THE VALUATION OF TRAVEL TIME SAVINGS IN LEAST DEVELOPED COUNTRIES: THEORETICAL AND EMPIRICAL CHALLENGES AND RESULTS FROM A FIELD STUDY

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Abstract

In developed countries travel time savings can account for as much as 80% of the overall benefits arising from transport infrastructure and service improvements. In developing countries they are generally ignored in transport project appraisals, notwithstanding their importance. One of the reasons for ignoring these benefits in the developing countries is that there is insufficient empirical evidence to support the conventional models for valuing travel time where work patterns, particularly of the poor, are diverse and it is difficult to distinguish between work and non-work activities. The exclusion of time saving benefits may lead to a bias against investment decisions that benefit the poor and understate the poverty reduction potential of transport investments in Least Developed Countries (LDCs). This is because the poor undertake most travel and transport by walking and headloading on local roads, tracks and paths and improvements of local infrastructure and services bring large time saving benefits for them through modal shifts. The paper reports on an empirical study to develop a methodology for valuing rural travel time savings in the LDCs. Apart from identifying the theoretical and empirical issues in valuing travel time savings in the LDCs, the paper presents and discusses the results of an analysis of data from Bangladesh. Some of the study findings challenge the conventional wisdom concerning the time saving values. The Bangladesh study suggests that the western concept of dividing travel time savings into working and non-working time savings is broadly valid in the developing country context. The study validates the use of preference methods in valuing non-working time saving values. However, stated preference (SP) method is more appropriate than revealed preference (RP) method.

Keywords: Transport; Appraisal; Rural; Value of time; Poverty reduction
Topic area: G02 Rural, National and International Transport

1. Introduction

Travel time savings are a major benefit arising from transport infrastructure and service improvements. In developed countries these benefits can account for as much as 80% of overall benefits. Usually in developed countries transport investment appraisals quantify travel time saving benefits using standard unit values provided by the agency responsible for the

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[*] The authors gratefully acknowledge the Department for International Development (DFID), UK support for this study through a research grant.

development of transport. In the case of non-availability of such values, travel time saving values are estimated using an established national practice. Although in developing countries economic evaluation procedures recognise the importance of travel time saving values, such practice is less well established. This is partly because there is a paucity of empirical evidence to support the use of conventional models of value of time calculation in developing countries where work patterns, particularly of the poor, are so diverse. Without reliable methods to value travel time savings, economists continue to use vehicle operating costs savings as a means to assess investments. Exceptions are urban, inter-urban and multilateral or bilateral donor assisted rural transport projects. This difference of approach leads to a bias of investment decisions that are most unlikely to benefit the rural poor and understates the poverty reduction potential of transport interventions in Least Developed Countries (LDCs). The bias stems from the fact that most rural travel and transport in the LDCs is undertaken by poorer people walking and headloading on local roads, tracks and paths, and any improvements to local infrastructure and services have the potential to bring about large time savings due to modal shifts. In the backdrop of more and more infrastructure investments being made in an attempt to reduce poverty, it is therefore essential that rural travel time savings, especially of the poor people, are valued and factored the investment decisions.

The conventional approach to valuing time used routinely in developed countries assumes that working hours are standard, most people work in formal employment (wage earning), and that journeys can easily be differentiated into "for work purposes" and "for non-work purposes." While the working time savings are valued based on the augmented wage rate (i.e. wage rate plus extra costs incurred such as taxes, compulsory contributions etc.), the non-working time savings are valued based on the willingness to pay for travel time saved in order to transfer those time savings to leisure activities.

There are a few reasons that a "western concept" of travel time savings is inapplicable in developing countries' context, particularly in rural areas. The most prominent among them is that in rural areas of LDCs informal employment and subsistence living rather than conventional wage earning predominates. In this context the "western concept" of dividing travel time savings into "working" and "non-working" time savings is apparently invalid. Therefore, the main challenge in the development of a methodology for the valuation of travel time savings in developing countries is to develop a methodology that can take into account the diversity of work and subsistence patterns, time use and multi-purpose trip travel, and yet produce values that are robust and simple enough to use in routine economic analysis.

In the light of the above description, a study supported by the Department for International Development (DFID) UK was carried out for the valuation of travel time savings in the LDCs. The study was completed in mid-2002. The main purpose of the study was *to develop, empirically test, and disseminate a methodology for deriving the value of time (VoT) in LDCs for transport/accessibility project appraisal*.

The study was designed to test the applicability of standard methods in valuing rural travel time savings for travellers in Bangladesh and, if successful, to propose a methodology that would enable the routine inclusion of travel time savings valuation when appraising rural transport projects in developing countries.

The paper summarises the main findings of the study. It is divided into four sections: Section 2 presents the theory of the VoT and discusses the issues and potential sources of variations of the VoT in the rural context of a developing country; Section 3 describes the methodology of the study; Section 4 gives the estimated travel time saving values and discusses the suitability of different approaches in valuing travel time savings; and Section 4 presents the conclusions.

2. The theory, issues and potential sources of variations

2.1. The value of time: a brief review of theories

MVA/ITS/TSU (1987) provides an in-depth theoretical overview of the relevant theories of the valuation of time in a transport context. In brief, the classical theory of consumer behaviour has been adapted to develop a sound basis for valuing travel time savings. The theory is used in the context of time allocation problems in relation to transport related attributes. The outcome of this exercise is a model that can be estimated empirically making use of the 'random utility' theory of discrete choice.

The final equations take the following forms (See I T Transport (2002) for details of the derivations of the equations):

$$(\delta U/\delta t_j)/\lambda = w + (\delta U/\delta t_w)/\lambda + (\varphi/\lambda) - (\psi_j/\lambda) \quad \ldots\ldots (1)$$

$$(\delta U/\delta t_j)/\lambda = \mu/\lambda - \psi_j/\lambda \quad \ldots\ldots (2)$$

Where,

w = the wage rate;

tw and tj = time spent in work and activities other than work respectively;

λ= marginal utility of income;

(δU/ δtj) = marginal utility of time in activity j;

(δU/ δtj)/λ = marginal valuation of time spent on activity j;

(δU/ δtw)/λ - marginal valuation of time spent on work;

(φ/λ) = the marginal valuation of time for decreasing the minimum working time required; and

(ψj/λ) = the marginal valuation of decreasing the minimum other time required.

When ψj is zero in Eq 2, i.e. when the time constraint does not bind, the marginal valuation of time in activity j is equal to μ/λ. This is known as the 'resource value of time'. This is interpreted as the marginal valuation of the 'pure leisure' time at the optimum. 'Pure leisure' time has a value, as one can derive utility from it (Eq. 2). However, there is generally no value, at the margin, for the leisure time saved. This is because there will be no increase in an individual's utility by transferring saved leisure time from one activity to another leisure activity.

Now if we turn to another activity (e.g. travelling), the difference between the marginal valuation of time spent on travelling (or activity j) and resource value of time (marginal valuation of pure leisure time) is $\psi j/\lambda$. $\psi j/\lambda$ is referred to as "the value of transferring time" or commonly as the "value of time." Empirical interest in valuing time is centred on the value of $\psi j/\lambda$.

2.2. Standard procedures for the valuation of working and non-working time savings

The value of working time savings for a travelling employee is taken as the marginal valuation of the employee's time to the employer. The classical economic theory of marginal productivity, which maintains that labour will be hired up to the point where the marginal value of an extra unit of labour is equal to the cost of that unit, underlies the valuation of the working time savings. The value of working time savings is generally taken as the wage rate plus other costs (e.g. employment taxes, other compulsory contributions, and overhead costs etc.) to keep someone employed.

Conversely the concept underlying the valuation of non-working travel time savings is that an individual makes trade offs between time spent in travelling and leisure pursuit. This behaviour can be analysed through preference methods. Two commonly used methods are: revealed preference (RP) and stated preference (SP). The RP analysis estimates values of time which best explain actual observed choices. In contrast, the SP method presents hypothetical choices which

provide credible trade off possibilities. These stated or behaviourally revealed values show someone's willingness to pay (WTP) for preferring to have travel times saved and transferring them to leisure activities. The salient features of the RP and SP methods are summarised in Table 1. This study set out to test whether either of these methods could be usefully used in the measurement of willingness to pay to value non-working time savings in a developing country situation.

Table 1- Comparison of SP and RP methods

Revealed Preference	Stated Preference
• Based on actual choices rather than stated intentions	• Based on hypothetical choices on which individuals base their preferences
• As they represent actual choices, they are not subjected to biases. • Direct evidence only on the alternative selected. No direct evidence on the alternatives rejected • Unsuitable for use in potential transport improvement situations • Expensive to undertake this type of survey as it can generate only one decision per respondent • Easier to design a study as they do not involve a complicated design process	• There may be biases in the SP responses • A variety of choices can be offered which enable the construction of statistical models • Suitable for use in existing or potential situations • Multiple observations per individual can be generated • May involve a complicated experimental design process

2.3. Relevant issues in the valuation of travel time savings in the rural context of the LDCs

Relevance of division of time savings into working and non-working classes

This is one of the main conceptual issues that need resolving in the valuation of travel time savings. This arises as there is little formal employment in rural areas of developing countries. Another question also remains unresolved. Do the working trips need defining differently in the case of rural areas of developing countries in comparison to their developed country counterparts or their urban counterparts?

Preference approaches in a subsistence context

The values of non-working time savings are assessed empirically using preference methods, and indicators of willingness to pay for their preference. The use of preference-based approaches to valuing travel time savings is viewed with suspicion in the context of a rural subsistence economy. The question is often asked, "how a traveller can attach a cash value to his preference when the use of cash is marginal?" This question is valid in, perhaps, a majority of the rural areas of developing countries.

Use of SP vs. RP approach for the measurements of WTP

Section 2.2 presents the advantages and disadvantages of the RP and SP approaches. Both the approaches have been tried in rural areas of LDCs. However, their systematic application appears to have been absent in the different studies reviewed (e.g. Lema, 2000; Hine, Pangihutan & Rudjito, 1998). Therefore, an examination of the suitability of either of the approaches in a systematic way is necessary.

Non-clarity about the meaning of the VoT

In some cases, the definition of the value of travel time savings is not well understood. The tendency is to ascertain only the productive values of the travel time saved. The argument is that

if saved travel time is not used for productive purposes, but for leisure, then why attach a value. By definition the VoT is the difference between the marginal value of travelling time and the marginal value of leisure time. It is conceptually inaccurate to question the productive use of the saved time while valuing travel time savings. This valuation simply reflects the traveller's willingness to pay for his/her preference to transfer saved travel time to leisure.

Perceived values of time vs. resource values of time (or behavioural value vs. resource value)

There is a need for adjustments (shadow pricing) for both working and non-working time savings in developing countries to determine true resource values. Such adjustments are necessary to correct market distortions caused due to the existence of unemployment and underemployment, formal and informal employment sectors, and taxes and subsidies.

2.4. Potential sources of variations of travel time savings

Earlier evidence indicates that VoT may vary because of socio-economic conditions of travellers, infrastructure conditions and transport modes. The main factors that may influence the VoT are:

- Income of the Travellers**:** This may be one of the major sources of variation. Indonesian experience shows that the VoT increases with household income but less than proportionally (Hine, Pangihutan & Rudjito, 1998);
- Person type: VoT may vary with the type of traveller (e.g. men vs. women, major wage earner vs. non-earner etc.);
- With and without load travel: This is one of the crucial issues in the rural context in LDCs given that a significant number of trips are made with load. Seasonal variation: Travel time values are expected to vary depending on season of travel (e.g. time saving values are expected to be higher in the harvesting season, when the family time budget is tight, compared to the non-harvesting season). It may also vary in the wet season compared to the dry season;
- Daily variation: Another factor that may influence the VoT in rural areas of developing countries is the day of travel – especially market and non-market days;
- Modal variation: This type of variation is applicable in developed countries as well as developing countries. For example, the travel time saving values may be different for non-motorised modes compared to motorised modes; and
- Variation due to infrastructure types: Evidence from Tanzania (Lema, 2000) suggests that the time savings values may vary depending on the quality of infrastructure and the remoteness of the infrastructure from main roads.

3. Methodology of the study

3.1. The study area and the overall methodology of the study

The study area was Jessore, a south-western (SW) district in Bangladesh. Although the physical, environmental and transport characteristics vary across Bangladesh, Jessore District represents the majority of the country where there is a predominance of land transport and only marginal water transport. Bicycles and rickshaw-vans are the most used forms of transport in Jessore. Buses ply accessible roads and bullock carts enable access where roads are of a poor quality. The study has covered seven paved, partly paved and earth roads of between 3 and 19 km in length.

A series of focus group discussions with travellers, householders in the area, and transport operators were conducted at the start of the study to inform the design of the household, RP and

SP questionnaires. These discussions also provided an important socio economic context for analysing the results of the preference ranking exercises. In addition, selected male and female travellers from different social groups were interviewed to understand their reasons for travelling and choice of transport modes and how these were related to their socio-economic circumstances. The understanding of socio-economic characteristics obtained from the qualitative appraisal and the household socio-economic survey provided the context for interpreting the empirical results on VoT.

In the study travellers' personal and travel attributes that can influence the VoT were tested to establish their significance. In cases they were found significant, personal and travel attributes values were also calculated. They included:

- Gender of the traveller
- Income levels of the traveller;
- Travelling in wet vs. dry season;
- Travelling on market vs. other days of the week;
- Travelling with or without a load;
- Willingness to pay for reduced walking time;
- Travelling on improved vs. unimproved road; and
- Comfort during the journey (e.g. a bus journey in an un-crowded bus with the availability of a seat for the major part of the journey is defined as a comfortable journey).

The RP questionnaires compared bus, rickshaw-van, bicycle and walking options. The SP questionnaires used a maximum of nine alternatives with two options for each alternative. A total of three attributes with a maximum of three levels were used in designing each of the SP questionnaires. The study made use of Kocur, et. al. (1982) in the fractional factorial experimental design of the SP questionnaires. Because of the high levels of illiteracy, interviewers posed the questions and explained the alternatives. Respondents chose one from two options provided against each alternative.

The study used a total of nine types of questionnaire. Seven of them were RP and SP questionnaires, the remainder being household income/expenditure and travel purpose questionnaires. Appendix I provides details of the questionnaires along with the objectives of their use. The SP and RP questionnaires were administered on the roadside in two rounds; one in the wet season and the second in the dry season. A total of 784 RP Questionnaires and 1547 SP questionnaires were administered. Use of household income/expenditure questionnaires helped to ascertain the respondents' economic status and time-use patterns. The travel purpose questionnaires were vital to understand the purpose of travel of the travellers.

Preference questionnaire results were analysed using logit analysis techniques with the help of standard software. The analyses provided model coefficients and their statistical significance. Reconciliation of responses with different preference exercises was facilitated through use of Hierarchical Logit (HL) modelling techniques.

3.2. Identification of the social class of the travellers and defining poverty thresholds

Section 2.4 suggests that the level of income of the travellers may be a potential source of variations in the VoT. For instance, a member of a high income household will be willing to pay more to avoid the inconvenience of longer travel as the affordability is higher than their low income counterparts. Therefore, there is a need to differentiate households on the basis of their economic status so that such differentiations can be used when modelling the valuation of travel time savings.

However, unlike developed countries or urban areas of developing countries, assessing someone's personal or household income from a roadside interview is difficult. This is due to two reasons: First a majority of the rural households in LDCs earn little cash income as they are engaged in subsistence agriculture unlike their developed country or urban counterparts. Secondly, there is a general reluctance to reveal income directly to outsiders. To overcome these problems, the household income/expenditure survey was conducted before the main roadside preference survey to develop an econometric model with indicators that significantly explain the households' per capita consumption expenditure. These indicators and their coefficient values were subsequently used in the roadside survey questionnaires to estimate the households' per capita consumption expenditure. This method was found convenient, as the respondents did not feel threatened when revealing information. The following equation provides the basic form of the model:

$$PERCAPEXP : \sum \alpha_i * X_j + \sum d_m * \beta_m \ldots\ldots\ldots \text{(i)}$$

Where: PERCAPEXP = Consumption expenditure per capita per year for the household; Xj = Continuous dependent variable j (e.g. amount of land per capita, number of members involved in income earning activities etc.) ; dm = Dummy for dependent variable m (e.g.
whether any household member is involved in a permanent job etc.; yes = 1 and no = 0); and αi and βm are coefficients.

Table 2 presents the significant variables along with their coefficients in the chosen model. The final econometric model for prediction of per capita consumption expenditure is shown in Equation ii.

Table 2 - Independent variables and their co-efficients

Independent Variable	**Coefficient**
Land Per Capita (Acres) [LANDCAP]	440
No of person involved in income earning activities in the household [NO_INCOME]	3813
Dummy for household owning motorised transport including motorcycle (Yes=1, No=0) [D_M_TRAN]	12215
Dummy for any member of the household with permanent job (Yes=1, No=0) [D_P_JOB]	5758
Dummy for any member of the household with established business (Yes=1, No=0) [D_P_BUSI]	3474

PERCAPEXP = 440 *LANDCAP + 3813 * NO_INCOME + 12215*D_M_TRAN + 5758 * D_PER_JOB + 3474 * D_PER_BUSI ……..(ii)

There are two internationally defined poverty thresholds: If a person's income falls below US$1 and $2, after adjusting for Purchasing Power Parity (PPP), then the person is considered to be below lower and higher poverty lines respectively. These figures of US$1 and US $2 are based on 1985 PPP estimates. The most recent recalculation quotes these figures as being US$1.08 and US$ 2.15 respectively (World Bank, 2001). The values of higher and lower threshold poverty lines are calculated at Tk[++] 5,434 (US$1.08 level) and Tk 10,817 (US$ 2.15) per person per year, respectively, for Bangladesh. I T Transport (2002) provides the detailed methodology for such calculations. To facilitate the international comparison of the study results, these two values of

[++] Taka or Tk is the Bangladesh currency.

Tk 5,434 and Tk 10,817 are used in this study to identify travellers below the two poverty lines. On this basis, the results of the household survey show that in the study area 53 per cent and 81 per cent of the households fall below the $1 and $2 international poverty thresholds respectively.

4. Estimated values of travel time savings and suitability of alternative approaches

Table 3 presents the results of the preferred models from separate SP and RP analyses, and a combined RP and SP analysis from both rounds of data (wet season and dry season). Appendix II presents the coefficient values and corresponding t-values of the chosen models. I T Transport (2002) provides the detailed estimation procedures.

Table 3 – Summary of the chosen models and estimated values of travel time savings

	Combined SP (Round-1&2)	Combined SP & RP	RP only
Base Value of Travel Time Savings (Tk/hr)			
IVT bus	[a]	[a]	[a]
IVT rickshaw-van	[a]	[a]	[a]
IVT (male)	4.75	4.82	7.64 [b]
IVT (female)	2.25	2.29	
IVT (average) [c]	3.50	3.55	
Walk (male)	5.16	5.14	[b]
Walk (female)	2.66	2.61	[b]
Walk (average)	3.91	3.87	[b]
Additional Value (Taka/hr)			
ASC Bus/Rickshaw-van [d]	N/S	N/S	N/S
Uncomfortable travelling condition	2.29	2.29	N/S
Market day	1.47	1.32	N/S
Fixed earner	14.72	14.76	N/S
Social and leisure travel	N/S	N/S	N/S
Travelling with load	0.48	0.52	N/S
Poor traveller	0.31	0.31	658.7
Travelling on poor road	N/S	N/S	8.26
Travelling on wet season	N/S	N/S	N/S
Other Statistics of the Models			
Rho_Sq	0.111	0.1064	0.0572
Rho_sq Const	0.0617	0.0575	0.0191
Scale Factor SP1	N/A	1.23	N/A
Scale Factor SP2	1.978	2.11	N/A
Scale Factor SP3	2.335	2.49	N/A
Scale Factor SP4	N/S	N/S	N/A
Scale Factor SP5	1.322	1.42	N/A
Scale Factor SP6	2.652	2.81	N/A
Scale Factor RP	N/A	N/A	N/A

Note: Taka or Tk is the Bangladesh currency. 1 US$ is equivalent to roughly Taka 57 in 2001. (i.e. 1 Taka = US$ 0.017); [a] = In-vehicle time (IVT) of bus and rickshaw-van was estimated jointly; [b] = IVT, walking time and waiting time are estimated jointly; [c] = Simple average of male and female; [d] = Alternative Specific Constant (ASC) that captures subtle preference towards a specific mode; N/A = Not Applicable; N/S = Non-significant.

The RP methods failed to provide consistent results. Closer analysis of the results suggests that this can be largely attributed to the fact that for many travellers the options are very limited (and often none at all, but to walk) and therefore no trade offs can be made and no meaningful valuation of travel time savings can be calculated. Furthermore, commercial vehicles in rural Bangladesh generally do not run to a schedule, but wait until the vehicle is full before moving off. This means that waiting times can vary enormously and complicates the issue when travellers try to compare modes of transport. Since rural people rarely wear watches, their recall on waiting and in-vehicle time (IVT) may not be accurate and this further complicates the administration of the RP methods.

However, the application of the SP methods was successful. All types of traveller were able to make choices about preferred travel options and were able to make rational justifications for their choices. The SP methods were found suitable for different infrastructure types and travel alternatives.

The computation of the SP questionnaire answers led to the following estimates of travel time savings values:

Base values of travel time savings	**Men**	**Women**	**Average**
In-vehicle time	4.75 Tk/hr	2.25 Tk/hr	3.50 Tk/hr
Walking time	5.16 Tk/hr	2.66 Tk/hr	3.91 Tk/hr

Additional computed values	
Uncomfortable travelling conditions	2.29 Tk/hr
Market day	1.47 Tk/hr
Salaried or traders	14.72 Tk/hr
Social and leisure	Not an additional factor
Travelling with a load	0.48 Tk/hr
Poor traveller	0.31 Tk/hr
Poor road	Not an additional factor
Wet season	Not an additional factor
Mode of transport (bus/rickshaw-van)	Not an additional factor

This suggests a number of significant conclusions specific to the SW Bangladesh situation:

- Men attach about double the in-vehicle time savings values compared to women;
- Willingness to pay by salaried persons and traders is four times the base average in-vehicle value;
- Travelling with a load increases the value of time by about 14% over the average base value;
- Market day travel attracts a higher VoT, equivalent to about 42% above the average base value;
- Poor travellers valued their travel time some 9% above the average base value. This higher figure may look counterintuitive at first if considered in a developed country context. The conventional belief is that the VoT increases with increase in household income. However, the poor in Bangladesh – both men and women – operate on a very tight time budget. An average poor person spends significantly less time for social and leisure activities compared an average non-poor person. They tend to make best use of their time in order to survive in a country with a

very high population but with a few income earning opportunities. Also, there is a tendency to earn an extra amount whenever opportunities come in order to secure themselves financially for future bad times;

- Uncomfortable travelling conditions attracted a value of 63% above the average base level;
- People make no distinction between travelling for essential and non-essential (e.g. travel for the purpose of social and leisure) purposes. Thus, the base value of time is appropriate for all types of journeys. By placing similar values on all journeys rural Bangladeshis are seemingly factoring in the productive nature of 'social' trips (time spent in family gatherings, community meetings, work search, networking, religious activities etc may be considered as an important aspects of social capital accumulation by the rural people);
- The condition of the road, mode of transport and season are not additional significant factors over the average base value; and
- Although walking time has a higher value than in-vehicle time (12%) the difference is much less than in developed countries where it is often as high as 100%. This can be explained by the fact that the rural population in the developing countries are more accustomed to walking than their developed country or urban counterparts. Also walking attracts more disutility when compared to more comfortable in-vehicle travelling conditions in developed countries.

Using these figures, value of time estimates can be made for different situations. For example, the value of time for a man travelling on market day with a load would be calculated at Tk 6.70/hr (base value (Tk 4.75/hr) + market day (Tk 1.47/hr) + load (Tk 0.48/hr) = Tk 6.70/hr). A base value for an average traveller on a rural road in Bangladesh was estimated at Tk 4.30 per hour.

The issue of work and non-work travel intrinsic to travel time savings valuations in developed countries was further reviewed. In fact less than 1% of trips could be categorised using the traditional definition of work trips (those undertaken when working for an employer). Adding "self employed working trips" and "purchasing/selling goods for profit" increased this proportion to 21%. Considering the nature of the rural economy in Bangladesh, it appears justifiable to redefine working trips. The newly defined working trips include: trips made in the course of work for an employer, trips made in the course of work as self-employed, and trips made for purchase/selling of goods for a profit. Time saving values of theses trips should at least be equal to the wage rate - calculated at Tk
6.82 per hour for the study area.

After adjustments to correct for market distortions caused by unemployment, underemployment, taxes and subsidies, the following economic travel time saving values were obtained:

- Working VoT 5.10 Tk/hr
- Base non-working VoT for an average traveller on a rural road 3.80 Tk/hr

The working and non-working travel time savings values were adjusted with a shadow wage rate factor (calculated at 0.75) and a Standard Conversion Factor (calculated at 0.88) respectively.

Only 14% of the trips were stated as being multi-purpose. This relatively low proportion could be due to the trip patterns in rural Bangladesh – frequent but short trip characteristics. However, this finding may be considered unique to Bangladesh or other countries with a high population density and short distances to facilities and services.

Women attach a much lower value to time savings than men. This may be a reflection of the fact that women in rural Bangladesh rarely have access to household finances thus limiting their options, that differences in wage rates for men and women are considerable, and that a woman's

contribution to the household (productive and reproductive) is rarely acknowledged in financial terms.

5. Overall conclusions

The study suggests that, in general, separating journeys into working and non-working categories is valid in a developing country context. However, working trips need redefining to take account of the nature of the rural economy. The redefined working trips should include trips which have opportunity costs of lost time equal to the marginal value of income of the travellers. The SP method for valuing of non-working travel time savings is more appropriate than the RP method. There is a need to adjust the working time saving values, when equated to the wage rate, with a shadow wage rate factor and the nonworking time saving values with the Standard Conversion Factor.

In addition to income levels, occupation and gender of the travellers, day of travel and travel conditions and travel with or without a load have significant effects on the value of travel time savings. However, types of trip, infrastructure conditions, seasons and transport modes do not seem to have any significant effects on the VoT in rural Bangladesh. Although walking time has a higher value than in-vehicle time, the difference is much less than in developed countries.

The study has demonstrated the applicability of conventional methods of valuing travel time savings for travellers in rural Bangladesh and indicated the types of adaptations which are required in designing and implementing the study and analysing and interpreting the results. However, there is some way to go in preparing guidelines for the routine inclusion of travel time savings in rural project appraisal. Bangladesh as a highly monetized and densely populated country could be considered a special case. The next stage is to replicate the study in a typical LDC with lower population density and lower level of monetization.

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Appendix I
Types of questionnaires used in the study

Questionnaire	Application Unit (Place of Administration)	Collected Data on	Objectives
Household Questionnaire	Household (at the household)	Basic household information, income and expenditure data, and activity data	To identify variables those significantly explain the household expenditure. These variables are used in preference questionnaires for estimating the household expenditure that is subsequently used for poverty analysis. Evidence from the activity diaries is used for analysis of time-use patterns of different social and gender groups.
RP Questionnaire	Individual traveller (roadside)	Basic personal and household information, travel attributes and revealed choice data	To value bus, rickshaw-van and other vehicles in-vehicle time (IVT) and walking time values for passengers from all modes.
SP Questionnaire1	Individual traveller (roadside)	Basic personal and household information, travel attributes and stated choice data	To value IVT for bus passengers travelling on an improved road including the value of travel time savings under un-comfortable travelling conditions.
SP Questionnaire 2	Individual traveller (roadside)	As above	To value bus and rickshaw-van IVT values for rickshaw-van passenger travelling on a non-improved road.
SP Questionnaire 3	Individual traveller (roadside)	As above	To value bus IVT and walking time values for bus passengers on an improved road.
SP Questionnaire 4	Individual traveller (roadside)	As above	To value bus and rickshaw-van IVT values for rickshaw-van passengers travelling on an improved road.
SP Questionnaire 5	Individual traveller (roadside)	As above	To value rickshaw-van IVT and walking time values for rickshaw-van passengers on a non-improved road.
SP Questionnaire 6	Individual traveller (roadside)	As above	To value bus IVT and walking time values for pedestrians on a non-improved road.
Travel Purpose Questionnaire	Individual traveller (roadside)	Travel attributes including travel purpose	To supplement travel purpose data already collected as a part of the preference data in order to understand the purpose of travel by the respondents.

Appendix II

Model Estimation Results

Coefficients	Type of variable	Dummy value applied to	Coefficients (t statistics)		
			Combined SP	Combined SP & RP	RP only
Cost	Continuous	N/A	-0.1138 (-10.2)	-0.1064 (-7.9)	-0.1482 (-4.2)
IVT	Continuous	N/A	-4.26E-03 (-3.6)	-4.07E-03 (-3.7)	-0.0189 (-4.2)
Walk	Continuous	N/A	-5.04E-03 (-4.1)	-4.64E-03 (-3.6)	N/S (N/A)
Uncomfortable travelling condition	Dummy	Time	-4.34E-03 (-3.6)	-4.06E-03 (-3.6)	N/S (N/A)
Market day travel	Dummy	Time	-2.78E-03 (-3.1)	-2.34E-03 (-2.8)	N/S (N/A)
Male	Dummy	Time	-4.75E-03 (-3.9)	-4.45E-03 (-3.7)	N/S (N/A)
Fixed income earner	Dummy	Time	-2.79E-02 (-9.4)	-2.62E-02 (-7.7)	N/S (N/A)
Travelling with load	Dummy	Cost	1.99E-02 (4.8)	1.98E-02 (4.5)	0.1465 (4.0)
Poor traveller	Dummy	Cost	1.38E-02 (3.4)	1.26E-02 (3.3)	N/S (N/A)
Travelling on poor road	Dummy	Cost	N/S (N/A)	N/S (N/A)	0.0770 (2.1)

Note: N/A = Not Applicable; N/S = Not-significant