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# Labour as a Utility Measure in Contingent Valuation Studies – How good is it really?

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**Abstract:**

The Contingent Valuation Method (CVM) aims at the assessment of people's willingness to pay (WTP) for a public project. The sum of the individual WTPs is interpreted as the social benefits of the project under consideration and compared to the project costs. If the benefits exceed the costs the project is recommended for realization. In very poor societies budgets are so tight that households cannot give up any part of their income, i.e. of their market consumption, in favour of a public project, so that their WTP for that project stated in a CVM interview has to be zero or close to zero. This leads to a severe discrimination against poor regions in the decision process on the allocation of public funds. Therefore, several authors suggest to use labour contributions to the realization of a public project instead of monetary contributions as a measure of people's WTP for that project. In this paper we show theoretically and empirically, based on a CVM study conducted in Vietnam, that labour is severely flawed as a measuring rod for individual utility so that CVM based on labour contributions does not provide a reliable and meaningful decision rule for the allocation of public projects.

**Keywords**: Cost-benefit Analysis, Contingent Valuation, Developing Countries, Public Expenditures

**JEL-classification:** D6, H4, L3, Q25, 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).

Interpreting a person's WTP for a commodity as a monetary measure for the utility she obtains from that commodity is in accordance with neoclassical household theory. From the first-order conditions for a utility maximum we know that in household equilibrium the price a consumer pays for a commodity equals the marginal utility (in monetary terms) she obtains from that commodity. The CVM transfers this market result to the idea of a hypothetical household demand for public goods like environmental quality where people's hypothetical WTP for a public good reflects the utility they obtain from that good. The WTP for a non-infinitesimal quantity of a public good is interpreted as a consumer's Hicksian Compensating Variation (HCV) for the utility she obtains from that quantity. From the mathematical definition of the HCV (see section 2) it is obvious that it is a reliable (monetary) indicator of individual welfare in the sense that it is strictly monotonically increasing in the utility change it represents.

In practice, however, the applicability of the CVM becomes problematic in countries where household incomes are very low and where subsistence economy prevails, so that a considerable part of a households' consumption is not bought in markets. WTP in terms of money is not a good utility measure in such cases since WTP is harshly restricted by households' ability to pay, i.e. by extremely tight budget constraints (cf. Ahlheim 1998). Therefore, the "classical" 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. In the literature dealing with CVM in developing countries, therefore, sometimes other measuring units than money, especially labour contributions (see e. g. Hardner 1996, Echessah, Swallow and Kamara 1997, Hung et al. 2007) or staple food (cf. e. g. Shyamsundar and Kramer 1996, Asquith et al. 2008), are suggested for the valuation of public goods. Instead of asking people how much money they would be willing to give up to obtain a certain public good they are asked how many working days they would be willing to contribute to the provision of that good or how much rice they would be willing to sacrifice in order to enable the public good to be provided.

In this paper we take a closer look at this form of in-kind measurement of benefits, especially the valuation of public goods and projects in terms of labour contributions. In the next section we discuss the theoretical background of the labour approach to contingent valuation of

public goods. In section 3 we describe our empirical survey approach in northern Vietnam and lay out our hypotheses regarding the suitability of labour as a measuring unit for the benefits accruing from a public project. Our main hypothesis is that labour cannot properly substitute money as a measuring unit for project benefits since it is not a universal means of payment like money which can be converted into any kind of consumption. We hypothesize that the WTP for a public project in terms of labour contributions depends on the specific kind of work and the circumstances under which it has to be done. In section 4 we test this hypothesis in a CVM study in which we assess Vietnamese people's WTP for a landslide protection program in mountainous regions of northern Vietnam. After having asked respondents of our CVM interviews their WTP for this project in monetary terms we asked them if they would also be willing to "pay" for this project in terms of working hours in addition to money. Over 80% of our respondents answered "yes" to this question. In a split sample we suggested two different kinds of work (one split was offered "hard work", the other "soft work" as a means of payment) where respondents in the "hard work" split were also told that they had to be available at any time for the work, while the "soft work" respondents where told that they could choose at their own convenience when they would like to do this work. As we had expected WTP in terms of "hard work" was significantly lower than WTP in terms of "soft work" which shows that WTP in terms of labour depends on the specific kind of work and the circumstances under which it has to be done. This result suggests that labour contributions cannot be used as a universal measuring rod for the valuation of public projects, since WTP in terms of labour done by different persons under different circumstances cannot be aggregated to assess the social value of a public project. Section 5 contains some concluding remarks.

## 2. Theoretical considerations

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. 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 have to be aggregated in order to compute the resulting change in social welfare.

The change of individual welfare or utility accruing from an improvement of environmental quality to an individual j can be expressed by the direct utility function according to

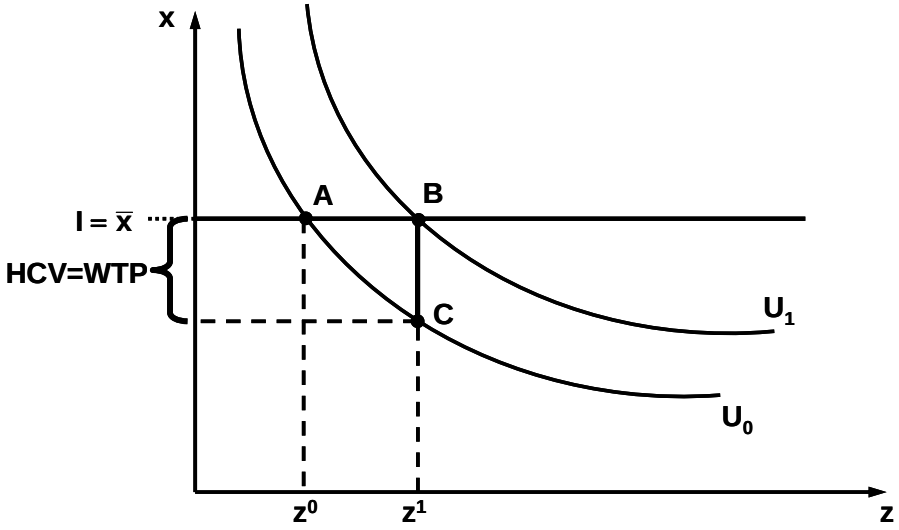
$$(1) \qquad \Delta U_j = U_j^1 - U_j^0 = u_j(x_j^1, z^1) - u_j(x_j^0, z^0)$$

where the index j denotes individuals $j \in \{1, 2, ..., J\}$ and $U_j^0$ and $U_j^1$ denote the utility levels attained by individual j before (situation 0) and after (situation 1) the project. The utility function $u_j(\cdot)$ is strictly monotonically increasing in market consumption $x_j \in \Re^N$ and in environmental quality as expressed by a vector of parameters describing the state of the environment $z \in \Re^M$.

Since utility changes cannot be observed directly $\Delta U_j$ is typically measured by the Hicksian Compensating Variation (HCV). If we concentrate solely on the environmental quality effects of a public project the Hicksian Compensating Variation for an individual j can be described by

$$(2) \qquad HCV_j\,(p, z^1, U_j^0, U_j^1) \;=\; e_j\,(p, z^1, U_j^1) \;-\; e_j\,(p, z^1, U_j^0)$$

where $e_j\,(\cdot)$ is the $j^{th}$ individual's expenditure function. This kind of welfare measurement is illustrated in fig. 1 where x is a composite of all market commodities and z represents environmental quality. Since the price of the composite commodity is normalized to one income I equals maximum market consumption X. If environmental quality increases as a consequence of a public project from $z^0$ to $z^1$ utility changes from $U_0$ to $U_1$. The maximum amount of money individual j can give up in the new situation 1 without being worse off than in the initial situation 0 is represented by the vertical distance between the new and the initial indifference curve at the new equilibrium, i.e. by the distance BC in fig. 1. This distance represents individual j's HCV and can be interpreted as her WTP for the public project that causes utility to rise from $U_0$ to $U_1$.




- Fig. 1: The Compensating Variation -

For the political decision if an environmental project should be carried out or not it is necessary to aggregate individual utility changes as expressed by the HCV according to (2). As a convention the Hicks-Kaldor criterion, according to which a public project should be accepted as socially beneficial if

$$(3) \qquad \sum_{j=1}^{J} HCV_j \;=\; \sum_{j=1}^{J} \left( e_j\,(p, z^1, U_j^1) - e_j\,(p, z^1, U_j^0) \right)$$

is positive, is widely accepted in cost-benefit analysis. In the practice of CVM studies a representative household sample is chosen and the average WTP of the households of this sample is multiplied by the number of all households affected by the project in question in order to obtain the social benefits it creates as

$$(4) \qquad B^{social} = J \cdot \overline{WTP}^{sample} \quad .$$

If the chosen household sample is representative, the difference between social benefits and costs, i. e. $(B^{social} - C^{social})$, is a good proxy for $\sum_{j=1}^{J} HCV_j$ so that the decision criterion

$$(5) \qquad B^{social} - C^{social} =$$

$$= J \cdot \overline{WTP}^{sample} - C^{social} \quad \begin{cases} > 0 & \rightarrow \text{the project should be realized} \\ = 0 & \rightarrow \text{the project can be realized or not} \\ < 0 & \rightarrow \text{the project should not be realized} \end{cases}$$

corresponds to the Hicks-Kaldor Criterion. The Hicks-Kaldor Criterion as well as the derived decision criterion (5) are based on the condition that utility is measured in monetary terms here, i.e. in terms of the HCV according to (2). Money as a measuring rod for utility has several advantages. The money-based individual welfare measure (2) is strictly monotonically increasing in utility which makes it a reliable welfare measure from a theoretical point of view. In most societies money is part of people's everyday life so that respondents have a clear-cut idea of what money means to them, which commodities can be bought for a certain amount of money and how much utility can be expected from these commodities. So, also in people's minds there is a close relationship between money and utility. This is important if people have to describe utility changes in monetary terms as it is the case when they are asked their WTP for a certain public good in a CVM interview: the question behind the WTP question is how much utility in terms of market consumption they are willing to give up in order to obtain the utility they expect from the public good. A necessary condition for a reliable answer to this question is that people are able to "translate" these utility changes correctly into the medium in which their WTP has to be expressed. With money as a medium this translation process seems to be rather straightforward.

The compensation scheme underlying the Hicks-Kaldor Criterion is based on the view that "a dollar is dollar is a dollar", i.e. that money is always the same, no matter who owns it, and that it is always allocated optimally according to the optimality rule that the marginal cost-benefit ratio $(\partial u / \partial x_n) / p_n$ (= marginal utility of income) has to be the same for all different uses. Therefore, money is a perfect aggregator for the variety of different goods we consume and which create utility for us. All these different goods can be aggregated into one single medium, money, which, on the other hand, can be converted back into utility-creating goods (and, therefore, into utility) at any time because of its universal character.

When considering other numeraires than money for CVM studies one should note that (5) is meaningful as a welfare-based social decision criterion only if the numeraire in terms of which individual WTP is measured

(C1) is strictly monotonically increasing in individual utility,

(C2) is part of people's everyday life so that they are familiar with it in the sense that they know what it means to them in terms of utility,

(C3) can be aggregated over individuals in a welfare theoretically meaningful way.

As soon as other aggregators than money are used one has to make sure that the criteria (C1) to (C3) are met. Criterion (C1) aims at the theoretical link between the numeraire on the one hand and individual utility on the other. It makes sure that the numeraire has any welfare theoretical significance at all. (C2) aims at the psychological link between the numeraire and utility in the minds of people. Only if people are closely familiar with the numeraire from their everyday lives they know what it means to them in terms of utility. The (hypothetical) compensation mechanism inherent in the Hicks-Kaldor Criterion makes it necessary that utility changes measured in terms of the numeraire can be compared and aggregated over individuals.

If only the benefits accruing from a public project are assessed in a CVM study while the costs are expressed in terms of money (as is usually the case) it is also necessary that the numeraire

(C4) can be converted into monetary terms so that the social benefits $J \cdot \overline{WTP}^{\,sample}$ can be compared to the social costs $C^{social}$ of a public project according to (5).

This discussion shows that it will be difficult to find a numeraire other than money which fulfils these criteria. Therefore, money seems to be first choice as a numeraire in CVM studies but there are circumstances under which the use of money is problematic.

The downside of using a money metric for the measurement of utility is that in very poor societies households often do not have enough money to express their appreciation of a public good in monetary terms. If a household lives on the poverty line there is simply not enough money left to be spent on public projects.

This is illustrated in fig. 2 where the household's income is just sufficient to cover the minimum level of consumption needed to survive.[1] At this basic level of consumption nearly no substitution of the public good for private consumption is possible, i. e. the household's WTP to increase environmental quality from $z^0$ to $z^1$ must be close to zero. At the new equilibrium in point B in fig. 2 nearly no additional quantity of the public good could compensate the household for a further loss in income. While in theory there must be a positive vertical distance between the two indifference curves so that the HCV is positive, but infinitesimally small, in practical CVM interviews the WTP respondents state in such cases is

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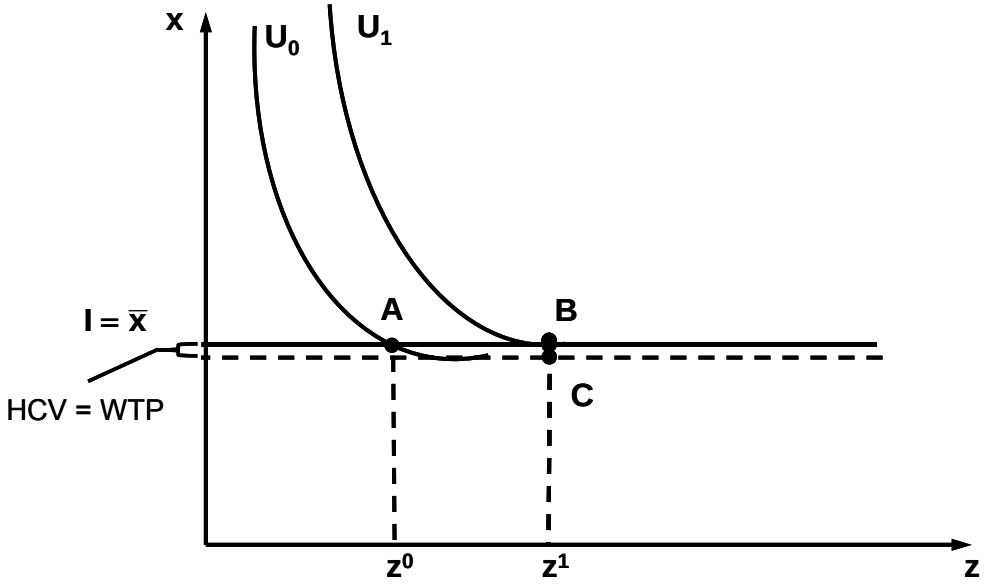
[1] One can think of such a situation in terms of a Stone-Geary utility function according to $u(x,z) = (x-\gamma)^{\alpha} \cdot z^{1-\alpha}$ where $\gamma$ is the subsistence level of market consumption.

zero. This result has shown in many practical CVM studies in developing countries (cf. e.g. Whittington 1998 and 2002).




- Fig. 2: Living on the poverty line -

Nevertheless, also at this low level of private consumption the household experiences an increase in utility from $U_0$ to $U_1$ as a consequence of the improvement of environmental quality. In this case the WTP of zero stated by the household in a CVM interview would not reflect the change in its well-being adequately. If the utility change resulting from the increase in environmental quality were measured by the Hicksian Equivalent Variation

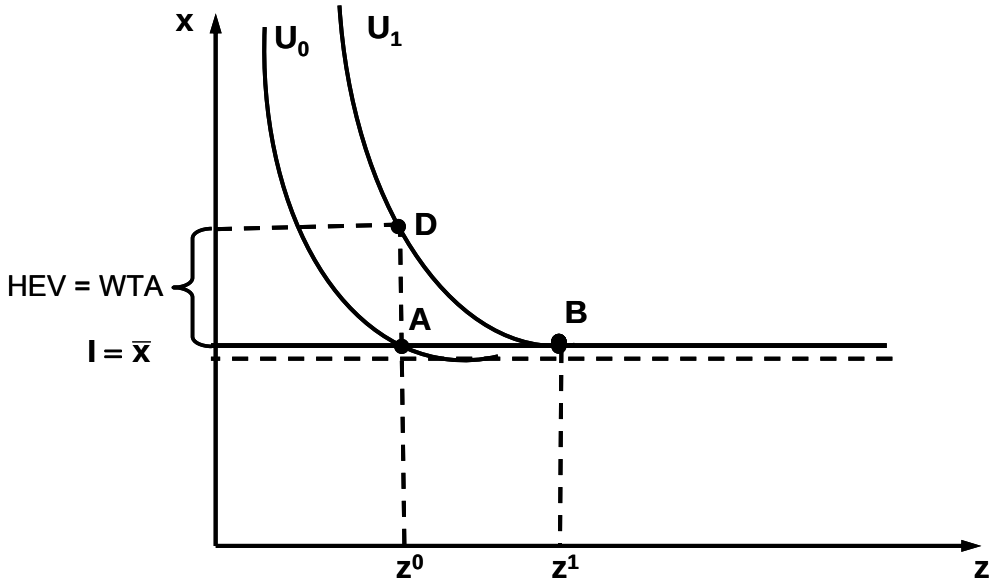
$$(6) \qquad HEV_j\,(p, z^0, U_j^0, U_j^1) \;=\; e_j\,(p, z^0, U_j^1) \;-\; e_j\,(p, z^0, U_j^0)$$

instead of the HCV things would look different. The HEV measures the utility change in terms of the income change that would lead the household to the new utility level $U_1$ without any change in environmental quality. In fig. 3 it can be seen that the HEV for the environmental improvement from $z^0$ to $z^1$ is clearly positive and can be represented by the distance AD.

As a consequence one might tend to use the Equivalent Variation instead of the Compensating Variation as a welfare measure in CVM studies like e. g. in Shyamsundar and Kramer (1996). This does not seem to be a promising way to solve the problem of low budgets since the HEV is generally considered an inadequate welfare measure in stated-preference surveys since it leads to exaggerative results (cf. e. g. Ahlheim and Buchholz 2000). Asking a household's HEV for an increase in environmental quality amounts to asking its willingness to accept (WTA) compensation for NOT getting this environmental improvement. While HEV and HCV are equivalent from a theoretical point of view they are not equivalent from a psychological point of view. When asked their WTP for an

environmental improvement people tend to state much lower amounts of money than the amount they claim as a compensation (WTA) for not getting this improvement.

Psychological reasons for this disparity between WTP and WTA are suggested by, among others, Kahneman and Tversky (1979), Knetsch (1994 and 1995), Boyce et al. (1992), Shogren et al. (1994), Morrison (1997) and Shogren and Hayes (1997). The general idea underlying these papers is that people have a strong psychological affinity to the status quo such that they are rather unwilling to accept a change for the worse and, therefore, demand high compensation payments for any deterioration of their actual situation while, in the WTP-situation, they are willing to pay only a comparatively modest sum for an equivalent improvement.




- Fig. 3: The Equivalent Variation -

From these considerations it follows that using the HEV or WTA as a welfare measure in CVM studies in developing countries is not a feasible option to overcome the problem of tight budget constraints in such countries. Other solutions have to be found. In a series of articles Whittington (1992, 1998, 2002) analyzed the specific problems faced by CVM researchers in developing countries. Since then the number of publications regarding the problems of conducting CVM surveys in Asia, Africa and South America has increased considerably. One of the central aspects in these studies is the tight budget constraint of respondents living on the subsistence level and their inability to express their true appreciation of a public project in terms of WTP.

Another approach to deal with the problem of tight money budgets is to use in-kind payments to value public goods or projects. In a CVM study Shyamsundar and Kramer (1996) assessed people's WTA for a restricted access to the Mantadia National Park in eastern Madagascar in terms of baskets of rice. In this study rice was treated as a numeraire and

afterwards converted into money by multiplying the number of rice baskets people claimed as their WTA by the market price of rice in terms of U.S. Dollars. At first sight choosing rice as a numeraire in this context seems to be a reasonable choice since rice fulfils the criteria (C1) to (C4) explained above. But when you look at it again it becomes obvious that this measurement method is practicable for a WTA study but does not work in a WTP context if people are really living on the poverty line (which was our problem here), because then they could give up neither money nor rice in order to protect rain forests from exploitation. A WTA survey does not lead to reliable results as was explained above and a WTP analysis is not feasible even with rice in a starving society, 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. In another study Asquith et al. (2008) use beehives and apicultural training as a "currency" to compensate farmers in Bolivia's Los Negros valley (Department of Santa Cruz) for the protection of threatened cloud forest habitat. For participants of this program tree cutting, hunting and forest clearing are prohibited on certain enrolled lands. As a "Payment for Environmental Services" (PES) they obtain beehives and learn how to cultivate them and harvest honey. In order to calculate the monetary value of these PES the price of the beehives and the value of the increase in human capital expressed in terms of future profits from apiculture are assessed. The PES can be interpreted as a kind of WTA compensation for not being allowed to exploit the cloud forest. Again, this does not seem to solve the problem of tight budget constraints since beehives and apicultural training could hardly be used as a numeraire for a WTP analysis and regarding a WTA analysis the same objections that were explained before hold here, too. Further, there are severe doubts that people can really calculate the present value of future profits from beekeeping so that at least criteria (C2) and (C4) are violated here.

Since WTA seems to be unsuitable as a welfare measure in CVM studies and since WTP in terms of money or in-kind does not seem to lead to useful results in societies where many households live on the poverty line, several studies try to solve the budget problem by using labour contributions as a numeraire for poor households' WTP for public projects. 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 are willing to contribute to the provision of this good (cf. e. g. Hardner 1996, Echessah, Swallow and Kamara 1997, Hung et al. 2007). 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. Stone 2008, Saxena 2008). Echessah et al. (1997) asked respondents in a CVM survey whether they are willing to contribute work or money or both in a tsetse control program in Kenya. For those who agreed, that question was followed by an open-ended question regarding the monthly amount they were willing to contribute during one year. It turned out that 57% were willing to contribute money and labour, while 28% wanted to contribute labour only and 10% only money. In a CVM survey in rural Vietnam, Hung et al. (2007) asked households their willingness to contribute labour to a forest fire prevention program. In their study two types of payment card were applied; an ordinary payment card indicating different money amounts and another one, offering options on how many working days they would be willing to contribute to the provision of such a project. In their study only 25% of all

respondents (among farmers it was only 10%) stated a positive willingness to pay in terms of money, while 90% stated their WTP in terms of labour.

At first sight labour seems to be a plausible choice of a numeraire in poor societies. Even if people live on the poverty line there is typically some time left for participating in public works, i.e. their time budget is by far not as tight as their money budget. Further, criterion (C2) is satisfied since people in poor societies typically are acquainted to physical labour, i.e. they know what physical work means for their wellbeing or (dis-)utility. Also criterion (C1), i.e. strict monotonicity in utility, seems to be satisfied for most households though the possibility that some people might even enjoy participating in public works because they meet friends there or because it gives them the feeling of doing something "good" or important cannot be ruled out completely. In these cases WTP stated in terms of working days does not measure a net sacrifice people are willing to make in order to get the public good in question, but it contains also significant parts of positive utility in addition to the utility created by the public good.

Even more problematic is the question to what extent the criteria (C3) and (C4), i. e. the conversion of labour contributions into money, can be met if labour is employed as a numeraire. In practical CVM studies the problem of converting labour into money according to (C4) is often "solved" by simply multiplying the working hours offered by CVM respondents by some average wage rate (see e. g. Hung et al. 2007, Sexana 2008 or Stone et al. 2008). Obviously, this makes sense only if respondents really had the possibility to earn this wage during the time they offer as WTP 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, especially if they are self-employed small-scale farmers like in our study presented in the next section. Therefore, the average wage is meaningless for them and, therefore, also for the CVM study. The valuation of time is more sophisticated, especially, since time can be used for various different purposes which have different relations to utility. This is 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 first theoretical model on how to value time in which different dimensions of time are considered was constructed by Becker (1965). He stated that “the cost of time […] varies considerably among commodities and at different periods." (p. 503). Later on De Serpa (1971) and Evans (1972) extended Becker’s ideas. In more recent years further approaches were developed to measure the value of time e.g. by Propper (1990), Jacoby (1993) and Dalenberg et al. (2004). A broad field of literature evolved regarding the valuation of time in the context of recreation demand estimation based on Cesario (1976) (see e.g. Bockstael 1987, Alvarez-Farizo et al. 2001, Lew and Larson 2005, Amoako-Tuffour et al. 2008, Hynes 2008, Jara-Diaz 2008, Palmquist 2009), in the transportation literature, where travel time savings are evaluated (e.g. Jiang 2004) and in the literature on the valuation of time spent on housework (e.g. Cheswick 1982). In a CVM study in Korea Eom and Larson (2006) asked respondents to state their WTP to pay for an improvement of water quality in the Man Kyoung River in

Korea in terms of money and, alternatively, in terms of time spent on housework.[2] In their study they find that the marginal value of housework time is about 70-80% of the average wage in the region.

This discussion shows that measuring the utility gains expected from a public project in terms of labour contributions is more than problematic. One part of the problem is that typically at the moment when the CVM interview is conducted respondents do not know yet how they would spend the time to be used on the public work alternatively, i.e. without the public work. Would they work in another job and earn money? Would they work in their fields? Would they do housework? Or would they spend it on leisure and recreation? All of these activities have different "opportunity costs" in terms of utility so that it is not clear in advance how big a sacrifice in utility terms people are willing to make in favour of the public good, if they state a "willingness to work" (WTW) of, say, five working days. The opportunity costs of the labour contribution will also depend on the question when the work has to be done. Will it be when farmers have to do a lot of work in their fields or will it be off-season? Will they have the opportunity to choose freely when they want to work for the public good, or will they have to be available whenever it is considered necessary by the organizers of the work? Further, the disutility accruing from the work itself will depend on the conditions and circumstances under which it has to be done and also on the kind of work respondents are used to from their everyday lives. Physical work will cause a higher disutility to a civil servant or a government official than to a farmer. For all these reasons it seems that conditions (C3) and (C4) cannot be satisfied by labour as a numeraire in CVM studies, but also the fulfilment of (C1) is questionable since the (dis-)utility equivalent of labour contributions, i.e. the sacrifice people are willing to make for the public project, depends on the specific circumstances of the work to be done and on the specific living conditions of the different respondents. For some respondents communal work might even be fun and not a sacrifice at all. In addition to these problems WTW answers may be biased by the existence of social norms with respect to communal norms in many societies. In Vietnam, where we conducted our CVM survey, participation in communal work is a "matter of honour" so that people are under social pressure to participate in such works, no matter what purpose these works serve.

Under such circumstances one has to be rather cautious with the interpretation of WTW answers. In our study on landslide protection in Vietnam which is presented in the next section we try to highlight empirically the questions addressed in this section.

## 3. The survey

The research site for our survey in Northern Vietnam is Yen Chau district in Son La province located about 250 kilometres west of Hanoi. The National Road No. 6 from Hanoi to Son La continuing to Dien Bien Phu which leads through Yen Chau is especially endangered by

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[2] Respondents were told that they could improve water quality by „changing their food preparation and disposal practices and water use in the bathroom, kitchen and laundry."

landslides during the rainy season. Landslides occur both in steeply sloped agricultural areas where sometimes entire farming fields are washed downhill, and in direct vicinity of roads without sufficient roadside stabilization. Especially during the typhoon season with intensive rainfalls from July to November poorly stabilized slopes move downhill burying fields, fish ponds, houses and, very often, roads. Consequently, people in landslide-prone areas suffer in many ways from these recurrent landslides: 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 loose their lives due to landslides.

The preparation of the survey was done in a sequence of steps as recommended in the literature (cf. e.g. Carson and Hanemann 2005). Before the survey, in-depth interviews were conducted with 50 representatives of the different social and economic groups in Yen Chau district in order to get a first impression of people's experiences with and their attitudes towards landslides. The respondents in these interviews comprised members of the People's Committee, Communist Party officials, members of the district administration, village heads, merchants, truck drivers, farmers, farm workers etc. On the basis of the results from these interviews a first questionnaire was developed. This questionnaire was tested and continuously further developed in two waves of pretests with a total of 65 completed face-to-face interviews. In addition, two rounds of Citizen Expert Group meetings (cf. Ahlheim et al. 2010, in press) were conducted with representatives of the survey population. During these meetings the whole questionnaire, especially the description of the project scenario and payment mechanism, was discussed and modifications of the text to lead to a better understanding by respondents were made. The main survey with 500 randomly selected households of villages located along National Road No. 6 in Yen Chau district was conducted in April 2008.

The questionnaire used in the survey consisted of three main groups of questions. The first referred to the respondents' personal experiences with landslides in order to explore their awareness of the problem in general and the damages they suffered due to landslides in particular. We also investigated their opinion on the main causes for the occurrence of landslides in this region. In the second part of the questionnaire we suggested a landslide protection program (project scenario) which consisted of several protection measures that had been proposed by our interview partners in the pretests and in the in-depth interviews. Based on suggestions obtained from the in-depth interviews and pretests in the third part of our questionnaire we constructed the following scenario for a landslide protection program which afterwards had to be valued by the respondents of our main survey:

*"As a consequence of the landslides in recent years, government authorities as well as scientists were looking for possibilities to reduce the risk of landslides in the region of Yen Chau. They would like to propose a landslide protection program that could comprise amongst other activities reforestation, appropriate changes of agricultural practices, stabilization of slopes, measures against soil erosion, roadside stabilization, etc. Those activities would be coordinated by government authorities. This program would lead to a prevention of future landslides in the region of Yen Chau and contribute to a more sustainable land use for a better environment."*

In the questionnaire, this text was accompanied by graphical illustrations of the proposed measures. Then we asked our respondents how much money they would be willing to contribute if this program were to be realized. For the construction of the respective payment scenario the results from our pretests, in-depth interviews and CEG meetings again turned out to be very helpful. When we asked who should pay for the landslide protection measures most respondents suggested then that the main part should be financed out of public funds while the rest should come from citizen action groups with mandatory work contributions and from financial contributions by local people. Having the choice between financing the part of the cost which had to be borne by the local people by compulsory payments like new taxes or by voluntary contributions most respondents suggested the compulsory version. From these suggestions gathered from our pretests we constructed a payment scenario where households in Yen Chau would make a compulsory contribution into a landslide protection fund. Respondents were told that the described project would be realized only if the overall money people are willing to contribute to that fund covers that part of the cost that cannot be borne by government alone. Following the description of the payment scenario, respondents were asked to mark on a payment card the highest amount of money that would be acceptable for the household to contribute twice a year for a duration of three years. For the elicitation of WTP the payment card format was chosen due to the encouraging experience that had been made with this format in Southeast Asia and also in other socio-economic contexts (cf. Ahlheim et al. 2008, Champ and Bishop 2006, Cameron and Huppert 1989). Its range was determined during the pre-tests and CEG meetings.

After having asked people their WTP for landslide protection in terms of money we asked them: "In addition to this payment would you be wiling to contribute working time to the realization of this project?". Almost 85 % of the respondents agreed to that question. This was a prerequisite for our intention to test the suitability of labour as a numeraire for measuring WTP for a public project. Based on the theoretical consideration of the previous section our hypotheses were that the willingness to contribute labour to the provision of a public project (willingness to work – WTW) depends significantly on

(H1) the kind of labour and the circumstances under which it has to be done,

(H2) the kind of work people do in their everyday lives,

(H3) the opportunity cost of the time they would have to spend on the communal work.

If these hypotheses proved to be true this would mean that – differently from WTP in monetary terms - the knowledge of people's stated WTW would say nothing about the sacrifice in terms of utility they are willing to make in order to secure the provision of the public good "landslide protection" (i. e. criterion (C1) for a feasible numeraire would be violated). In this case labour would not be a "currency" uniquely defined in terms of utility like money. Its equivalent in terms of utility would depend on the specific kind of work necessary for a specific project (H1), while for money it holds that "a dollar is a dollar is a dollar". Therefore, the social benefits in terms of labour, i. e. $J \cdot \overline{WTW}^{sample}$, could not be compared between different projects in order to find out which is most beneficial from a social point of view. Further, labour contributions would not be comparable between different

people since their "value" in terms of utility would depend on individual people's everyday occupation (H2) and on the kind of time they would have to sacrifice for the communal work (H3). Anyway, it seems that for people who are not used to physical work in their everyday life (government officials, clerks, shop owners etc.) it would be difficult to imagine what the specific kind of work required for a certain project would mean for their wellbeing or utility since they have no experience with it, so that also criterion (C2) would be violated. If WTW depends on the opportunity cost of the time spent on the communal work according to (H1) it would also be impossible to convert WTW into monetary terms (C4) since at the moment of the CVM interview respondents cannot know with certainty which use of their time (the specific kind of work or leisure) they would make if the communal work would not have to be done. Therefore, the payment vehicle which is decisive for the elicitation question is uniquely determined, if it plays a role for stated WTW according to (H3) this numeraire cannot be used for measuring individual welfare or utility.

In order to test (H1) to (H3) we designed two different payment scenarios in terms of labour contributions, one "hard work" scenario and one "soft work" scenario, which were presented to two different split samples of 250 households each:

**"Soft 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 would allow you to choose the days of your personal working contribution at your convenience, how many working days would you be willing to contribute?"*

and

**"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 would require 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? "*

In the following section the results of the CVM survey on the value of landslide protection in Yen Chau district will be presented and the hypotheses H1 – H3 stated above will be tested.

## 4. Results and discussion

*Characteristics of the survey population*

The means of the most important socio-economic variables in our sample are presented in table 1. Among the 500 interviews only 171 (34.2%) have been conducted with women, which is due to the fact that the interviews have been conducted with the household head who is also responsible for other economic decisions of the household. The average age was

almost 46 years and the average household consisted of 4 persons with 2 children. Over 90% of the people interviewed stated that they are married.

**Table 1: Socio-economic characteristics of the survey population**

| Variable | Mean | S.D. |
|---|---|---|
| Gender (0=male, 1=female) | 0.34 | - |
| Age | 45.59 | 13.535 |
| Household size | 4.39 | 1.472 |
| Income (in mio VND/year) | 27.91 | 18.91 |

Since Yen Chau is a rather 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% having finished high school or higher educational degrees). Since the farmers live at least partly on a subsistence level the total average yearly income is rather low reaching an average of 28 million VND (about 1400€). Concerning the ethnicities most of our interviews have been conducted with Black Thai people (68.4%) which constitute the majority in that area. Although in the rest of Vietnam most people belong to the 'Kinh' in Yen Chau district they constitute a minority. In our survey 30.8% of the interviews have been conducted with Kinh, only 4 surveys were conducted with households from other ethnic groups, like Muong and Kho Mu.

*WTP and its determinants*

For the estimation of WTP a logarithmic functional form of the WTP function was used following Cameron and Huppert (1989) and Haab and McConnell (2002). This functional form has desirable properties both from a theoretical and a statistical perspective. Contrary to the linear functional form often used, it is ensured that WTP cannot be negative which is plausible in the case of a utility increasing project and it allows to estimate mean and median WTP separately. Since it is found in this study that the distribution of payment card intervals chosen by the respondent households is skewed to the left, it should be expected that median WTP is smaller than mean WTP. In this model, the logarithm of household h's WTP for the program is assumed to be a linear combination of characteristics of the household denoted as a vector $x_h$ and an unobservable error term $\varepsilon_h$, i. e. $\log WTP_h = x'\beta + \varepsilon_h$ where $\beta$ is a vector of parameters to be estimated. Under the assumption of normally distributed error terms a probit model of the payment card responses (bids) can be specified following Cameron and Huppert (1989). From this model, a mean WTP for the proposed program of 22,931 VND (the 95% confidence interval estimated by the bootstrap approach by Park et al., 1991 ranges from 20,972 to 25,106 VND) and a median of 14,263 [13,064 to 15,579] VND are estimated.

**Table 2: 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) | 0.78 | - |
| SHORTAGE | No. of times shortages of commodities were experienced due to landslides in the last 5 years | ≤ 5 | - |
| DAMAGE_FARM | No. of times damages to the farm were experienced due to landslides in the last 5 years | 6 – 10 | - |
| DAMAGE_MERC | No. of times damages to merchandise were experienced due to landslides in the last 5 years | ≤ 5 | - |
| ECONLOSS | No. of times economic losses were experienced due to landslides in the last 5 years | 6 – 10 | - |
| SEVERE | Respondent rating of severeness of the damages suffered in 2007 (1 = not at all, 4 = very severe) | 2.75 | 0.879 |
| 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 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) | 3.30 | 0.775 |
| IMPROVEROAD | Rating of importance of preventing road blockings in the future(1 = not important at all, 5 = very important) | 3.65 | 0.564 |
| IMPROVEEROS | Rating of importance of reducing soil erosion in the future(1 = not important at all, 5 = very important) | 3.71 | 0.497 |
| APPROVAL | Rating of overall approval of the program (scale from 1 to 10) | 9.30 | 0.939 |
| SAD | Rating of feeling sad when forests are destroyed (1 = not at all, 5 = very much) | 4.38 | 1.160 |
| HAPPY | Rating of approval of the statement that nature is important for contributing to human happiness (1 = not at all, 5 = very much) | 4.87 | 0.407 |
| INCOMESAT | Rating of satisfaction with the household's income (1 = compl. unsatisfied, 5 = compl. satisfied) | 2.56 | 1.169 |
| COMPARE | Judgment of own economic situation as compared to others (1 = much worse, 4 = much better) | 2.50 | 0.599 |
| EDU | Level of education (scale from 1 to 7) | 2.87 | 1.350 |
| ETHNIC | Ethnicity of respondents (1 = kinh, 0 = ethnic minorities) | 0.3 | - |

In a next step, a regression model with explanatory variables expected to systematically influence stated WTP was estimated. Table 2 gives an explanation and some descriptive statistics of these variables. From the probit regression results in table 3 it can be seen that many variables show a significant effect on WTP in our study, most of the estimated influences are plausible from a theoretical point of view. The more severely hit respondents were by landslides in 2007 and the more money they had expended to repair the damages the higher was their WTP. The more they appreciate a lower frequency of road blockings due to landslides the higher is their WTP. The judgment of feeling better off than other households in the area and the level of education also had a strongly significant positive effect on WTP. Regarding environmental attitudes, respondents who consider nature to be important for contributing to human happiness have a higher WTP, which is plausible, while the significantly negative relationship between feeling sad when forests are cut and WTP is rather puzzling, as we think.

**Table 3: Determinants of willingness to pay**

| Variable | Coefficient | Significance (p-value) |
|---|---|---|
| CONSTANT | -6.95*** | 0.0000 |
| lnBID | -1.19*** | 0.0000 |
| PROBLEM | 110.99 | 0.4245 |
| SEVERE | 179.98** | 0.0121 |
| REPAIR_MONEY | 138.57*** | 0.0018 |
| REPAIR_WORK | -42.44 | 0.3344 |
| WORRY | 42.70 | 0.6598 |
| IMPROVEROAD | 202.18* | 0.0810 |
| IMPROVEEROS | -51.54 | 0.6937 |
| APPROVAL | 107.30 | 0.1191 |
| SAD | -157.97*** | 0.0007 |
| HAPPY | 345.68*** | 0.0025 |
| INCOMESAT | 77.71 | 0.1160 |
| COMPARE | 261.38*** | 0.0074 |
| EDU | 108.33*** | 0.0065 |
| Log-Likelihood | -816.2005 | - |
| $\chi^2$-statistics | 1632 (df = 15) | 0.0000 |

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

*Willingness to work for landslide protection*

As mentioned above, in our study we asked respondents after the WTP statement 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. Almost 85 % of the respondents agreed to that question. To test our hypothesis H1 that the willingness to contribute labour to the implementation of a public project depends on the kind of labour and the circumstances under which it has to be done, we analyze whether respondents' willingness to work (WTW), i.e. the working days they are willing to contribute for the implementation of the program measures, differs significantly between the specific work scenarios mentioned above, i.e. whether they have to contribute in terms of "hard" or "soft" work.

**Table 4: Differences in WTW between the different work scenarios (hard vs. soft)**

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

As table 4 shows, the difference in the means of number of working days respondents are willing to contribute in addition to monetary payments is significant at the 1%-level between the "soft" and "hard" work scenario. WTW of respondents in the “hard” work scenario is significantly lower than that of respondents in the “soft” work scenario. This result is in accordance with our hypothesis H1.

In a next step we test H2, i.e. whether the kind of work people do in their everyday life influences their willingness to work for landslide protection. First, we estimate different models to explain respondents’ decisions to contribute working time in addition to their monetary contributions. In all of these probit regression models the dependent variable is the decision to contribute working time (0 = no, 1 = yes) and the regressors are the respondent's age, education, income, ethnicity (1 = Kinh, 0 = other) and gender. These models vary only by a variable indicating the occupation of respondents taking into account the three most frequent occupations official, farmer and self-employment. Table 5 shows that, rather surprisingly, higher age and education level have a significantly positive influence on the likelihood to contribute working time, whereas female respondents, those belonging to the Kinh ethnic group and, most importantly, officials are significantly less likely to contribute working time. The model shown in table 6 has less significant variables, however, it shows that farmers are significantly more likely to contribute working time and respondents with other occupations. A model with self-employment as dummy variable did not show any significant effect of that type of occupation. These results support our hypothesis H2.

**Table 5: Determinants of the decision to contribute working time: controlling for officials**

| Variable | Coefficient | Significance (p-value) |
|---|---|---|
| AGE | 0.012*** | 0.0024 |
| EDU | 0.273*** | 0.0002 |
| INCOME | 0.00000005 | 0.1666 |
| ETHNIC | -1.358*** | 0.0000 |
| GENDER (0 = female, 1 = male) | 0.402* | 0.0257 |
| OFFICIAL | -.848*** | 0.0036 |
| McFadden's $R^2$ | 0.12 | |
| Percent correctly predicted | 87.5 % | |
| $\chi^2$-statistics | 33 (df = 5) | 0.0000 |

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

**Table 6: Determinants of the decision to contribute working time: controlling for farmers**

| Variable | Coefficient | Significance (p-value) |
|---|---|---|
| AGE | -0.662 | 0.2031 |
| EDU | 0.204*** | 0.0021 |
| INCOME | 0.00000006 | 0.1054 |
| ETHNIC | -0.571** | 0.0171 |
| GENDER (0 = female, 1 = male) | 0.224 | 0.2676 |
| FARMER | 1.560*** | 0.0000 |
| McFadden's $R^2$ | 0.29 | |
| Percent correctly predicted | 89.5 % | |
| $\chi^2$-statistics | 81 (df = 5) | 0.0000 |

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

Only after respondents had decided whether to contribute working time in addition to monetary payments or not the specific kind of working setting, i. e. whether they had to contribute under the option "hard work" or "soft work" (see above) was explained to them. After the explanation

of the work setting respondents were asked how many working days at maximum they would be willing to contribute in addition to the monetary amount stated before.

In table 7 we estimate a Tobit regression model regressing the stated number of working days a respondent is willing to contribute on some variables that we hypothesize to influence these statements[3].

**Table 7: Explanatory model for WTW**

| Variable | Coefficient | Significance (p-value) |
|---|---|---|
| CONSTANT | -2.39 | 0.4125 |
| WORK (0 = soft, 1 = hard) | -1.24*** | 0.0035 |
| AFFECTED (0 = no, 1 = yes) | 2.74 | 0.2450 |
| SHORTAGE | 0.27 | 0.4592 |
| DAMAGE_FARM | 0.59 | 0.1313 |
| DAMAGE_MERC | -0.01 | 0.9733 |
| ECONLOSS | -0.20 | 0.6560 |
| SEVERE | -0.19 | 0.5342 |
| REPAIR_MONEY | -0.77 | 0.6915 |
| REPAIR_WORK | 0.22 | 0.2115 |
| ETHNIC | -3.58*** | 0.0000 |
| EDU | 0.57*** | 0.0051 |
| AGE | 0.02 | 0.3470 |
| GENDER (0 = female, 1 = male) | 0.74 | 0.1206 |
| INCOME | 0.31* | 0.0868 |
| OFFICIAL | -2.13** | 0.0161 |
| Log-likelihood | -1043 | |
| ANOVA based fit measure | 0.059 | - |
| DECOMP based fit measure | 0.098 | - |
| LM test for tobit | 111.923 (df = 16) | 0.0000 |

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

[3] Since the dependent variable is left censored a Tobit model must be used for estimation, an OLS regression model would produce biased parameter estimates (Maddala, 1983).

In accordance with the results given in table 4, table 7 shows that, as expected, the dummy variable for the "hard work" setting has a significantly negative relationship with WTW. Further, Kinh people contribute significantly less working time than Black-Thai people. The sign of two more variables with a significant effect on WTW are not plausible: people with a relatively higher education and more income state significantly higher contributions in terms of working time, we had expected negative signs here. These astonishing results need further investigation. Using FARMER instead of OFFICIAL as a dummy variable for professional occupation in the model yields the same qualitative results as shown in table 7 for the explanatory variables, however FARMER is estimated with a positive sign ($p = 0.0308$). This result illustrates that officials are willing to provide significantly less working time for this program than non-officials and farmers are willing to contribute significantly more time than non-farmers while controlling for ethnicity in both cases. The results of table 8 support our expectations stated in H1 and H2.

Finally, we argued that it must be expected that respondents' WTW depends on the opportunity cost of the time they spend on the communal work for landslide protection (H3). In our survey, respondents were asked what contributing working time would mean for them personally. As response categories, three options ordered according to descending opportunity cost were provided. Option 1 would entail losing money because no paid work could be done during that time, option 2 stands for getting into difficulties with respect to other tasks the respondent has to do, and option 3 entails almost no constraints at all since the respondent would just forgo free time. Specifically, we hypothesize that respondents under the "soft work" setting run much less into problems with their time allocation than respondents under the "hard work" setting since they expect that they would be able to choose the time and day of the contributed work for the program flexibly. To test H3 we analyze the correlation between the dummy variables for the three different response options and the work scenario (hard work vs. soft work).

It can be seen from table 8 that, as expected, option 2 is significantly positively correlated with “hard work” whereas option 3 shows a significantly negative correlation with “hard work”. No significant correlation between option 1 and the work scenarios is found, only about 7 - 8 % of respondents had chosen this option, anyway. We attribute this latter result to the fact that regardless of the kind of work respondents expected to contribute, they knew that they would be forced to catch up with their regular work (office work, farming etc.) anyway and, thus, would not lose money in the end. However, the correlations between the work scenarios and options 2 and 3 show that respondents already form specific expectations regarding their opportunity costs of contributing communal work for landslide protection. This result clearly supports our hypothesis H3.

**Table 8: Differences in opportunity costs of contributed working time between work scenarios**

| | Correlation coefficient (p-value) |
|---|---|
| If you contributed your personal working time, would that mean that you… | Work scenario (0 = soft work, 1 = hard work) |
| … lose money because you cannot perform any paid work during that time? (option 1) | 0.15 (0.730) |
| … 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) | 0.153 (0.001) |
| … forgo only leisure time because you have enough spare time to do some extra work? (option 3) | -0.188 (0.000) |

Summing up, our three hypotheses (H1) to (H3) claiming the unsuitability of labour as a numeraire in CVM surveys could be confirmed through our empirical study. Using labour as a measuring rod for utility changes does not solve the problem that the monetary WTP of very poor households for public goods is severely restricted by their (un-)ability to pay. On the contrary, new and more severe problems of consistency are created by this approach.

## 5. Concluding remarks

In this paper we deal with the problem that in very poor countries household budgets are so tight that people cannot express their appreciation of a government project, e. g. in the environmental sector, adequately in terms of willingness to pay for that project. Therefore, the results of CVM analyses aiming at the monetary WTP of people for some environmental project might significantly underestimate their true appreciation of that project, i. e. the social benefits it creates. Since the decision for or against the realization of a public project depends on the comparison of its cost to the social benefits it creates, CVM might lead to wrong decisions in that it discriminates against projects in poor regions where WTP has to be low due to low incomes.

It is demonstrated in this paper that households living on the poverty line will have to state a (close to) zero WTP in CVM interviews even if their true appreciation of the public project is much higher. As a consequence several authors suggest to use labour contributions instead of monetary contributions to the provision of a public project as a measuring rod for the utility a household expects from that project.

We show that labour does not fulfil the fundamental requirements for a numeraire in CVM studies since labour is not as easily and straightforwardly convertible into utility as money. It

is shown empirically in the course of a CVM study in Vietnam that the WTP for one and the same public project in terms of labour depends decisively on the kind of labour ("hard work" or "soft work") that has to be done and the circumstances under which it has to be provided. Therefore, the "a dollar is a dollar is a dollar"-rule that is inherent in money-based CVM surveys typically does not hold for CVM surveys in terms of willingness to work (WTW). This makes the aggregation of WTW over households which is essential for the validity of the Hicks-Kaldor Criterion underlying the CVM decision rule highly problematic. In our CVM survey conducted in Vietnam our hypothesis that WTW is situation-dependent and not universal like money is proved empirically. As a consequence the use of labour contributions as a numeraire in CVM studies cannot be recommended. Instead, it has to be asked if the decision on public investments in very poor societies can reasonably be based on CVM surveys or WTP studies. At the moment it seems that the answer to this question is "no".

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