can be used in the cost-benefit comparison criterion for public investments.

Requirement (2a) represents the crucial difference between IND and a normal utility function. (2b) requires that there exists a one-to-one relation between the indicator IND and the item it indicates, i.e. utility. IND should show a positive value if and only if an individual's utility level is raised by a public project and its value should increase with the level of utility that is produced by a public project, i.e. IND should not only indicate the direction of a utility change, but also its extent in a uniquely defined way. Requirement (2c) makes sure that the units in which IND is measured are the same for all individuals, so that the values of IND are comparable between individuals for aggregation and not arbitrary. Requirement (2d) is necessary for the use of IND in cost-benefit analyses, since the costs of a project are typically assessed in monetary terms.
The standard utility indicator used in project appraisal studies, no matter if they employ Stated Preference methods like Contingent Valuation or Choice Experiments (CE) or Revealed Preference methods like the Travel Cost Method or Hedonic Pricing, is the Hicksian Compensating Variation

(3) $$HCV_j^{01} = e_j\left(p, z^1, U_j^1\right) - e_j\left(p, z^1, U_j^0\right) \quad \left[= WTP_j^{01}\right]$$

where e(·) for given commodity prices p and given environmental quality z is what Samuelson (1979) called a money-metric utility function based on Lionel McKenzie's (1957) minimum expenditure function. It indicates the minimum expenditure necessary to attain a utility level U with commodity prices p and environmental quality z. The HCV according to (3) expresses, therefore, the maximum amount of money a consumer j can give up after environmental quality has been improved from z^0 to z^1 without being worse off in utility terms than in the initial situation 0. For a rational consumer this amount equals her maximum willingness to pay to get this environmental improvement realised. For utility decreases (e.g. as a consequence of environmental damages) the HCV is, of course, negative and can be interpreted as a household's willingness to accept compensation for that damage. In this paper, however, we will focus on the appraisal of utility-increasing public projects.
Using a household's indirect utility function $v_j(p, z, I_j)$ the idea of the willingness-to-pay concept can be expressed by the identity

(4) $$v_j(p, z^1, I_j - WTP_j^{01}) \equiv v_j(p, z^0, I_j) = U_j^0$$

where market prices p and the household's lump-sum income I_j are assumed to be constant. Willingness to pay for a commodity as an indicator of the utility a consumer expects from the consumption of that commodity is a concept that people are acquainted with from their everyday lives. Therefore, (3) is suitable for the use in Stated Preference surveys where people are asked their WTP for the realization of a certain project, so that requirement (2a) is fulfilled. Since the HCV is defined in monetary terms it also satisfies requirement (2d) by definition.

From the strict monotonicity of the money-metric utility function in utility (cf. Weymark, 1985, p.221) it follows immediately that HCV fulfils also requirement (2b) for a given project: WTP is positive if and only if the respective public project leads to a utility increase and the amount of the WTP increases with the utility gain that is cause by that project. Aggregation of a utility indicator over different individuals is, of course, a conceptual challenge in the context of ordinal utility, since it implies a cardinal interpretation of the individual utility measures and the possibility of a trade-off between the utility changes of different individuals as in a social welfare function. In applied cost-benefit analyses, however, it is common to calculate the social benefits B^{social} accruing from an environmental project by simply adding up the individual WTPs over all individuals

(5) $$B^{social} = \sum_{j=1}^{J} WTP_j^{01} \quad \left(= \sum_{j=1}^{J} HCV_j^{01}\right) \quad .$$

From a welfare theoretical perspective this amounts to defining a social welfare function where all individuals obtain the same social weights. The realization of a specific environmental project depends then on the comparison between the social benefits according to (5) and the project costs. According to the Hicks-Kaldor criterion (Hicks, 1939; Kaldor, 1939), a project is considered for realization only if the benefits exceed the costs. The dependence of the realization of a public project on B^{social} demonstrates the importance of the conceptual soundness of a welfare measure and of the validity and reliability of its empirical assessment.

If we accept this idea of aggregation in principle, the question arises, under which conditions an aggregation procedure is meaningful under a welfare economic perspective according to requirement (2c). We find it necessary for a meaningful aggregation that the units, in which the welfare indicator IND is defined, are homogeneous for one and the same individual as well as between different individuals. Ideally, a dollar of stated WTP should be uniquely defined regarding the utility change it signifies for a single household, and it should also represent the same utility change for different households. For a single household the "currency" in which it

pays for a utility increase is uniquely determined in terms of its WTP. But if we accept the general notion of diminishing marginal utility of income, it is clear that the next dollar donated for an environmental project has different values in terms of utility for rich households on the one hand and poor households on the other. For them WTP is not a uniform "currency" in terms of utility. This fact is disregarded by the well-known "a-dollar-is-a-dollar" principle used in practical cost-benefit analysis according to the aggregation procedure in (5).

Since in most valuation studies WTP is assessed not on an individual but on a household level, it is, further, held that summing up individual WTP statements leads to a discrimination against poorer households, whose WTP is restricted by their budget constraint, i.e. by their ability to pay. Therefore, they have less "voice" to express their appreciation of an environmental project than richer households. Especially, when considering households with many household members, where more people will benefit from an environmental project than in single-person households, one would expect higher WTP statements. Contrary to this hypothesis many empirical studies yield results where stated WTP decreases with household size (see e.g. Whitehead, 1991; Whittington et al., 1992; McDaniels et al., 1992; Garrod and Willis, 1994; Johannesson et al., 1996; Chambers et al., 1998; Hammitt et al., 2001; Dong et al., 2004; Aprahamian et al., 2007). Chambers et al. (1998, p.149) give the following explanation for their result of a negative influence of family size on WTP: “This result might be related to ability to pay; as family size increases, budgets tighten, and WTP falls”. Ahlheim and Schneider (2013), therefore, suggest to use household equivalence scales as weights in an aggregation process analogous to (5).

The problem remains that in countries or regions where all households are poor, they might not be able to express their appreciation of an environmental project adequately in terms of WTP. In this case money does not seem to be an appropriate measuring rod for the utility people expect from a public project. This has consequences for the allocation of public projects within a country, if government has to decide which of several alternative public projects in different parts of the country should be realized. If some of these regions are rich and some are not, the social benefits in terms of stated WTP assessed in the rich regions will be higher than in the poor regions, and the public money will go to the rich regions where it seemingly creates higher benefits, while, probably, it would be more needed in the poorer regions.

Another argument held against WTP as a utility measure is that in poor societies an important part of people's consumption often does not come from commodity markets but, instead, from the subsistence or barter economy (s. e.g. Gibson et al., 2016). In this case it does not hold that the utility from a household's consumption x_j depends on income alone (for given p and z). Instead, the household's consumption bundle comprises also a "non-market" component that is not restricted by the household's budget constraint and, therefore, not affected by its payments

for environmental projects. However, this argument does not seem to harm the idea of WTP as a measure of individual utility, as long as at least a part of the household's consumption is paid for out of its budget and as long as the marginal utility of income is positive. In this case each dollar spent on a public project in terms of WTP stands for a consumption sacrifice and a loss in utility.

Summing up, we can say that the Hicksian Compensating Variation or WTP according to (3) fulfils the requirements (2a, b and d), while aggregation over different individuals (2c) is problematic within the context of ordinal utility theory. Further, it is not clear how valuation studies should deal with the problem that in very poor regions of the world stated WTP for environmental projects is very small, so that the question arises, if under such circumstances WTP is a suitable welfare measure.

3. Related Literature

Since the early 1990s, the use of Contingent Valuation surveys to determine people's willingness to pay in developing countries has become a common technique. Most of these studies focus on the empirical objective of assessing the social value of environmental projects without mentioning further methodological aspects. Only few attempts have been made to address the specific problems originating from different socio-economic, cultural and political circumstances that might complicate the conduction of CVM surveys in developing countries. In his 1998 and 2002 articles, Whittington analyses specific problems faced by CVM researchers in developing countries and provides a systematic overview.

One of the central aspects frequently discussed when it comes to Contingent Valuation studies especially in poor areas with households that live on the subsistence level, is the tight budget of respondents. Their budget constraint might hinder people to express their real appreciation of the project in terms of their WTP since they just do not have any money. Their appreciation for the project might however be substantial. In this context, Whittington (1998) categorizes the respondents in a CVM survey according to their willingness and their ability to pay. He states that only respondents who are willing and able to pay should be taken into consideration for the estimation of total benefits. According to his opinion, people who are willing but not able to pay should be categorized as "not willing to pay". Following this suggestion would, however, result in very low average WTP statements since there would only be a rather small fraction of the overall population left that is able and willing to pay. To avoid this potential bias caused by tight budget constraints in poor regions, various solutions have been suggested.

As an alternative to money, payment vehicles such as in-kind payments, e.g. rice or beehives (Shyamsundar & Kramer, 1996; Asquith et al., 2008), or working days (Echessah et al., 1997; Hardner, 1996; Hung et al., 2007; Vondolia et al., 2014) have been suggested.

Hardner (1996) was one of the first ones to use labour as a payment vehicle in CVM surveys. In his study, he assesses people's willingness to work for potable tap water in a community in rural Ecuador. He finds that 72% were willing to contribute a positive amount of labour time for the construction of a water purification system (mean= 1.4 days). The comparison to WTP in monetary terms was, however, not possible in this subsistence agriculture-based community.

In later studies, it became more common to simultaneously assess respondents' contributions in terms of labour time and money (Swallow & Woudyalew, 1994; Echessah et al., 1997; Kamuanga et al., 2001). Each of the studies finds that respondents were rather willing to contribute labour time instead of money. However, the authors do not attempt to compare the two types of contributions in monetary terms; hence, contributions stated in labour time are not converted into monetary units.

Hung et al. (2007) assess respondents' WTP in terms of labour time for a forest fire prevention program in a small-scale study. By means of two payment cards, they elicit respondents WTP in monetary terms as well as in working days. To make the payment cards comparable, they multiply the working days by the current wage rate and thereby determine the monetary payment card intervals. They find that 81.4% are willing to contribute a positive amount of money while farmers are significantly less likely to state a positive amount. In terms of labour time, 90% are willing to contribute a mean of 5 working days per year.

Casiwan-Launio et al. (2011) estimate the WTP in pesos per month and the WTW in days per month to maintain the San Miguel Island fishery reserve in the Bicol Region, Philippines, using the trichotomous choice question format after Loomis et al. (1999). To compare the two resulting estimates, they multiply the WTW estimates by 33% of the average daily income of the respondents, assuming this to be the opportunity cost of labour. They find that the WTW is approximately eight times higher than the lower-bound WTP estimate. To explain this divergence, they consider that missing labour markets reduce the opportunity cost of time or that respondents are more likely to forgo future income (with regard to contributing labour time) than income already earned due to the endowment effect (Thaler, 1980).

Vondolia et al. (2014) compare WTP (money) and WTW (working time) of an open-ended CV format focussing on the experience that respondents have with the different payment vehicles in a CVM study among Ghanaian farmers. According to their results, more experience leads to lower response asymmetries between money and time suggesting that respondents' experience with the payment vehicle should be considered when conducting CVM surveys in poor regions.

Vásquez (2014) investigates the two different payment vehicles in a context of municipal and community-managed water service systems in Guatemala by means of a sequential CV survey. He finds that respondents served by municipal services are substantially more willing to pay for safe drinking water in terms of money and labour than respondents served by community-managed services are.

While most of these studies elicit WTW as a single point measure, Pondorfer and Rehdanz (2015) elicit a WTW- and WTP-range in order to assess uncertainty of people's willingness to work or to pay. They conclude that uncertainty decreases when people are asked for a contribution in labour time instead of money.

The concept of willingness to work is also applied with other Stated Preference methods such as Choice Experiments. Abramson et al. (2011) investigate the willingness to pay, to borrow (WTB) and to work for water service improvements in a CE in rural Zambia. The authors introduce microfinance to enhance the WTP of the respondents in their experiment in order to circumvent problems with the ability to pay. Hence, respondents were able to choose between three payment vehicles: cash, interest-free loan or labour. They compare the results of the three vehicles (labour converted at the local wage rate for unskilled labour) and find their hypothesis confirmed that loan and labour financing yield higher estimates for water service improvements than WTP in cash.

Gibson et al. (2016) implement a split-sample CE in Kandal Province, Cambodia, to test labour and money contributions as payment vehicles for improved drinking water focussing on e.g. attribute non-attendance. Their results suggest that, as long as functioning labour markets exist, the internal opportunity cost of time is similar to the local wage rate for similar labour tasks. In addition, there is no difference in non-attendance of the payment vehicle. They argue that it is not the type of payment vehicle that leads to non-attendance of the payment attribute but the payment vehicle itself.

The wide acceptance of contributing labour time in CVM and CE studies suggests that exclusively asking for WTP in monetary terms will undervalue the benefits from the goods in question. The use of labour time as a measure of individual utility changes, however, also bears some problems. In contrast to money, working time is not a homogeneous good; it might thus have different values depending on the time and place where it is carried out. In practice, many studies simplify the problem by applying the average wage rate as the value of one working hour (see Hung et al., 2007; Abramson et al., 2011; Casiwan-Launio et al., 2011). Furthermore, in these studies the working conditions (time, place, kind of work) are usually not clearly defined. While avoiding the tight-budget bias, the use of labour as a numeraire can thus produce two other biases: one is due to imprecise specifications of the work to be done and the other originates

from the problem of converting stated labour contributions into monetary terms in order to be able to include them in a cost-benefit analysis.

4. Discussion of different payment vehicles

While it seems plausible, that under very austere living conditions people have more pressing problems than environmental preservation, so that a low stated WTP mirrors their true preferences given their actual situation, many authors, nevertheless, believe that poor people's true preferences towards public projects cannot be adequately expressed in terms in WTP. As discussed in the previous section they suggest to use payment vehicles different from money to give poor households the opportunity to express their preferences regarding the environment adequately. Three main suggestions are made in the literature in this context. One suggestion is that respondents should state their WTP in terms of hypothetical cuts in government expenditures which they consider equivalent from a utility point of view to the environmental improvement in question (cf. Bergstrom et al. 2004). In this version respondents in Contingent Valuation studies "pay" for an environmental improvement in terms of a reduction of public expenditures on other (already existing) public goods or services. This idea is very appealing at first sight, since respondents' personal incomes are not affected by this "payment", so that their WTP is not restricted by their tight household budgets. An important problem arising in this context is that, typically, it cannot be defined uniquely in a CVM interview which public goods or services will be reduced in order to finance the environmental project in question and to what extent this will happen. If a respondent in a CVM interview is willing to pay 50€ out of his budget for the preservation of a rare species, he knows what he gives up in terms of his private consumption and what the consequences for his wellbeing or utility are. But if, on the one hand, he does not know which public expenditures will be reduced, he cannot assess the ensuing reduction of his personal utility and, therefore, he cannot compare it to the utility gain expected from the environmental project in question. If, on the other hand, he is told which specific public good or service will be reduced in order to finance the environmental project, this "currency" will have completely different values in terms of utility for different people, so that requirement (2c) will be fundamentally violated. If somebody does not have children he does not care if subsidies for kindergartens are cut back, and if he does not have a car he does not mind if expenditures for road construction are reduced. Analogous arguments hold for museums, theatres etc. This means that different people would understand different things by a certain cut in public expenditures and they would associate different utility losses with it, so that their "willingness to cut public expenditures"-statements could not be aggregated or traded off against each other. Therefore this idea has to be dismissed on theoretical grounds**.**

Another suggestion for a numeraire different from money is to express one's WTP in terms of an essential and very common commodity or basic food, e.g. rice. This approach was followed by Shyamsundar and Kramer (1996) in their already mentioned CVM study where they assessed people's WTA for a restricted access to the Mantadia National Park in eastern Madagascar in terms of baskets of rice. It is rather obvious that this measurement method does not work in a WTP context: if people are really living close to the subsistence level (which is our assumption here), then they can give up neither money nor rice in order to enhance environmental quality. Therefore, using rice as a numeraire does not solve the problem of tight budgets. Additionally, since rice can easily be converted into money the question arises why one should ask WTP in terms of rice first and then convert it into money later. The same kind of argument holds for other in-kind payment vehicles as beehives (s. Asquith et al. 2008).

While the non-monetary payment vehicles discussed so far appear unsuited for solving our problem, several studies suggest to use labour contributions as a numeraire for poor households' WTP for public projects, as discussed above in section 3. In these studies households are not asked how much money they are willing to pay for a public good but, instead, they are asked how many working days they would be willing to contribute to enable the provision of this good (cf. e.g. Hardner 1996, Echessah et al. 1997, Hung et al. 2007, Vondolia et al., 2014, Lankia et al., 2014). While some of these studies rely on the valuation in terms of labour only, others give respondents the possibility to state their contributions in terms of labour and / or money (cf. Hung et al., 2007; Abramson et al., 2011; Casiwan-Launio et al., 2011; Gibson et al. 2016).

In order to consider this suggestion in detail, assume a household j has an overall time budget of T hours which can be used either for leisure L_j or for paid work W_j in the labour market or for working in the household's own business or farm B_j. The household's overall income consists then of a lump-sum income I_j plus labour income $w \cdot W_j$ plus income from the work in the household's own business $r_j \cdot B_j$, where w is the wage rate and r_j is the individual monetary return per working hour in household j's own business, i.e. the monetary value of the marginal product of this work. It is clear that r_j depends on the individual circumstances of the household's business or farm like the fertility of the soil, the technical equipment etc. Therefore, r_j will be different for different households.

A household's utility maximization problem is then restricted by its overall income Y_j and the overall time T available for leisure or different kinds of work:

(6) (a) $Y_j = I_j + w \cdot W_j + r_j \cdot B_j$; (b) $T = L_j + W_j + B_j$

From this presentation it becomes obvious that the financial equivalent of an hour of work dedicated to a public environmental project instead of a financial contribution, i.e. instead of WTP, depends on which kind of activity (leisure, paid work, own work) will be cut back in favour of the public work. Therefore, the value of an hour of public work in terms of its opportunity cost will differ from household to household. Also for one and the same household it will differ according to the actual situation, in which the work has to be delivered. If this happens to a farmer during the harvest season his monetary opportunity cost per community working hour will be r_j. If he misses paid work, his opportunity cost per community working hour would be the wage rate w. The monetary opportunity cost of leisure is zero. Here the individual loses utility in terms of the marginal utility of leisure, while in the other two cases he loses utility in terms of reduced market good consumption caused by the implied loss of income. The same number of working hours (WTW) will, therefore, stand for different utility equivalents, so that requirement (2b) for a reliable utility indicator will be violated by WTW as a payment vehicle.

The uncertainty regarding the alternative use of communal working time leads us to the hypothesis that it is not possible to convert the working hours an individual is willing to contribute to the provision of an environmental project into monetary units, as long as we do not know what people would do during those hours, otherwise. Even if we had this information, neither the monetary value of leisure nor the value of the marginal product of an individual's work on his farm etc. would be known. This implies a violation of our requirement (2d) above.

In practical CVM studies the problem of converting labour into money is often "solved" by simply multiplying the working hours offered by CVM respondents by some average wage rate (Hung et al., 2007; Abramson et al., 2011; Casiwan-Launio et al., 2011). Obviously, this makes sense only if respondents really have the possibility to earn this wage rate during the time they offer as WTW for the public good, so that the average wage represents the opportunity costs of their work contribution to the public good. Typically this will not be the case, since there exist no functioning labour markets in remote rural areas of developing countries and since many people there will be farmers or self-employed in their own businesses. Therefore, the average wage rate is meaningless to them. The valuation of time is more sophisticated, especially, since time can be used for various different activities which have different relations to utility, as we have explained above. This is also shown e.g. by Dalenberg et al. (2004) in a Contingent Valuation study where they show that time can have different values to a person depending on which activity is undertaken. A fundamental theoretical model on how to value time in which different dimensions of time are considered was constructed by Becker (1965).

It should be mentioned in this context that in empirical valuation studies it is often assumed for simplicity's sake that the only opportunity cost of community work for some environmental project

is a loss of leisure time. Based on this assumption people's WTW for a public project is often defined in analogy to (4) as

(7) $$v_j\left(p, z^1, I_j, L_j - WTW_j^{01}\right) \equiv v_j\left(p, z^0, I_j, L_j\right) = U_j^0 \quad .$$

Considering the different possible uses of time, this kind of modelling is obviously misleading (cf. e.g. Eom and Larson (2006), Vondolia et al. (2014), or Gibson (2016)).

We should, further, note that the utility equivalent of a working hour is only incompletely captured by the pure loss of time (as in (7)), since work itself has a direct influence on utility. This is an important difference between money and working hours. While money is a mere medium of exchange, labour may cause different degrees of disutility depending on the kind of work, hard or light physical work, brain work etc. Therefore, people's willingness to work for an environmental project is not even for one and the same household a uniform measuring rod for utility, as required in (2b), as long as the kind of work to be contributed to a public project is not uniquely specified. But even then it is not comparable between different households, because the disutility a specific kind of work causes depends, among other things, on the kind of work the respective individual is used to from his everyday life, his age, health status etc. Aggregation of working hours across households according to some "an-hour-is-an-hour" principle will, therefore, not be possible, so that also our requirement (2c) is violated by WTW as a payment vehicle in Stated Preference studies. Our respective hypothesis for our empirical study is that in Stated Preference surveys people make differences in their WTW statements for the same project depending on the kind of labour they have to contribute (H1).

Further, we think that the utility sacrifice a household is willing to make in terms of working hours for an environmental project depends on the kind of work the household is used to from his everyday life. Physical work means more disutility for somebody, who works in an office than for a farmer or a construction worker. Hence, our hypothesis here is that stated willingness to do a specific kind of work depends on the kind of work people are used to from their everyday jobs (H2).

Additionally, if the alternative uses of the time people are willing to spend on communal work for the public project are not homogeneous (i.e. only paid labour or only leisure) but different for different persons and occasions, then the monetary value per hour of their WTP is also not uniquely determined (H3), especially since we do not know the monetary value of leisure time or time spent in one's own business or farm. Then it is pointless to compare or aggregate the WTW of different people with different life backgrounds because their work contributions stand for

totally different opportunity costs or utility sacrifices. By testing hypotheses (H1) to (H3) empirically we want to find out if WTW is a suitable alternative to WTP in poor societies.

Summing up, we suppose that requirements (2) for a reliable empirical measure of individual utility changes are not fulfilled by WTW. The utility equivalent of individual labour contributions is not uniquely determined (violation of (2b)), because it depends, among other things, on the kind of communal work that has to be done by that individual (together with his age, health, the weather on that specific day etc.) and on the kind of work that this individual is used to from his normal job and everyday life. Since there exists no one-to-one relation between WTW and individual utility changes, a welfare economically meaningful aggregation of WTW over different individuals is not possible (violation of requirement (2c)). A conversion of WTW into monetary terms (requirement (2d)) would be meaningful in a welfare economic sense if there was only one alternative use of the time contributed to communal work (e.g. paid private labour) and if there was a uniform monetary value of this time use (e.g. a wage rate). If there are different possibilities of an alternative use of the time contributed to communal work (depending on the specific personal situation when the communal labour has to be done) and if there is no uniform monetary value of the different time uses (like leisure or work in one's own business) it is not possible to assess the opportunity cost of the time contributed to communal work in a welfare theoretically meaningful way, so that (2d) is violated.

In our CVM study conducted in a rural area in northern Vietnam we tested the hypotheses that people's stated willingness to work for the realization of a public project depends

(H1) on the kind of labour required,

(H2) on the kind of work people are used to from their usual jobs and their everyday lives

and

(H3) that the opportunity cost of the contributed labour as a monetary measure of people's WTW cannot be determined unambiguously.

If hypotheses (H1) and (H2) will be confirmed in our empirical study, requirement (2b and c) for a reliable empirical utility measure are violated, if (H3) is confirmed requirement (2d) will be violated. In the next chapter we briefly describe the main features of our CVM survey.

5. An empirical study

The research site for our survey in northern Vietnam is Yen Chau district in the Son La province located about 250 kilometres west of Hanoi. Every year between June and September heavy rainfalls in these regions lead to an increase in the frequency and severity of landslides and the destruction of fields, buildings and infrastructure. In June 2015, in the wake of Tropical Cyclone Kujira, torrential rain caused flash flooding in the northern province of Son La, Vietnam, which was the study site of the research project underlying this paper. Landslides occur in the steeply sloped agricultural areas where sometimes entire farming fields are washed downhill. Consequently, people in landslide-prone areas suffer in many ways: substantial numbers of people lose their homes, road blockings and destruction severely impair the transportation of people and merchandise for various days or weeks. Some people even lose their lives due to landslides. The National Road No. 6 from Hanoi to Son La, which leads through Yen Chau, is especially endangered by landslides during the rainy season.

Against this background a CVM study was conducted in Yen Chau district where the main areas endangered by landslides are situated. A survey with personal interviews of 500 randomly selected households of villages located along National Road No. 6 in Yen Chau district was conducted in April 2008. In these interviews respondents were first asked how much money they would be willing to contribute in the form of a mandatory landslide prevention fee in order to get this program realized. For this elicitation question the payment card format was chosen. After having asked people their WTP for landslide protection in terms of money we asked them if they were willing to contribute working time to the realization of this project in addition to the money contribution they had just offered. We asked the WTP question first, because we wanted to find out if people's stated WTP for the landslide protection program would really be so high that one could reasonably assume it to be truncated by their ability to pay. Letting them express their appreciation of the landslide protection program in terms of WTW alone, would not have been advisable since their time budgets are rather tight as well. Due to the low degree of mechanisation in agriculture in those areas, farmers (65% of the population), but also craftsmen and other workers have long working hours and harsh working conditions, so that after work they are exhausted and not much time is left for additional community work for the public project. Therefore, WTW as the only payment vehicle would not have led to a comprehensive valuation of our public project. Almost 85 % of the respondents answered ‘yes’ to the question if they were willing to contribute labour in addition to money. This was a prerequisite of our intention to test the suitability of labour as a numeraire for measuring households’ appreciation of a public project. If it turns out that labour contributions are not a uniform yardstick of utility in the eyes of those who make these contributions, but that their utility equivalent depends on the specific objective

(kind of labour) and subjective (personal job experience) circumstances, under which these contributions are made, it means that WTW is a much more subjective and more arbitrary utility gauge than monetary WTP and, therefore, should not be used as a numeraire in CVM studies. This will be the case, if in our survey statistically identical treatment groups state different mean WTW contributions for the same utility gain, i.e. for the same environmental project, depending on the kind of labour they have to contribute (H1) and the kind of labour they are used to (H2). If it turns out that the opportunity cost of labour contributions cannot be assessed unambiguously in monetary terms according to hypothesis (H3), a meaningful comparison of costs and benefits accruing from a public project is not possible on the grounds of WTW.
In order to test (H1) we designed two different payment scenarios in terms of labour contributions, one "hard work" scenario and one "light work" scenario, which were presented to two different split samples of 250 households each in our CVM survey in rural Vietnam:

"**Light work" scenario** (Split 1): "If you were employed as part of a working group planting trees on hilltop areas in Yen Chau district and if the organization of the works allowed you to choose the days of your personal working contribution at your convenience, how many working days would you be willing to contribute?"

"Hard work" scenario (Split 2): "If you were employed as part of a working group constructing protection walls along the roads in Yen Chau district and if the organization of the works required that you have to be available whenever necessary (which might happen also during seeding and harvesting time), how many working days would you be willing to contribute?"

With these different labour scenarios we wanted to find out if WTW for landslide protection depends on the kind of work scenario presented to the respondents of the two separate split samples. If this turns out to be true, hypothesis (H1) holds, hence, WTW does not constitute a homogeneous indicator of utility like WTP.
Hypothesis (H2) implies that the (dis)utility equivalents of labour contributions by people with different skills and work experience from their normal job backgrounds are different, so that the usual "a dollar is a dollar"-aggregation rule according to the Hicks-Kaldor criterion cannot be applied to labour contributions. Therefore, aggregation in the sense of requirement (2c) would be problematic, to say the least, if (H2) turned out to hold. To test hypothesis (H2) we include a question in our questionnaire, where we ask respondents their everyday jobs.

Hypothesis (H3) was tested by asking respondents subsequent to the WTW question to indicate what they would do alternatively to contributing work to the landslide and flood protection program. These and some other results of our survey are discussed in the next section.

6. Results and discussion

Selected characteristics of the survey population

Since Yen Chau is a rural area it is not surprising that 65% of the interviewed households are farmers (another 15% are self-employed and most of the rest (12.2%) are officials) with a rather low level of education (less than 25% have finished high school or higher educational degrees). Since the farmers live at least partly on a subsistence level the total average annual income is rather low reaching an average of 28 million VND (about 1750 USD) [7]. Most of our interviews were conducted with Black Thai people (68.4%) which are the major ethnic group in that area. Although in the rest of Vietnam most people belong to the 'Kinh' ethnicity, in Yen Chau district they constitute a minority. In our survey 30.8% of the interviews were conducted with Kinh, only 4 interviews were conducted with other ethnic groups, like Muong and Kho Mu.

Willingness to pay and its determinants

For the estimation of WTP we used an interval regression model. (cf. Haab and McConnell, 2002). From this model, a mean WTP for the proposed program of 24,353 VND (about 1.52 USD) is estimated (the 95% confidence interval estimated by the bootstrap approach by Park et al. (1991) ranges from 20,172 to 28,533 VND). It should be noted here, that when answering the WTP question respondents did not know that, afterwards, they would be asked to state their additional WTW for the landslide protection project. So, the amount stated here should represent their total WTP for the project at the moment when they were asked. The average WTP of 24,353 VND corresponds to less than one per mill (0.08 percent) of the average income. It does not seem plausible that under these circumstances respondents' WTP statement had been restricted or truncated by their ability to pay. This holds also for other Stated Preference studies which found very low shares of income as WTP for public projects (cf. e.g. Wang et al. 2006; Boman et al. 2008 or Yang et al. 2014).

[7] At an exchange rate of 1 USD = 16,000 VND in April 2008 this equals app. 1.47 USD.

In a next step, a regression model with explanatory variables expected to systematically influence stated WTP was estimated. Table 1 gives an explanation and some descriptive statistics of these variables.[8]

Table 1: Description of variables used in the regression models

Variable	Description	Mean	S.D.
PROBLEM	Indicates whether respondent considers landslides as a problem that needs to be redressed by extra efforts (1 = yes, 0 = no)	0.79	-
SEVERE	Respondent rating of severeness of the damages suffered in 2007 (1 = not at all, 4 = very severe)	2.75	0.882
REPAIR_MONEY	Amount of money expended to repair personal damages due to landslides in 2007	1 – 10 Mio. VND	-
REPAIR_WORK	Amount of working time in days expended to repair personal damages due to landslides in 2007	2 - 7	-
WORRY	Rating of being worried about landslides in the future (1 = not at all, 4 = very worried)	3.39	0.699
COMPARE	Judgment of own economic situation as compared to others (1 = much worse, 4 = much better)	2.49	0.596
WORKDAYS	Number of workdays respondents are willing to contribute to the realization of the project	3.71	4.115
HAPPY	Rating of approval of the statement that nature is important for contributing to human happiness and to a high quality of life (1 = not at all, 5 = very much)	4.86	0.385
SATIS	Rating of the satisfaction level regarding personal life situations, e.g. health, job, household income (1= completely unsatisfied, 5= completely satisfied)	3.20	0.799

[8] Many of the possible explanatory variables were found to be correlated. In order to avoid collinearity in the regression model, the selection of variables to be included in the model was determined by using factor analysis for selecting the variables with the highest capacity to include all the variables from a given correlated cluster.

PROTEST	Indicates if a respondent has severe doubts in the program and if collected money will be only spent on landslide protection (1 = yes, 0 = no)	0.083	-
MALE	Indicates if a respondent is male (1 = yes, 0 = no)	0.67	-
INCOME	Level of income	27.8 Mio VND	16 Mio VND
EDU	Level of education (scale from 1 to 7)	2.80	1.343
HARD_WORK	Indicates if respondent was part of the “hard work” split (1 = yes, 0 = no)	0.498	-
DAM_FARM	Indicates how many times respondent has personally experienced damage to farming fields or animals (1 = not at all, 5 = eleven to fifty times)	2.173	0.741
FARMER	Indicates if respondent works as a farmer (1 = yes, 0 = no)	0.715	-
OFFICIAL	Indicates if respondent works in government official or similar (1 = yes, 0 = no)	0.100	-
PUB_WORK	Indicates if a member or a household has participated in public work to repair damages before (1 = yes, 0 = no)	0.733	-
LEISURE	Indicates if respondent only loses leisure time when contributing working time (1 = yes, 0 = no)	0.268	-
NOPAY	Indicates if respondent cannot perform paid work when contributing working time, hence loses money (1 = yes, 0 = no)	0.058	-
FARMDIFF	Indicates if respondent faces difficulties with own business/ farm when contributing working time (1 = yes, 0 = no)	0.633	-
CHILDREN	Number of children	2.69	1.935
ETHNIC	Ethnicity of respondents (1 = kinh, 0 = ethnic minorities)	0.248	-

The regression results in table 2 show that a number of variables have a significant effect on WTP in our study, most of the estimated influences are immediately plausible. The more a respondent is worried about landslides (variable: WORRY) and the harder his household had

been hit by the last flooding event (REPAIR_MONEY) the higher is his WTP. It is also no surprise that WTP increases with household income (INCOME).

Table 2: Determinants of willingness to pay (Interval regression)

Variable	Coefficient	Std. error	Significance (p-value)
CONSTANT	**-62889.580****	30714.400	0.041
PROBLEM	-3733.323	5272.638	0.479
SEVERE	-4738.387	2951.983	0.108
REPAIR_MONEY	**3684.759***	1923.187	0.055
REPAIR_WORK	1099.776	1663.746	0.509
WORRY	**8074.692****	3378.142	0.017
COMPARE	6866.266	4260.045	0.107
HAPPY	6082.879	5584.349	0.276
SATIS	-2096.820	3029.095	0.489
MALE	4527.107	4800.589	0.346
INCOME	**3358.648***	1957.146	0.086
EDU	1180.827	1810.431	0.514
ETHNIC	-6722.301	5604.286	0.230
Observations	400		
Log-Likelihood	-1334.113		
χ^2-statistics	30.53 (df=12)		0.002

***, **, * mean statistical significance at 1 %, 5 % and 10 %, respectively

After their WTP statement we asked respondents whether in addition to their monetary contribution they would be willing to contribute some of their time to work on the implementation of the landslide protection measures (variable WOULDWORK). Almost 85 % of the respondents agreed to that question. Those who had agreed were explained the specific conditions under which they would have to contribute their working time (“hard work” or “light work”) and then they were asked how many working days at maximum they would be willing to contribute to the project. Considering that they would have to be transported to the working site and back home after work and considering the road conditions in that region it would not have been plausible to ask them to contribute single working hours.

To test our hypothesis H1 we analyse whether respondents' willingness to work, i.e. the working days they are willing to contribute to the implementation of the program, differs significantly between the specific work scenarios mentioned above, i.e. whether they have to contribute "hard" or "light" work. Table 3 shows that the average "hard work" contribution is 3.02 days while the average "light work" contribution is 3.99 days. The difference between the two average WTW statements is significant at the 5% level (p-value 0.024). This result confirms our hypothesis (H1). It shows that measuring people's appreciation of a public project in terms of labour contributions is indeed context-dependent, just as we expected.

Table 3: Differences in willingness to work between the different work scenarios (hard vs. light)

		N	Mean	Std. Dev.	Std. Err.
How many working days would you be willing to contribute?	light work	249	3.99	4.609	0.292
	hard work	250	3.02	3.200	0.202

WMW test – Comparison of WTW "hard work" and "light work" splits			
	Hard work	Light work	p-value
WORKDAYS	3.024	3.990 **	0.024

***, **, * mean statistical significance at 1 %, 5 % and 10 %, respectively.

In order to investigate further factors that determine both the decision to contribute labour in principle (WOULDWORK) and the specific number of working days to be contributed (WTW) we made use of a two-step estimation procedure to model both decisions jointly. This is necessary since in our survey the answer to the WTW-question is contingent on the answer to the question whether the household would in principle be willing to contribute labour in addition to a monetary amount. The generic structure of such a two-step decision can be modelled by a Heckman sample selection model (cf. Heckman 1979, Greene 2003) according to:

$y_i = \boldsymbol{\beta}' \boldsymbol{x_i} + \varepsilon_i$ (outcome equation)

$z_i^* = \boldsymbol{\alpha}' \boldsymbol{w_i} + u_i$ (selection equation)

$z_i = 1 \; if \; z_i^* > 0 \; and \; z_i = 0 \; if \; z_i^* \leq 0$

$\varepsilon_i, u_i \sim N[0,0, \sigma_\varepsilon^2, \sigma_u^2, \rho]$

The vector x_i denotes the explanatory variables of the outcome equation, i.e. in our case WTW, and w_i denotes the explanatory variables of the selection equation, i.e. in our case the decision whether to contribute labour in principle or not. The expected value of WTW given that it is observed can then be expressed as

$$E\,[y_i \;|z^* > 0] = \boldsymbol{\beta}' \boldsymbol{x_i} + \rho\sigma_\varepsilon \, \lambda_i \, (-\boldsymbol{\alpha}' \boldsymbol{w_i}/\sigma_u)$$

where $\lambda_i \, (-\boldsymbol{\alpha}'\mathbf{w_i}/\sigma_u) = \phi \, (\boldsymbol{\alpha}'\mathbf{w_i}/\sigma_u)/\Phi \, (\boldsymbol{\alpha}'\mathbf{w_i}/\sigma_u)$ denotes the inverse Mill's ratio and ρ stands for the correlation coefficient between ε_i and u_i. Estimating this equation yields the coefficient estimates of the outcome equation corrected for sample selection as well as the coefficients of the selection equation. If ρ is significant the two-step procedure must be used to estimate $\boldsymbol{\beta}$, otherwise these estimates are biased due to sample selection.

Table 4: Everyday jobs of respondents

job	Freq.	Percent	Cum.
Worker/employee	12	2.4	2.4
Official	61	12.2	14.6
Farmer	325	65	79.6
self-employed	75	15	94.6
Trainee	1	0.2	94.8
Housewife/-husband	1	0.2	95
Retiree	25	5	100
Total	500	100	

Table 5 shows the results of two alternative model specifications that differ only in the dummy variable for respondents' everyday occupation (OFFICIAL vs. FARMER), for which we control in

the selection model as well as in the outcome model. In our questionnaire we offered a choice of all in all seven different employment categories (worker/employee, government official, farmer, self-employed, trainee, housewife/househusband, retiree) from which respondents were asked to choose their personal type of employment. The most frequently chosen categories were farmers (65%), self-employed (15%) and officials (12.2%), as can be seen from table 4. Since farmers are used to doing hard work, while government officials are used to light work (for the other job categories this is not clear in general), we chose these two kinds of work as control variables for models 2 and 1, respectively. With these two regression models we wanted to scrutinize the influence of respondents' everyday occupation on their willingness to offer physical work contributions to the provision of the landslide protection program.

In the two versions of the selection model shown in table 5 it turns out that the general readiness to participate in communal work for the landslide and flood protection program (dependent variable WOULDWORK) is significantly higher for respondents who have participated in communal work before (independent variable PUB_WORK), and that readiness to work is significantly lower for members of the Kinh ethnicity (ETHNIC). From Table 5 it can also be seen that (in model 1) respondents' age (AGE) has a negative impact on their willingness to do physical work, which seems quite plausible, while income (INCOME) has a positive effect on the basic readiness to provide work in both models. The latter result underlines our argument that the readiness to provide work does not necessarily follow from a tight budget constraint, which would make it impossible to express one's appreciation of a public project in terms of money. Instead, the readiness to work increases with income in both regressions. The decisive result in the sense of our hypothesis (H2) is that farmers' stated readiness to work is significantly higher than that of other professions (FARMER in model 2). This confirms our conviction that the occupational background of respondents influences their willingness to contribute physical work to the realization of a public project like flood and landslide protection significantly. Therefore, a workday in communal work is not the same workday for everyone.

Table 5: Explanatory model for willingness to work (Heckman two-step model)

	Model 1		**Model 2**	
Variable	Coefficient	p-value	Coefficient	p-value
Selection equation: dependent variable **WOULDWORK** *(1 = Yes, 0 = No)*				
CONSTANT	0.230	0.796	-0.776	0.377
SEVERE	0.040	0.798	0.056	0.739
REPAIR_WORK	0.002	0.976	-0.025	0.757
OFFICIAL	-0.551	0.171	-	-
FARMER	-	-	**1.122*** **	0.002
AGE	**-0.014***	0.099	-0.013	0.162
EDU	0.006	0.955	0.033	0.759
MALE	0.041	0.864	-0.007	0.978
INCOME	**0.231****	0.033	**0.269*****	0.010
COMPARE	0.103	0.675	0.102	0.695
PUB_WORK	**1.157*****	0.000	**0.958*****	0.001
ETHNIC	**-1.328*****	0.000	**-0.819****	0.013
Outcome equation: dependent variable **WTW** *(number of working days offered)*				
CONSTANT	-0.178	0.921	-1.339	0.488
HARD WORK	**-0.964****	0.023	**-0.928****	0.030
SEVERE	-0.316	0.280	-0.317	0.281
DAM_FARM	**0.766***	0.074	0.671	0.136
REPAIR_WORK	0.163	0.161	0.175	0.156
OFFICIAL	**-1.656****	0.021	-	-
FARMER	-	-	**1.557***	0.061
AGE	**0.036***	0.078	0.032	0.111
EDU	**0.473****	0.041	**0.472****	0.036
MALE	**1.052*****	0.008	**0.978****	0.026
LAMBDA	-1.242	0.250	0.234	0.878
Wald χ^2 (df = 8)	22.74	0.004	24.53	0.002
Rho	-0.312		0.059	
Sigma	3.978		3.948	

***, **, * mean statistical significance at 1 %, 5 % and 10 %, respectively

In the lower part of table 5 containing the results of the outcome regression model for WTW contingent on the decision to contribute labour in principle, we see again that hypothesis (H1) is supported since the dummy variable HARD_WORK indicates that the hard work scenario has a significantly negative effect on WTW in both models. The results of the Wilcoxon-Mann-Whitney test in table 6 show that there is no significant difference in the socio-demographic characteristics of the two split-samples of respondents confronted with the "hard work" scenario and the "light work" scenario, respectively. The fact that the number of working days (WTW) respondents of the two sub-samples offer to contribute to the same public project, i.e. landslide and flood protection, differs significantly according to the kind of labour they would have to do, again confirms our hypothesis (H1) that labour is not a homogenous indicator of utility. Since both sub-samples consist of statistically identical respondent groups, we can assume that both groups would enjoy the same utility increase from the landslide and flood protection program. If working days were a uniform indicator of utility changes, both groups would, therefore, have to state the same average WTW for that program. This is not the case, as can be seen from both regression models in table 5, where the number of workdays offered in terms of the "hard work" currency is significantly lower than in terms of the "light work" currency. Therefore, working days (WTW) are not even for the same person a uniform currency to pay for one and the same utility increase.

Further, our hypothesis (H2), i.e. that WTW depends on people's everyday occupation, is also supported by the outcome regression model. Being a government official (OFFICIAL) has a significantly negative effect on WTW in model 1, while being a farmer (FARMER) has a positive effect on WTW in model 2. Since we control for the kind of work in the outcome model, this means that people with different professional backgrounds state significantly different numbers of days (WTW) of the same kind of work for the same public project. In other words, this shows that the same kind of work represents different "currencies" to pay for the same utility increase for different people, depending on their professional background.

From the lower part of table 5 it can, further, be seen that WTW increases with the number of times a respondent's own farm has suffered damages from landslides or flooding (DAM_FARM in model 1), and that male respondents (MALE) are willing to contribute more working days than female respondents. Both results are more or less self-explanatory. It is interesting to see that the number of working days offered by those respondents who are ready to work in principle, increases with age and also with respondents' level of education.

Table 6: Frequencies and percentages regarding the opportunity cost of time

If you contributed your personal working time, would that mean that you…	Freq.	Percent	Cum.
… lose money because you cannot perform any paid work during that time? (option 1)	36	7.59	7.59
… get into difficulties with the work you have to do for your own business or farm because nobody else can do it for you? (option 2)	311	65.61	73.21
… forgo only leisure time because you have enough spare time to do some extra work? (option 3)	127	26.79	100
Total	474	100	

Our last hypothesis (H3) holds that it is not possible to determine the opportunity cost of the labour contributed to community work unambiguously, because the opportunity cost of the different working days are not known. In our questionnaire we asked respondents what the consequences of contributing work to the landslide and flood protection program would mean for their other activities: "If you contributed your personal working time [to that program], would that mean that you … (a) lose money because you cannot perform any paid work during that time, (b) get into difficulties with the work you have to do for your own business or farm because nobody else can do it for you, (c) forgo only leisure time because you have enough spare time to do some extra work?". These three possibilities correspond with our discussion of this problem in the context of the budget equations (6) above. From table 6 it can be seen that a majority of 65.61% of respondents would run into difficulties with the work in their own business or farm, 26.79% would lose leisure time and only 7.59% of respondents would lose the opportunity to do paid work. This shows that there is practically no functioning labour market where people have the possibility to earn some homogeneous wage rate. Therefore, it does not make sense to convert WTW contributions into monetary units by multiplying the hours of communal work by an average wage rate, since this wage rate does not capture the opportunity cost of the communal working hours. This opportunity cost consists partly of the opportunity cost of labour in respondents' own business and partly of the opportunity cost of leisure. Researchers conducting a CVM survey do not know what kind of alternative activity respondents would choose instead of working for the environmental project, so they cannot reasonably assess the monetary value of this work in terms of its opportunity cost.

Of course, in this context it will also play a role if respondents are free to choose the date when they join the public work by themselves or if they have to come whenever they are called. This is also one of the differences between our two working scenarios. "Hard work" requires respondents to come whenever they are needed, which might also happen during the seeding or harvesting period, while in the "Light work" scenario respondents can choose by themselves the date and time of their community work contribution. To compare the two splits we tested for differences in socio-demographic variables between the groups. No significant differences have been found (see table 7).

Table 7: Wilcoxon-Mann-Whitney test for differences in socio-demographic variables between splits

WMW test – Comparison of socio-demographics between “hard work” and “light work” splits			
	Hard work (n=199)	Light work (n=201)	p-value
MALE	0.67	0.65	0.6377
AGE	45.51	45.68	0.8997
EDU	2.88	2.86	0.7946
INCOME	5.56	5.66	0.3625
CHILDREN	2.64	2.7	0.7664
ETHNIC	0.29	0.33	0.3332

***, **, * mean statistical significance at 1 %, 5 % and 10 %, respectively

As one might expect, respondents would run into difficulties with their own work (FARMDIFF) significantly more often under the "Hard work" conditions than under the "Light work" circumstances. Opportunity cost in terms of lost leisure time (LEISURE) would accrue significantly more often under the conditions of "Light work", where people can choose by themselves the date of their working contribution. There is no significant difference between "Hard work" and "Light work" with respect to a loss of paid work as an opportunity cost of community labour (NOPAY), since only very few people have the opportunity to conduct paid work at all in such regions, anyway. This can be seen from table 8.

Table 8: Wilcoxon-Mann-Whitney test for differences in opportunity costs of contributed working time between work scenarios

WMW test – Comparison of indicated opportunity costs between "hard work" and "light work" splits			
	Hard work	Light work	p-value
NOPAY	0.076	0.068	0.7296
FARMDIFF	0.696 ***	0.548	0.001
LEISURE	0.172	0.336 ***	0.000

***, **, * mean statistical significance at 1 %, 5 % and 10 %, respectively

Summing up, our three hypotheses (H1) to (H3) implying the unsuitability of labour as a numeraire in CVM surveys are supported by the results of our empirical study. Using labour instead of money as a measuring rod for utility changes does not solve the problem, that the monetary WTP of very poor households for public projects might be restricted by their (in)ability to pay. On the contrary, new and more severe consistency problems would be created by following this suggestion.

7. Concluding remarks

In this paper we deal with the empirical problem that in Stated Preference studies in very poor countries or regions stated willingness to pay for environmental improvements is typically very low. This is a disadvantage for these regions, if government makes investments in environmental projects dependent on a comparison between the project costs and the social benefits accruing from such an investment. Of course, it is plausible, that if people live under austere material conditions they do not appreciate environmental improvements the same as people living in better circumstances.

Nevertheless, it is often held that such people are not able to express their true appreciation of an environmental project adequately in terms of willingness to pay, because their WTP is limited by their ability to pay, i.e. by their budget constraint. Therefore, it is suggested to use working time people would be willing to contribute to the realization of an environmental project as an indicator of utility instead of money. In this paper we showed that people's willingness to work is unsuitable as a utility measure in Stated Preference studies, because of several theoretical and empirical inconsistencies. Based on a Contingent Valuation study conducted in northern Vietnam

we showed that WTW is not a uniform or homogeneous payment vehicle for CVM studies, since its utility equivalent varies with the kind of labour that has to be provided by respondents of a CVM interview and also with the kind of labour these people are used to from their normal job. Labour contributions affect people's utility not only as a loss of leisure time but, differently from money, labour has also a direct impact on their wellbeing. While money expenditures cause disutility only by reducing the market consumption opportunities of individuals, labour contributions cause a reduction of opportunities to use the time differently (e.g. for paid work, work in one's own house or business, leisure time) and, additionally, they cause a direct utility loss by the inconvenience or pain caused by the work to be done, which depends on the specific kind of work that is required. These characteristics of voluntary work contributions to public projects make them inept as general utility measures in Stated Preference studies, since a working day will represent different alternative utility sacrifices for different people under different circumstances. This holds also for one and the same person, depending on the alternative uses of the time to be contributed, the kind of work to be done and the kind of work people are used to from their everyday lives. In our CVM study conducted in a rural area in northern Vietnam we proved these hypotheses also empirically.

What is the consequence of these findings? In this study as well as in other CVM studies it showed that the monetary contributions stated as WTP for an environmental project amount only to a very small share of households' disposable incomes (0.08%), so that it cannot be reasonably assumed that people's stated WTP is seriously limited or truncated by their budget constraint. Therefore, the low WTP amounts for environmental projects stated in CVM surveys in poor regions might reflect people's true preferences, i.e. they might indeed desire material goods more than environmental improvements. If politicians and environmentalists think that, nevertheless, environmental projects should be conducted in these regions, because they consider themselves more farsighted than the local population, then they should simply conduct these programs on the grounds of their better judgement. Maybe cost-benefit analyses based on Stated Preference surveys are not suitable decision criteria for the realization of environmental projects in very poor areas, because local people's vision of the future is blurred by their short-run material needs and desires, so that the principles of sustainable development have to come from outside these areas. Changing the numeraire in Stated Preference studies in order to obtain the desired results does not solve the problem, as has been shown in this paper.

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