RURAL TRAVELLERS' TIME SAVINGS IN DEVELOPING COUNTRIES: CAN THEY BE MEASURED AND DO THEY MATTER ? [1]

Paper for the 11th World Conference on Transportation Research

Farhad AHMED
IT Transport Ltd., The Old Power Station
Ardington, Nr Wantage
OXON, OX12 8QJ, UK
Tel: +44 (0) 1235 833 753
Fax:+44 (0) 1235 832 186
E-mail: farhad.ahmed@ittransport.co.uk

Kirit VAIDYA
Economics and Strategy Group
Aston Business School
Aston University
Birmingham, B4 7ET, UK
Phone:+44 (0) 121 204 3263
E-mail: k.g.vaidya@aston.ac.uk

Mark WARDMAN
Institute for Transport Studies
University of Leeds, LS2 9JT, UK
M.R.Wardman@its.leeds.ac.uk

[1] The authors gratefully acknowledge the UK Department for International Development (DFID) support for this study through research grants.

Rural travellers' time savings in developing countries: Can they be measured and do they matter ?

Abstract

Travel time saving values are generally ignored in rural transport project appraisal in developing countries because of perceived difficulties in valuing them and an assumption of low savings. Excluding such savings for rural projects and their inclusion in urban and inter-urban project appraisal creates a bias against rural development. Studies in Bangladesh, Ghana and Tanzania demonstrate that the stated preference approach to valuing time savings, supported by studies of local socio-economic conditions, are feasible and produce robust results. The in-vehicle time savings on non-work trips for men vary between 53 and 70 per cent of the wage rate with differences in values between men and women, groups with different income levels and modes of travel. The distinction between working and non-working time savings also has to be adapted for the rural context.

Key Words: transport project appraisal / rural / developing countries / time saving values

1. Introduction

Travel time savings can account for as much as 80 per cent of the overall benefits of transport projects in developed countries. The need to include travel time saving benefits in appraising transport projects in developing countries is now accepted (Gwilliam, 1997). However, such savings are rarely included as benefits on rural projects. One reason for this exclusion is doubts about the applicability of conventional models in estimating travel time savings in rural areas in developing countries where work patterns are diverse and include subsistence activities. Low rural incomes and underemployment also underlie the assumption of very low or even zero value of travel time savings of rural people and therefore justification for ignoring them. Since time saving values of travellers are often included for urban and inter-urban transport projects in developing countries, there is an inherent bias against rural projects. The incidence of poverty is typically higher in rural areas and poorer people are typically heavier users of rural roads, tracks and paths. Therefore rural pro-poor effects of

improving the local transport infrastructure may be lost by excluding travel time savings when appraising rural projects.

Conventional approaches to valuing time in developed countries assume that most people work in formal employment and journeys can be easily differentiated into "work" and "non-work" categories. The augmented wage rate (i.e. the wage rate, related taxes and compulsory contributions and other employment related costs) representing the cost to the employer of the time spent by the employee in travelling during working time represents the value of working time savings. The value of non-working time savings is represented by the willingness to pay to save travel time and transfer it to leisure activities.

The conventional "western" distinction between working and non-working time savings cannot be applied in the rural economies of developing countries without some adaptation. A large proportion of the population is engaged in a combination of formal and informal employment, subsistence production and activities such as fetching water and fuel which are essential for the household. Typically, a small minority of the labour force is engaged in formal wage employment. Therefore, in arguing a case for routine inclusion of travel time saving values in the appraisal of rural transport projects in developing countries, the challenge is to develop a methodology for valuing time savings which can accommodate the diversity of work and subsistence activities, multi-purpose travel and time use patterns of rural households.

This paper reports on studies which tested the applicability of revealed and stated preference (RP and SP) approaches[2] to valuing rural travel time savings in three developing countries,

[2] The RP approach was found to be problematic as later discussion later in this section indicates. The results presented here are entirely from SP studies.

Bangladesh, Ghana and Tanzania. Section 2 briefly outlines the theory underlying estimation of travel time saving values and some issues of relevance in applying the theory in the rural economy context in developing countries. Section 3 summarises the findings of the earlier Bangladesh study as the context for the Ghana and Tanzania studies (section 4). Section 5 compares the findings from the three countries followed by conclusions and recommendations in section 6.

2. The conventional theory and issues related to valuing rural travel time savings in developing countries

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

Theory underlying the valuation of travel time savings is well known and has been summarised and reviewed succinctly by Mackie et al (2001). As noted above, a distinction is made between time savings in the course of work and other travel. The value of working time savings for a travelling employee is 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 this valuation of working time savings which are generally taken to be the augmented wage rate as defined in section 1. The implicit assumptions underlying this approach are that all travel time saved during work are transferred to work and lead to higher production, employees do not use any of the work travel time for productive purposes, there are no additional benefits from reduced travel time (for example from reduced fatigue) for the employer or employee, and employees do not derive greater utility or disutility when travelling than when engaged in work. More sophisticated theoretical modelling can take account of these complications but the required empirical measurement is difficult and by and large the loss of production or "cost saving" approach is accepted in practice (Mackie et al, 2001).

The theoretical basis for valuing non-working travel time savings is the classical economic theory of utility maximising consumer behaviour. Allocation of time is included in the constrained utility maximisation model in which an individual's utility is derived from consumption of a set of commodities, and allocation of time to a set of activities (Becker, 1965; DeSerpa, 1971). One of these activities is work through which an individual derives income, though there may also be other non-work sources of income such as return on savings. Consumption of commodities is constrained by income and prices and the allocation of time is constrained by the total available time.

The valuation of non-working travel time savings is based on the premise that an individual faced with a choice between longer and shorter travel times can indicate willingness to pay to reduce travel time and increase time available for leisure or other discretionary activities. Willingness to pay for reduced travel time can be estimated through preference methods. The theoretical framework underlying the empirical measurement of non-working time savings is the discrete choice model based on random utility theory (Ortuzar and Willumsen, 1996) which postulates that the behaviour of a rational person is explained by his/her desire to maximise utility subject to random variations in behaviour due to errors in the perception of individuals, errors in measurement and variations in tastes between individuals. The discrete choice model framework enables the use of disaggregated data on individuals' choices between specified alternatives for valuation of non-working travel time savings or 'behavioural values of time'.

Two standard approaches to collecting data for estimating the behavioural values of time are revealed preference (RP) and stated preference (SP). The applicability of both these

approaches was tested in the three countries. In principle, the RP approach which reveals the actual behaviour of travellers appears to be superior to SP which produces information on stated intentions which may differ from actual behaviour. In practice, the RP approach was found to be unsuitable in all three countries because of:

- limited choice of travel options in rural areas leading to lack of realistic trade-offs between travel modes or within modes;
- complicated trip characteristics of rural travellers involving the use of several modes during a trip;
- difficulty of estimating waiting times because commercial transport services do not operate to schedule but wait until the vehicle is full, and
- RP data collection being more time consuming and expensive.

Therefore, results for all three countries reported here are from SP studies[3].

2.2 Relevant issues in the valuation of travel time savings in the rural context of developing countries

As noted earlier, a complication in developing countries is the definition of working time. For a person travelling during formal or informal wage employment, the wage and other employment related costs could be used to value working time savings. However, the proportion of persons travelling during wage employment is likely to be much smaller than those in self employment or engaged in subsistence activity. For those in self employment or subsistence activities, direct evidence to estimate the value of loss of production as a result of longer travel time is difficult to obtain. Further, some travellers may be engaged in essential activities for the livelihoods of households such as fetching water or going to market to buy necessities. In order to address these issues, the SP approach has been used to estimate the

[3] The SP approach has also been found to be easier to use and is therefore more common in developed countries. Comparison of values of time derived from SP and RP studies show no evidence of the SP approach overstating values (Wardman, 2004).

value of time savings for all respondents (whether travelling during wage employment and others). Travel purpose surveys were carried out to assess the proportion of travellers in the different categories. The evidence was then used to consider whether the definition of working trips needs to be adjusted for rural areas in developing countries and to determine the appropriate time saving values for travellers in different categories.

Earlier evidence indicates that value of time savings may vary because of socio-economic conditions of travellers, infrastructure conditions and transport modes. The main factors found to have influenced time saving values are the incomes of travellers (Hine, Pangihutan and Rudjito, 1998), the gender and employment status of the traveller and whether the traveller is carrying a load. There may also be variations in time saving values between seasons and days of the week (e.g. market vs non-market day). The willingness to pay may also be affected by the mode of transport, travel comfort and the quality of the infrastructure (Lema, 2000). Therefore the studies collected data on travellers' socio-economic and demographic characteristics and their responses to travel conditions to assess the effects of these features on the value of travel time savings.

Questions that had to be addressed in the early stages of designing the studies were: (a) whether rural travellers have sufficiently objective perceptions of time and time savings and appreciation of the trade-off between time spent travelling and its employment in alternative activities, and (b) how preference questionnaires should be designed to obtain robust responses on trade-offs between time savings and monetary costs. Indicators of the socio-economic status and incomes levels of travellers on which data could be readily collected were also needed. Socio-economic investigations using focus groups and participatory rural appraisal reported in IT Transport (2005) and Vaidya et al (2007) showed that with appropriate design of questions (e.g. by relating time periods to duration of local activities),

meaningful choices between different periods of time could be conveyed to travellers. The qualitative approaches also provided information on possible indicators of the socio-economic status of the households of travellers. This information was used to design household surveys to estimate quantitative relationships between household expenditure level and socio-economic indicators on which data could be readily collected from travellers. The results of the analyses were used to assess the living standards of the households of travellers and differences in travel time saving values between better off and poorer households.

3. The Bangladesh study

The Bangladesh study reported in IT Transport (2002) and Ahmed and Vaidya (2004) demonstrated that the separation of travel time savings into working and non-working categories is valid and practicable in rural Bangladesh. However, only a small proportion of total rural trips could be defined as conventional "working trips" and therefore working trips were redefined to include trips made in the course of self-employment and trips made for selling or buying goods for profit. The value of time savings during working time defined in this manner should be equivalent to the increased value of production the travellers' employers (for those in employment) or the travellers themselves (for those in self employment) can gain from using the saved travel time.

The study used the SP approach to produce a set of travel time saving values – base in-vehicle time saving value, walking time saving value and other time saving values that can be linked to personal attributes of travellers, trip purpose, travel mode and seasonality (IT Transport, 2002; Ahmed and Vaidya, 2004). A question that remained was whether the methodology used in Bangladesh could be replicated in other developing countries. Bangladesh is a densely populated country with a highly competitive transport sector offering a range of non-motorised and motorised transport mode options. The methodology may not be suitable in

countries and locations with lower population densities, more widely spaced communities and less diverse and competitive transport sectors.

A limitation of the Bangladesh study was that it did not attempt to value children's travel time savings, an important omission given the socio-economic roles of children in rural areas of developing economies. To assess replicability, compare results, extend the study and to reach more robust conclusions as a basis for policy recommendations, further studies were undertaken in rural localities in Ghana and Tanzania representing socio-economic and transport characteristics different from those in Bangladesh.

4. Ghana and Tanzania studies

4.1 The study areas

The study area in Ghana was in Yendi District in the Northern Region which is flat, dry, with large areas of uncultivated bush and the most sparsely populated Region in Ghana. Agriculture is the mainstay of the economy, with limited manufacturing and services. Much of the agricultural production is small-scale with more than 60 per cent of farms being less than two hectares. Road vehicles include cars, buses, minibuses, *Mammy Wagons*[4], trucks, tractors and bicycles. Roads in the Region are generally in bad condition with two-thirds of the feeder road network classified as unmaintainable. About 70 per cent of the people in Northern Region were classified as poor in 1999 (Government of Ghana, 2003). Yendi District is typical of socio-economic characteristics in the Region with a population density of 24 persons per square kilometre.

The location of the study in Tanzania was Moshi Rural District in Kilimanjaro Region. With per capita Gross National Income of US$340 in 2005, Tanzania remains one of the poorest

[4] A Mammy Wagon is a wooden construction on a lorry chassis widely used in Ghana for carrying both goods and passengers.

countries in the world. It has an estimated population of 35 million with an average population density of 40 persons per sq km. Kilimanjaro Region is in the mountainous agro-ecological zone which has a cool climate with relatively high rainfall. Agriculture is a mixture of vegetables, maize, rice, coffee and a range of other crops and livestock. Cars, buses, pick-ups, trucks, minibuses and bicycles are the main transport modes. Moshi Rural District is one of the six districts in Kilimanjaro Region. The district has a high population density, about 294 persons per sq km and approximately 657 km of mostly earthen rural roads generally in poor condition. Apart from agriculture, there are employment opportunities within the district in the tourism sector.

4.2 The results

Table 1 presents the estimated base and attribute travel time saving values for Ghana and Tanzania and the relevant model statistics[5]. The results are based on the analysis of the SP data for both countries. The additional values in the lower part of the table are the differences from the base values related to the attributes of travellers and other conditions. For example, the value of travel time savings for a man travelling under "uncomfortable travel conditions" would be Cedi 3,119 per hour (i.e. the base value of Cedi 1,731 per hour plus the additional value of Cedi 1,388 per hour for uncomfortable travel conditions). Average base in-vehicle travel time saving value in Ghana is Cedi 1,627 (or US$0.18) per hour. Average walking time saving value in Ghana is Cedi 2,886 per hour, i.e. 77 per cent higher than the average in-vehicle time value. In-vehicle and walking travel time saving values could not be estimated separately for Tanzania. The base in-vehicle time saving values were calculated from the composite base values for in-vehicle and walking time by assuming that the base walking time values are 50 per cent higher than in-vehicle time values. If the differences between

[5] For further technical details on the design of the studies and the statistical results, see IT Transport (2005).

walking and in-vehicle time values are higher than 50 per cent, as they are in Ghana and Bangladesh, calculations of in-vehicle time values based on the assumption of 50 per cent difference would clearly overstate the in-vehicle time saving values and understate the walking time values.

Table 1 Estimated travel time saving values in Ghana and Tanzania

	Ghana (Cedi/hr)	**Tanzania (TZS/hr)**
	Combined SP	**Combined SP**
Base Values		
In-vehicle time (men)	1,731	213 [a]
In-vehicle time (women)	1,523	177
In-vehicle time (average) [c]	1,627	195
Walk (male)	2,991	[b]
Walk (female)	2,782	[b]
Walk (average)	2,886	[b]
Additional values		
Children (travellers below 16 years of age)	-345 Cedi/hr	-94 TZS/hr
Uncomfortable travelling condition	1,388 Cedi/hr	110 TZS/hr
Market day	Not an additional factor	Not an additional factor
Safe travelling condition	Not considered	Not an additional factor
Use of visual aid in SP	Not an additional factor	Not an additional factor
Travellers with a permanent job	1,515 Cedi/hr	Not an additional factor
Social and leisure travel	Not an additional factor	Not an additional factor
Travellers with a load	Not an additional factor	Not an additional factor
Travellers with a watch	259 Cedi/hr	35 TZS/hr
Travellers who are traders	Not an additional factor	Not an additional factor
Poor traveller	-173 Cedi/hr	-84 TZS/hr
Travelling on poor road	Not an additional factor	51 TZS/hr
Travelling on wet season	Not an additional factor	Not an additional factor
Model statistics		
Rho_Sq	0.074	0.097
Rho_sq Const	0.065	0.080
Scale Factor SP1	N/A	N/A
Scale Factor SP2	0.68	Not significant
Scale Factor SP3	0.39	0.68
Scale Factor SP4	Not significant	Not significant
Scale Factor SP5	0.70	1.24
Scale Factor SP6	0.45	Not applicable

Notes: [a] Calculated by assuming that average walking time saving value is 50 per cent higher than average in-vehicle time saving value because in-vehicle and walking time values could not be estimated separately for Tanzania.
[b] Walking time and in-vehicle time saving values could not be estimated separately.
[c] Simple average of time saving values for men and women.
N/A – Not applicable.

Time saving values for men and women in Ghana are Cedi 1,731 and Cedi 1,523 respectively, i.e. the value of women's travel time savings is 88 per cent of that of men's. Women's value of time in Tanzania is about 83 per cent of that of men. This lower behavioural value of women's time is unlikely to be because women's time is less scarce. In both study locations in Africa, women are very active economically and are as likely as men to be involved in business. Results of the activity analysis showed that women spent less time in sleep and social and leisure activities than men in Ghana. Further evidence from Ghana suggests that women make up roughly 85 per cent of the wholesale and retail trading industries and about two-thirds of manufacturing, working mostly in the informal sector (World Bank, 1999). Results of the travel purpose data analysis show that the proportions of trips made by women for wider socio-economic needs both in Ghana and Tanzania are similar to those by men.

The above evidence suggests that women's time is as constrained as men's if not more. One of the reasons for the lower willingness to pay by women which emerged from focus groups was the economic balance of power and control of cash within households. Men tend to be engaged in cash crops and other cash earning activities and control household finances while women focus more on subsistence production. Women were also thought to be more careful with money. Children were found to have positive travel time savings but as would be expected, lower than those of adults (21 per cent and 48 per cent of the base in-vehicle time in Ghana and Tanzania respectively).

Other results of note are:

- The higher base walking time saving value in Ghana which reflects the higher disutility of walking compared with in-vehicle travel.

- Willingness to pay more to avoid uncomfortable travelling conditions but not for travelling with a load.
- No difference in travel time savings between market and non-market days, possibly because of close proximity of markets and unwillingness to pay more to travel to and from the market because of the low value of transactions undertaken.
- No difference in the willingness to pay between essential and non-essential (social and leisure) trips, possibly because of the social capital accumulation function of the latter.
- Poor travellers' travel time savings were found to be lower than the base in-vehicle time savings (11 per cent and 43 per cent less for Ghana and Tanzania) as would be expected but counter to the Bangladesh evidence[6].
- No willingness to pay a premium for safer travelling conditions.

5. Comparisons of travel time saving values: Bangladesh, Ghana and Tanzania

For inter-country comparison, Table 2 shows travel time saving values as proportions of average wage rates in the study areas at the time of the study. The local rural wage rate in Bangladesh was obtained from secondary sources (IT Transport, 2002). Because of lack of credible secondary data, wage rates for Ghana and Tanzania were estimated from data collected from the study areas during the studies. The main points emerging from the comparison in Table 2 are as follows:

- The average values of in-vehicle time savings range from 49 per cent (Tanzania) to 64 per cent (Ghana) of the average wage rate, with the average in-vehicle figures for male travellers ranging between 53 per cent (Tanzania) to 70 per cent (Bangladesh). More detailed examination of evidence on local conditions, including the relative scarcity of transport services, would be needed to explain the differences.

[6] This result is discussed in the next section.

- The range of in-vehicle time figures for women is larger, between 33 per cent (Bangladesh) and 60 per cent (Ghana). The lower percentages for women than for men are because the comparison is with average wage rates for men and women while women's wage rates are likely to be lower than the average. In Ghana and Tanzania, women's time saving values are proportionally higher than in Bangladesh. The most plausible reason for this difference is that women in Africa are more involved in wider socio-economic activities and are possibly more financially independent than their Bangladeshi counterparts.
- Average walking time saving values for Bangladesh and Ghana were 76 per cent and 117 per cent of the average wage rate[7]. The average walking time value in Ghana is substantially higher than the walking time value in Bangladesh possibly because of the more extreme weather conditions and longer distances in the Northern Region of Ghana which increase the disutility of walking.

Table 2 Inter-country comparisons of travel time savings (% of average hourly income)

	Bangladesh	**Ghana**	**Tanzania[a]**
IVT (male)	70%	68%	53%
IVT (female)	33%	60%	44%
IVT (average)	51%	64%	49%
Walk (male)	76%	117%	[b]
Walk (female)	39%	109%	[b]
Walk (average)	57%	113%	[b]

Notes: [a] Walking and in-vehicle time saving values could not be estimated separately. Average walking time saving values are assumed to be 50 per cent higher than the average in-vehicle time saving values.
[b] Not available.

Table 3 presents inter-country comparisons of walking time and other travel and personal attribute values as a proportion of base in-vehicle time value:

- The average walking time values for Bangladesh and Ghana are 112 per cent and 177 per cent of the base in-vehicle time value respectively. This provides an average figure

[7] As noted earlier, walking time saving values for Tanzania could not be estimated separately.

of 145 per cent. In developed countries walking time saving values are often as high as double the in-vehicle time values. The proportionally lower walking time saving values in Bangladesh and Ghana can perhaps be explained by rural people in developing countries being more accustomed to walking and therefore attaching lower disutility to walking than travellers in developed countries.

- Women's travel time savings value as a proportion of the base in-vehicle time savings value is considerably lower in Bangladesh (64 per cent) compared to Ghana (94 per cent) and Tanzania (91 per cent). A possible reason for this difference has been suggested above. The average figure from three countries is 83 per cent.
- Children's travel time saving values in Ghana and Tanzania were estimated at 79 per cent and 52 per cent respectively of adults' average base in-vehicle time values. This provides an average of 66 per cent, about two third of adults' base value.
- Market day travel and travelling with a load attracted additional 42 per cent and 14 per cent respectively of the base in-vehicle time value in Bangladesh. However, these features were found not to increase the willingness to pay to save travel time in Ghana and Tanzania. Although travelling on a poor road attracted an additional travel time saving value in Tanzania (26 per cent), it did not attract a premium in Bangladesh and Ghana.
- In the Bangladesh study, the travel time savings of the poor were higher than those of the non-poor. This counterintuitive result may be explained by the very tight time budget of the poor in Bangladesh and their need to devote more time to income earning and subsistence activities to meet basic household needs. Arguably, the higher value of time savings can be explained by the willingness to pay more to reduce unproductive travel time. The travel time saving values for the poor in Ghana and Tanzania were lower than those for the non-poor, 89 per cent and 57 per cent of the

base values respectively, reflecting their normal lower willingness and ability to pay for time savings.

Table 3 Inter-country comparison of travel time savings (per cent of base IVT)

	Bangladesh	**Ghana**	**Tanzania**
Average Walking time	112 per cent	177 per cent	[a]
Women's time	64 per cent	94 per cent	91 per cent
Children's time	Not estimated	79 per cent	52 per cent
Uncomfortable travelling condition	165 per cent	185 per cent	156 per cent
Market day	142 per cent	[b]	[b]
Travellers with a permanent job	521 per cent	193 per cent	[b]
Travellers with a load	114 per cent	[b]	[b]
Travellers who are poor	109 per cent	89 per cent	57 per cent
Travelling on a poor road	[b]	[b]	126 per cent

Notes: [a] Could not be calculated separately.
[b] Not an additional factor.

6. Conclusions and recommendations

The studies reported here have demonstrated that the stated preference approach can be adapted for use in rural areas in developing countries. The value of time savings per rural traveller may not be large but the total time saving benefits for all users from modal shifts and faster travel may be substantial in relation to the relatively modest rural infrastructure investment costs. Qualitative investigations and household and trip purpose surveys are essential to gain an understanding of the local context, widen the concept of work-related activities and to adapt the design of SP questionnaires to elicit meaningful responses to questions on trade-offs between time saving and money.

The studies support the case for routine inclusion of travel time saving benefits as in the appraisal of rural infrastructure projects and services improvements in developing countries. However, detailed studies to estimate travel time saving values may not always be feasible because of resource constraints. Tables 4 and 5 indicate the ideal and alternative approaches to estimating work and non-work travel time savings respectively including the application of

relevant shadow wage rates and standard conversion factors to convert financial values to economic values for project appraisal[8].

The first column in Table 4 shows the so-called "ideal" approach under which time saving values for conventional work trips (i.e. for those who are in formal employment) would be valued on the same basis as in developed countries but with shadow wage rate adjustment if necessary. Less than 1 per cent of trips in Bangladesh and Ghana and 5.5 per cent of trips in Tanzania were working trips under the conventional definition. The proportions of work trips are 20.4 per cent (Bangladesh), 13.6 per cent (Ghana) and 18.5 per cent (Tanzania) when the definition of work trips is expanded to include those in the course of self-employment and for selling and buying goods for profit. For working trips during self-employment and for selling or purchasing goods for profit, use of the observed average wage rate which reflects the wage rates of the road users with the appropriate shadow wage rate adjustment is recommended.

There may be substantial variations in the wage rates of road users. However, project appraisal is a pragmatic exercise in which there is need to find a compromise between the need to reflect more detail and to keep the exercise manageable. The average observed wage rate is a reasonable compromise. However, there is need for further research on whether observed rates reflect the value of time of self employed travellers. A priori, the marginal productivity of the self employed may be higher or lower than the market wage rate which is different for different types of skilled and unskilled employment. Glick, Saha and Younger (2004) argued that those who choose to remain self-employed do not take up wage employment because their marginal productivity is higher than the market wage rate. For others, even if their marginal productivity is lower than the market wage rate, they may prefer

[8] See Squire and van der Tak and IT Transport (2005) for further details on theory and application and application respectively.

to secure adequate food supply for the household than to take temporary casual employment at the prevailing wage rate and for some, the work being offered at the prevailing wage rate may be too arduous or in the wrong location.

Table 4 Valuing working trip time savings: Ideal and alternative approaches

"Ideal" approach	Second best approach	Minimum approach
• **Conventional work trips**: Average observed formal employment wage rate (adjusted by employment overhead and shadow wage rate factors).	• **Conventional work trips**: 1.33 x adjusted average observed formal employment wage rate (adjusted by the shadow wage rate).	• **Conventional work trips**: Average wage rate of skilled labour (adjusted by the shadow wage rate). Applicable only if a very small proportion of trips are conventional work trips.
• **Other trips that have opportunity costs of lost time equal to marginal value of income:** Observed weighted average wage rate (adjusted by the shadow wage rate).	• **Other trips that have opportunity costs of lost time equal to marginal value of income:** Observed weighted average wage rate (adjusted by the shadow wage rate).	• **Other trips that have opportunity costs of lost time equal to marginal value of income:** Observed weighted average wage rate (adjusted by the shadow wage rate).

The "second best" approach in Table 4 is very similar to the "ideal" approach, the only difference being the use of 1.33 as a factor for employment overheads in the absence of relevant data. The "minimum" approach recommends the use of the average wage rate for skilled labour in the absence of data for all formal sector employees on the assumption that those travelling in the course of formal work will tend to be skilled persons.

The "ideal" approach for valuing non-working time savings (Table 5) is to base them on values derived from SP studies with disaggregation of users and modes. Following practice in developed countries, such studies should be carried out periodically to estimate and revise values and adjustment factors to be used in project appraisal. The Practical approaches 1 and 2 in Table 5 recommend factors for calculating values of time if they are not available from

local studies. The factors are broadly averages from the three studies. Practical approach 1 relates values of time to the rural wage rate while Practical approach 2 relates them to household consumption expenditure.

Table 5 Valuing non-working trip time savings: Ideal and alternative approaches

"Ideal" approach	Practical approach 1	Practical approach 2
• Empirically derived travel time saving values for non-working time using the SP approach disaggregated by social, gender and age groups, modes and journey conditions. Also separate values derived for walking and waiting times. Values need to be adjusted by standard conversion factor.	• **Adult's IVT value:** 0.55 x weighted average wage rate per hour (adjusted by standard conversion factor) • **Children's IVT value:** 0.79 x 0.55 x weighted average wage rate per hour (adjusted by standard conversion factor) • **Walking and waiting time value:** 1.45 x 0.55 x weighted average wage rate per hour (adjusted by standard conversion factor)	• **Adult's IVT value:** 0.37 x household consumption expenditure per head per hour (adjusted by standard conversion factor) • **Children's IVT value:** 0.79x0.37 x household consumption expenditure per head per hour (adjusted by standard conversion factor) • **Walking and waiting time value:** 1.45 x 0.37 x household consumption expenditure per head per hour (adjusted by standard conversion factor)

The latter is similar to the approach proposed in World Bank (2005) which relates time savings to household income. World Bank (2005) recommends that to estimate the in-vehicle time saving value for adults, the hourly household income per head should be multiplied by the factor 0.3. This is somewhat lower than the factor to relate time value to hourly household expenditure per head suggested here. The children's in-vehicle time factor of 0.15 is also significantly lower than the one recommended here based on empirical results. Trip purpose surveys in the three study areas show high proportions of trips undertaken either to meet households' basic needs or wider socio-economic needs (74.5 per cent in Bangladesh and 80

per cent in Ghana and Tanzania)[9]. Trips for basic needs include water and firewood collection for the home and others required for subsistence activities. Trips for wider socio-economic needs include trips to markets, banks, health centres and schools as well as work related trips. Given the high proportion of trips to meet household needs, the higher time values indicated by the studies seem to be justified. Further research is clearly needed in this area to refine inform policy and practice.

REFERENCES

Ahmed F and Vaidya K (2004) "Socio-economic investigations for rural value of time studies in developing countries: Combining qualitative and quantitative methods" *Proceedings for the 10th World Conference on Transport Research,* Istanbul, Turkey, July 4-8, 2004

Vaidya K, Ahmed F and Wattam M (2007) "Socio-economic investigations for rural value of time studies in developing countries: Combining qualitative and quantitative methods" *Paper for the 11th World Conference on Transport Research***,** Berkeley, June

Becker G (1965) "A theory of the allocation of time" *The Economic Journal,* 75: 493-517

DeSerpa A (1971) "A theory of the economics of time" *The Economic Journal,* 81: 828-846

Glick, P Saha, R and Younger, S (2004) *Integrating gender into benefit incidence and demand analysis: Report,* Cornell University Food and Nutrition Policy Program, May

Gwilliam K M (1997) *The value of time in economic evaluation of transport projects (Infrastructure Notes No. OT-5),* The World Bank, Washington DC

Hine J, Pangihutan H & Rudjito D (1998) *A Study of the Value of Time in Indonesia Using Stated Preference Data*, Road Research Development Project, IRE, Bandung

IT Transport (2002) *The value of time in Least Developed Countries (Knowledge and Research (KaR) 2000/01 DFID Research No. R7785): Final Report*, IT Transport Ltd, Ardington

IT Transport (2005) *The value of time in Least Developed Countries: The African studies (Knowledge and Research (KaR) 2003/04 DFID Research No. R8307, Final Report,* IT Transport Ltd, Ardington

[9] About 14, 22 and 40 per cent of trips in Bangladesh, Ghana and Tanzania respectively were multiple purpose. The lower proportion in Bangladesh is possibly explained by shorter distances and better access to transport in enabling more frequent short trips for single purposes.

Lema C I (2000) *Rural Transport Infrastructure Improvement in Tanzania: Communities Ability and Willingness to Pay, MA Dissertation (Unpublished),* Institute for Transport Studies, The University of Leeds, Leeds

Mackie P J, Jara-Diaz S and Fowkes A S (2001) "The value of time savings in evaluation", *Transportation Research Part E,* 37: 91-106

Ortuzar J de and Willumsen D (1996) *Modelling Transport (Second Edition)*, Wiley, Chichester

Squire L and van der Tak (1975) *Economic analysis of projects,* John Hopkins University Press, London

Wardman M (2004) "Public transport values of time" *Transport Policy.* 11: 363-377

World Bank (1999) *Ghana: Women's role in improved economic performance: Africa Region Findings No.145*, World Bank, Washington D. C. [also available at: http://www.worldbank.org/afr/findings/english/find145.htm]

World Bank (2005) *Notes on the economic evaluation of transport projects, Transport Note No TRN-15,* World Bank, Washington