UNRAVELLING TRAVEL COSTS: TOWARDS IMPROVED DATA COLLECTION AND TRANSPORT EXPENDITURE POLICY INDICATORS

Roger Behrens[1] and Christo Venter[2]

[1]Department of Civil Engineering ,University of Cape Town, Private Bag X3, Rondebosch, 7701. E-mail: rbehrens@ebe.uct.ac.za. Tel: (021) 650-4757 Fax: (021) 689-7471(corresponding author)
[2]Department of Civil and Biosystems Engineering, University of Pretoria, Pretoria, 0002 E-mail: christo.venter@up.ac.za. Tel: (012) 420-2184. Fax: (012) 362-5218

ABSTRACT

A previous paper by the authors examined theoretical and methodological issues around the measurement of transport expenditure patterns of households in South Africa, and the use of such data for benchmarking government policies affecting subsidies and user costs of transport. It was argued that such benchmarking is very important for monitoring policy impacts as well as identifying trends and changes in the contribution of transport to household livelihoods. Some previous experiences cast doubt on the accuracy with which household transport expenditures can be measured through current survey methodologies, due to difficulties survey respondents experience in estimating their expenditure on transport. This could apply to users of both private modes (which typically incur expenses of an episodic nature, such as irregular vehicle repairs), and public modes (which may consist of a combination of diverse fare instruments, including cash and monthly fares). The research explores these measurement issues through small, targeted survey tests of transport users in Pretoria and Cape Town, aimed at assessing the accuracy of recalled transport expenditure data, and identifying the influence of personal variables on data accuracy. Implications for methodological improvements that can be made to improve the accuracy of transport expenditure data collection in future household surveys are discussed.

1. INTRODUCTION

This paper continues a commentary on the adequacy of policy indicators of acceptable expenditure on transport initiated in a paper by the same authors at last year's Southern African Transport Conference (SATC) (see Venter and Behrens 2005). This commentary is motivated by a concern that current policy indicators are too crude and too ambiguous to yield meaningful information that has clear implications for policy and strategy formulation.

The earlier paper on this topic provided a general critique of the current policy indicator. The aim of this paper is, more specifically, to explore the accuracy of respondents' estimations of their household's transport expenditure, and to discuss the implications this has for the development of a better policy indicator.

The paper is divided into five sections. The next section summarises the key points of criticism put forward in the earlier paper. Section 3 describes the method of exploratory

research conducted to investigate the accuracy of respondent's transport expenditure estimations. Section 4 discusses the findings of the exploratory research conducted. The final section concludes with discussion on the implications findings have for the development of a more useful transport expenditure policy indicator and for improved methods of travel expenditure data collection.

2. SUMMARY OF PROBLEMS WITH CURRENT TRANSPORT EXPENDITURE POLICY INDICATORS

Within the context of current government policy emphasis on transport affordability and poverty relief, as well as a possible imminent reformulation of public transport subsidisation formulae, the SATC paper presented in 2005 argued that transport expenditure indicators are appropriate instruments for measuring the performance of the transport system over time, and can help give useful direction to decisions around subsidisation and the pricing of services (Venter and Behrens 2005). It was argued, however, that the particular way in which these indicators have been defined and applied in South Africa, and elsewehere in the world, has been misdirected and confusing. It is particularly the linking of the indicator to a benchmark of 10% of disposable income, specified by the White Paper on National Transport Policy (1996), that creates problems both conceptually and related to its accurate measurement. The paper argued that, in principle, problems of non-monotonicity prevent the accurate application of such a benchmark to situations spanning a range of modes and socio-economic conditions. In other words, it is not always clear whether a person's or household's welfare is better or worse if their expenditure on transport moves from below to above the 10% benchmark level, or *vice versa*.

Analysis of secondary data sources revealed evidence that 'affordability' means different things to different people, depending on, for instance, their income, residential location, and expectations. It was argued that applying a single benchmark across all households or all individuals within a household could be misleading, either masking important underlying trends, or leading to wrong-headed policy decisions. The implications of setting the 'affordable' fare level of subsidised modes either too low or too high due to an inadequate understanding of user needs could be significant.

The paper argued that there is a clear need for a more nuanced understanding of transport affordability from the user's point of view, perhaps based on both quantitative and qualitative explorations of how transport costs affect personal welfare and equity among individuals and households. It was argued that such work could help support the development of better-defined measures of affordability that could make a more relevant contribution to policy formulation.

3. SURVEY TEST METHOD

In order to explore the accuracy of respondents' estimation of their household's transport expenditure, a survey test was conducted between January and March of 2006 in Cape Town and Pretoria. A cross-section of cleaning, technical, administrative and academic/research staff at the Universities of Cape Town and Pretoria, and on the Pretoria campus of the CSIR, were surveyed, on the grounds that this spread of work portfolios would yield a diversity of educational and income conditions. A total of 52 workers were surveyed, spread equally across the two cities. It should be noted, therefore, that given such a small sample the exploratory survey conducted can make no claims of statistical representivity of larger target populations. The purpose of the survey was simply to test different types of respondents' abilities to recall transport expenditure accurately.

Respondents with higher education levels (i.e. administrative and academic/research staff) completed the survey questionnaire themselves, while respondents with lower educations levels (i.e. cleaning and technical staff) completed the questionnaire through personal interviews.

Figures 1 and 2 illustrate the household income and education characteristics, and age and gender characteristics, of the survey sample. Both figures demonstrate a reasonable diversity of respondents.
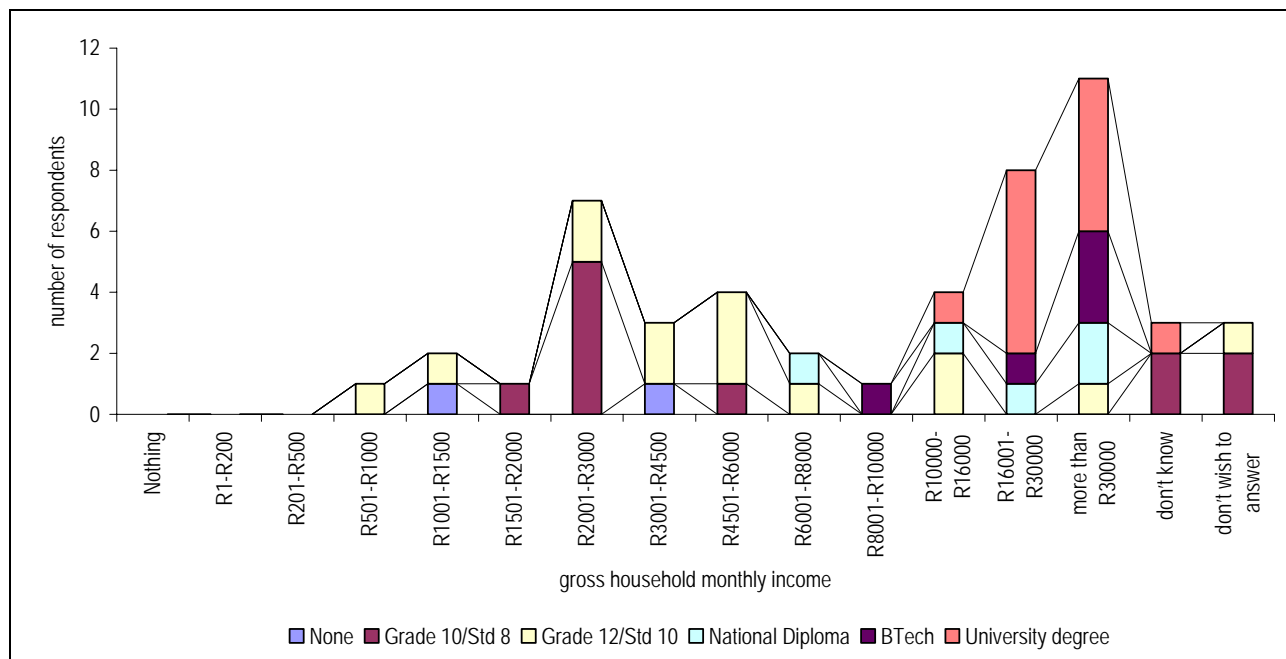

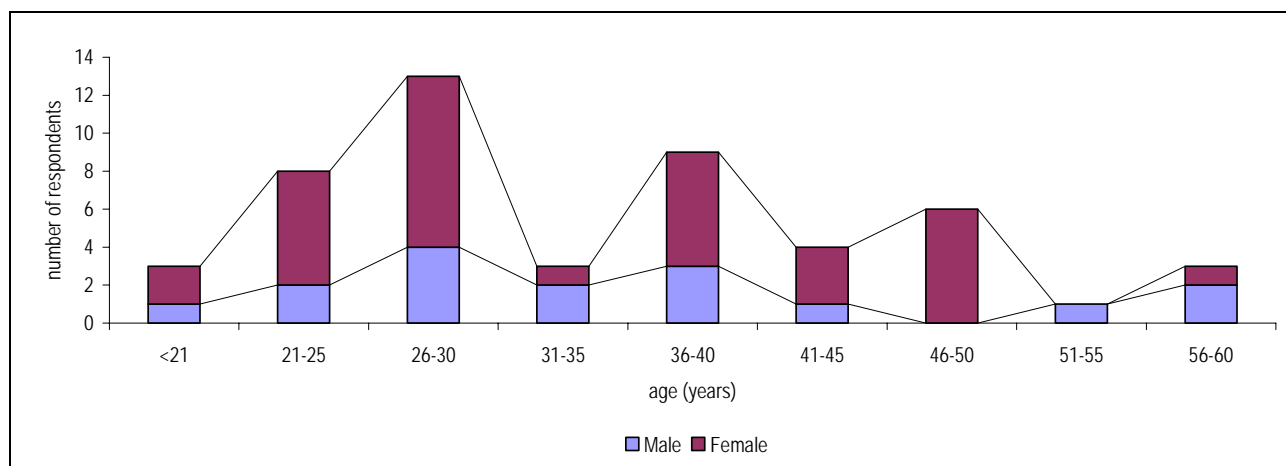**Figure 1. Household income and education characteristics of the survey sample (2006, n=52p).**

Figure 2. Age and gender characteristics of the survey sample (2006, n=52p).

The survey test instrument took the form of a questionnaire broken into four parts (see table 1). The first two parts of the questionnaire asked standard socio-demographic questions. The third part asked a standard travel expenditure question modelled on the National Household Travel Survey of 2003. The fourth part asked questions intended to force respondents to reflect upon the accuracy of the estimate of household travel expenditure provided in the third part. Respondents were instructed not to revise their initial estimate of their total monthly household travel expenditure after completing the rest of the questionnaire.

Table 1. Survey instrument questions.

PART 1:	**RESPONDENT INFORMATION**
1.1	In which neighbourhood and city do you live?
1.2	What is the highest level of education you have achieved?
1.3	What is your gender?
1.4	How old are you?
PART 2:	**HOUSEHOLD INFORMATION**
2.1	How many people are there in your household?
2.2	Does your household own a car or a bakkie that is regularly used?
PART 3:	**TYPICAL TRAVEL EXPENDITURE**
3.1	What is the total monthly household expenditure on travel (including train, bus, taxi and car) for all members of your household? Your answer should exclude holiday travel. (DO NOT REVISE THIS ANSWER AFTER COMPLETING PART 4)
PART 4:	**TRAVEL EXPENDITURE INFORMATION**
4.1	How many members of your household travel using the following ways of getting around at least once per month?: Train, Bus, Taxi, Car.
4.2	Thinking back to your answer to Question 3.1, are there any members of your household who spend money on travelling who you forgot to consider in making your estimate? If so, how many household members did you forget?
4.3	If any member (or members) of your household uses a <u>train</u> to travel, how much does he or she (or all of them) spend on the following?
4.4	If any member (or members) of your household uses a <u>bus</u> to travel, how much does he or she (or all of them) spend on the following?
4.5	If any member (or members) of your household uses a <u>taxi</u> to travel, how much does he or she (or all of them) spend on the following?
4.6	If any member (or members) of your household uses a <u>motor car</u> (or motor cars) to travel, how much does he or she (or all of them) spend on the following? Car loan/lease payment(s), Insurance, Licence fee(s), AA membership, Fuel, Oil, Battery, Tyres, Exhaust/shock absorbers, Servicing/repairs, Parking fees, Toll fees.
4.7	Thinking back to your answer to Question 3.1, are there any expenses that you forgot to consider in making your estimate? If so, what are these?
4.8	Thinking back to your answer to Question 3.1, are there any expenses that you included in your estimation that are not included in Questions 4.3 to 4.6? If so, what are these, and what is the level of expenditure?
4.9	Do you receive any financial assistance for your travel expenses from your employer? If so, for what do you receive assistance (for example train or bus ticket, petrol allowance, parking), and what is the value of this assistance?
4.10	Did you take into account the value of the financial assistance you receive from your employer (as indicated in Question 4.9) in the estimates of travel expenses you have made in this survey?
4.11	What is the total monthly income (before deductions) of all the members in your households, from all sources?
4.12	Do you agree or disagree with the following statements? • My household is paying more for transport than we can afford. • Compared to my household's other expenses, I consider our transport expenses to be affordable. • My household would travel more on a day-to-day basis if transport was cheaper. • I would be willing to pay more for travel if better transport was available.

4. DISCUSSION OF FINDINGS

4.1 General pattern of underestimation of expenditure costs

What then did the survey test reveal with respect to how accurately people estimate their household's transport expenditure? The most obvious way of addressing this question is to compare what respondents estimated their household's expenditure to be in response to the question in part 3, with their household's expenditure imputed from summing over the

individual expenditures reported in the fourth part of the questionnaire. Figure 3 illustrates this comparison, with imputed household expenditure including car purchase payments. For clarity of illustration, only data values less than R6,000 are presented in the figure. Respondents are broken into those who were, and those who were not, able to estimate all the expenditure items included in the fourth part of the questionnaire. (So, by definition, provided data are accurate the latter imputed expenditure amounts are less than actual amounts, and therefore under numerated.) The figure illustrates a consistent pattern of underestimation of transport expenditure across both groups.
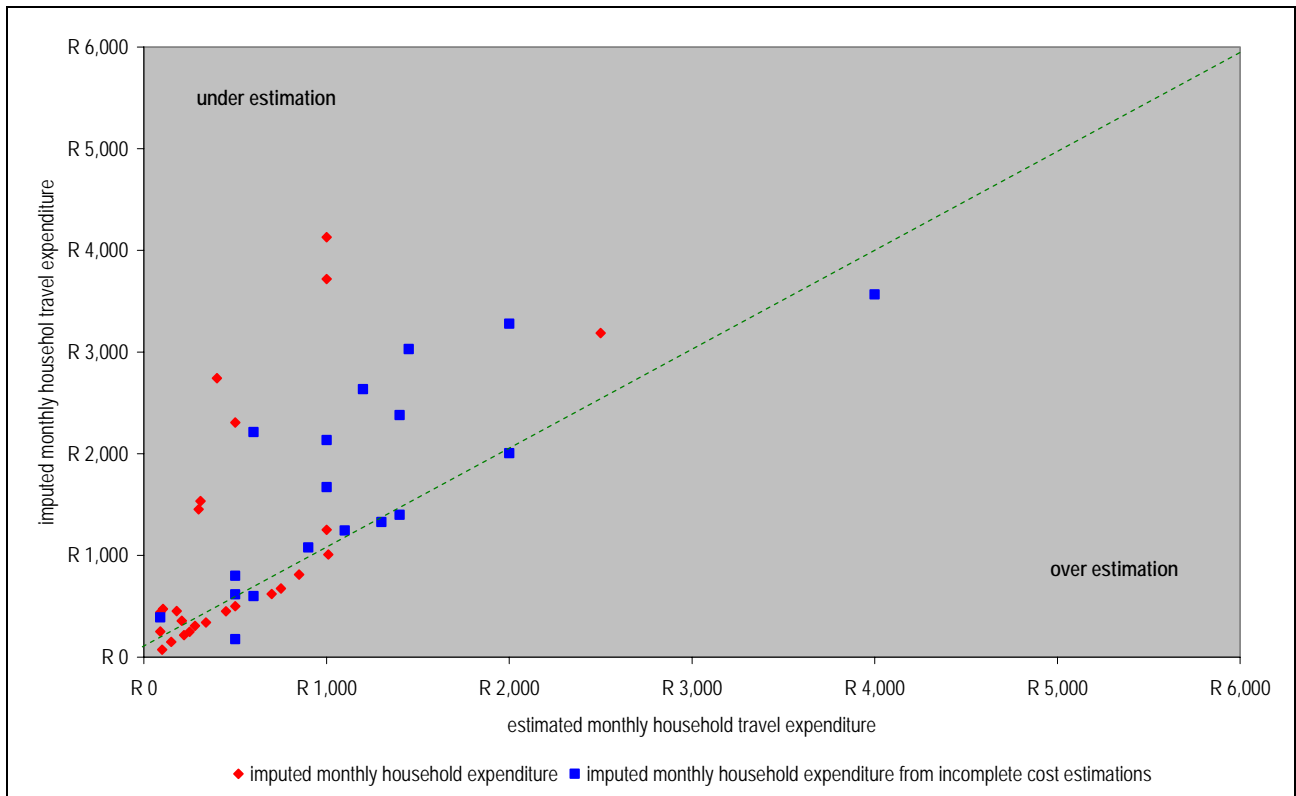

Figure 3. Comparison of estimated vs. imputed expenditure (including car purchase payments) (2006, n=52p).

Because some definitions of monthly transport expenditure exclude fixed monthly car purchase payments, in figure 4 these are excluded. This adjustment in definition does not alter the broad pattern of underestimation indicated in figure 3.

On average people in the sample tended to underestimate their travel expenditures by about R550 per month (excluding car payments), and by about twice this figure if car payments are included. This amounts to an underestimate of between 23% and 43% of expenditure (or 31% on average across all data, excluding car payments).
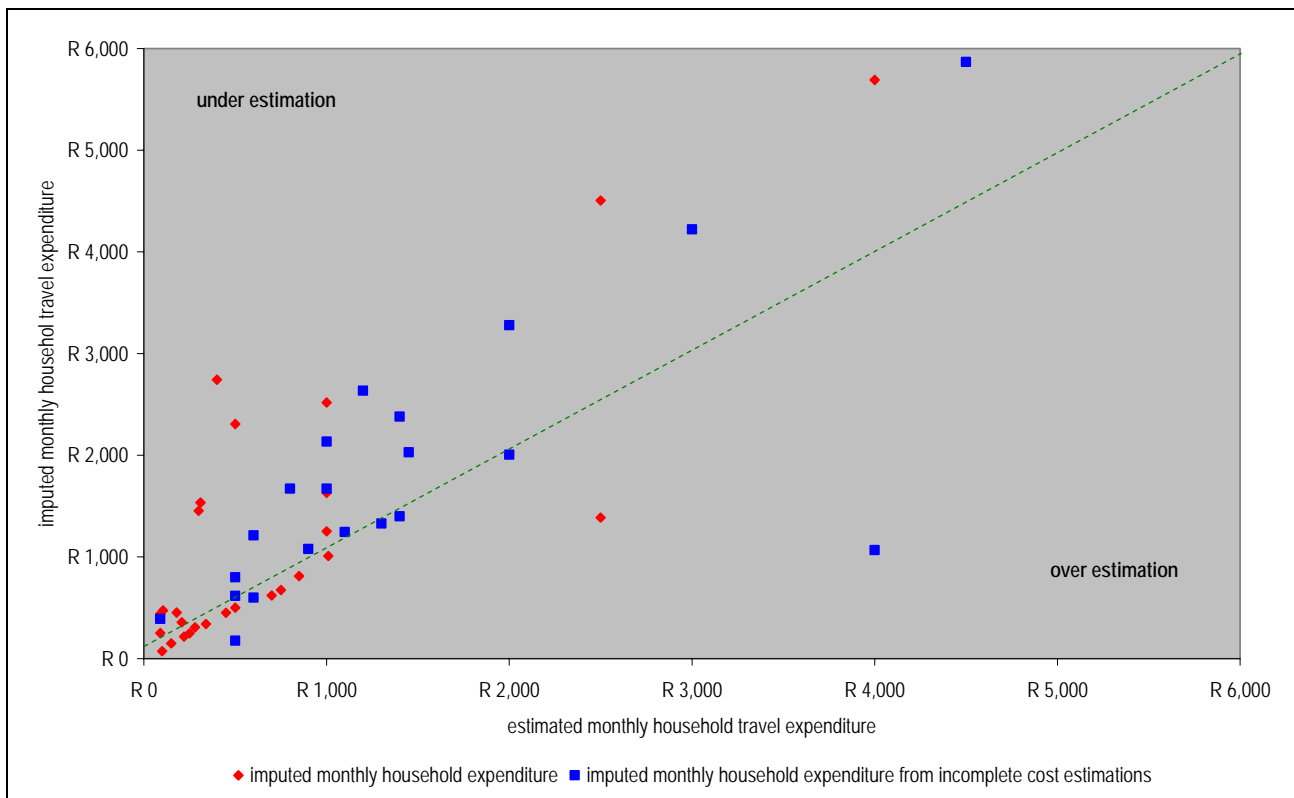
Figure 4. Comparison of estimated vs. imputed expenditure (excluding car purchase payments) (2006, n=52p).

4.2 Tendency to underestimate expenditures by subgroup

Figures 5 and 6 explore these data further by separating the sample into two groups on the basis of whether or not they own a car. The figures indicate that respondents in households without cars, and therefore more reliant on public and non-motorised transport, are more likely to produce more reliable estimates of monthly household travel expenditure than respondents from car-owning households.

Assuming a close correlation between car ownership, wealth and level of education, these data suggest the complexity of expenditure is more of a factor in determining data reliability than the respondent's level of education. This suggestion is borne out by a comparison of the average respondent error (difference between estimated and imputed expenditure) by education level (see table 2). The average error (excluding car payments) is almost three times higher for persons with a tertiary qualification than for those without. Significantly, the latter group is almost entirely car-using.
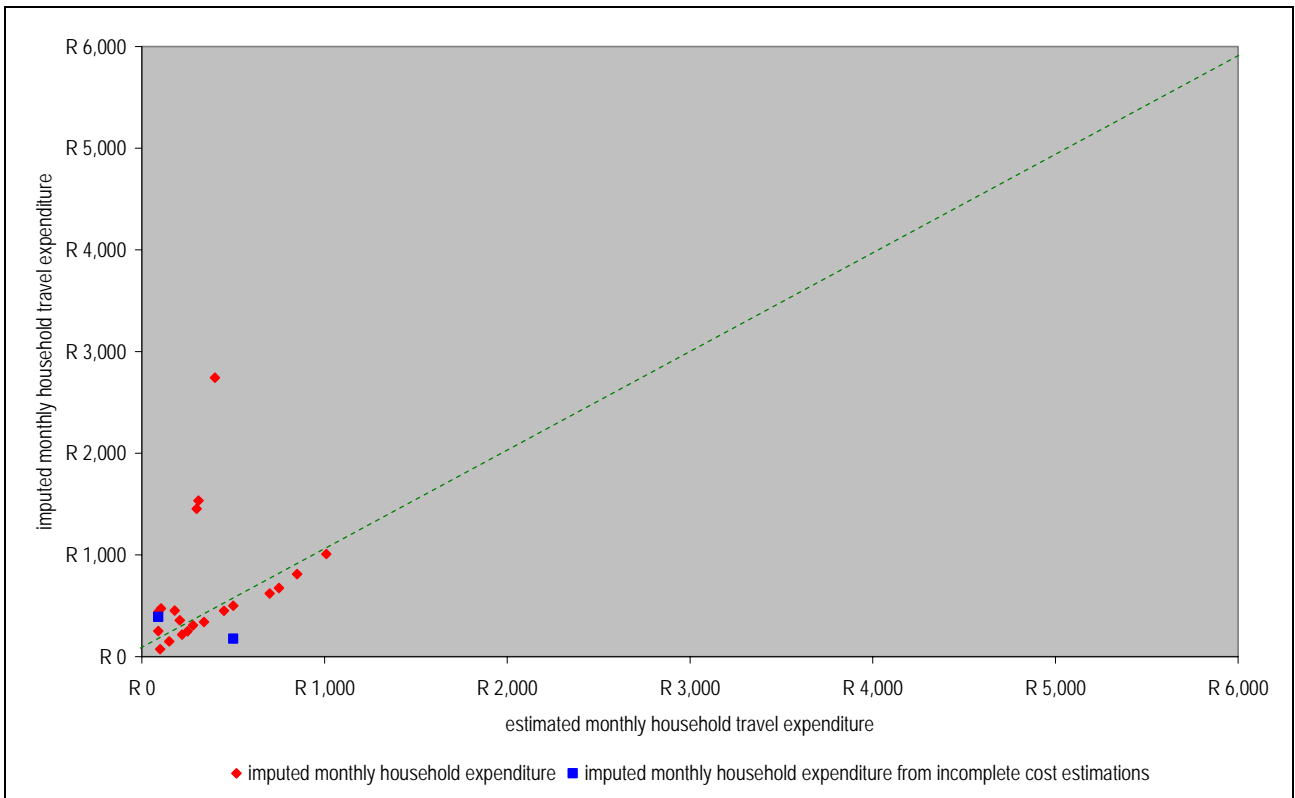
Figure 5. Comparison of estimated vs. imputed expenditure (including car purchase payments): no car-owning households (2006, n=52p).
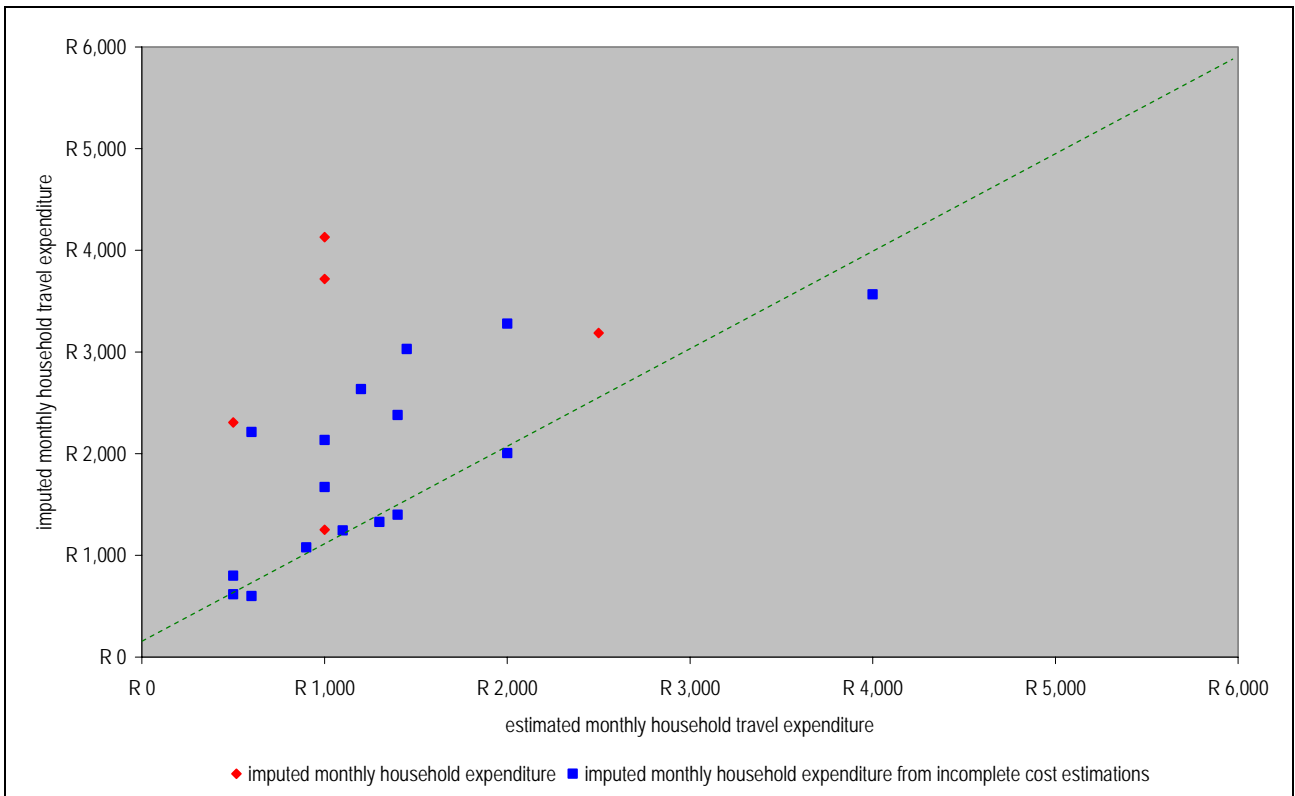

Figure 6. Comparison of estimated vs. imputed expenditure (including car purchase payments): car-owning households (2006, n=52p).

Table 2. Average respondent error by education level.

Education level of respondent	Average error (imputed minus estimated expenditure, excluding car payments)	Percentage of respondents using car (sample size)
Up to primary or secondary school	R349	35% (31)
Tertiary education	R900	94% (18)

4.3 Reasons for underreporting of car costs

If car users are consistently more prone to significantly underestimate their travel expenditures, why is this so? Figure 7 sheds light on this question by showing, for car-using households, the percentage of respondents who could not report (i.e. did not know) each item of car expenditure as prompted by the questionnaire (this excludes respondents who reported zero expenditure in a category), and the percentage of respondents who indicated that they forgot the specific item when making their initial estimate of total expenditure.
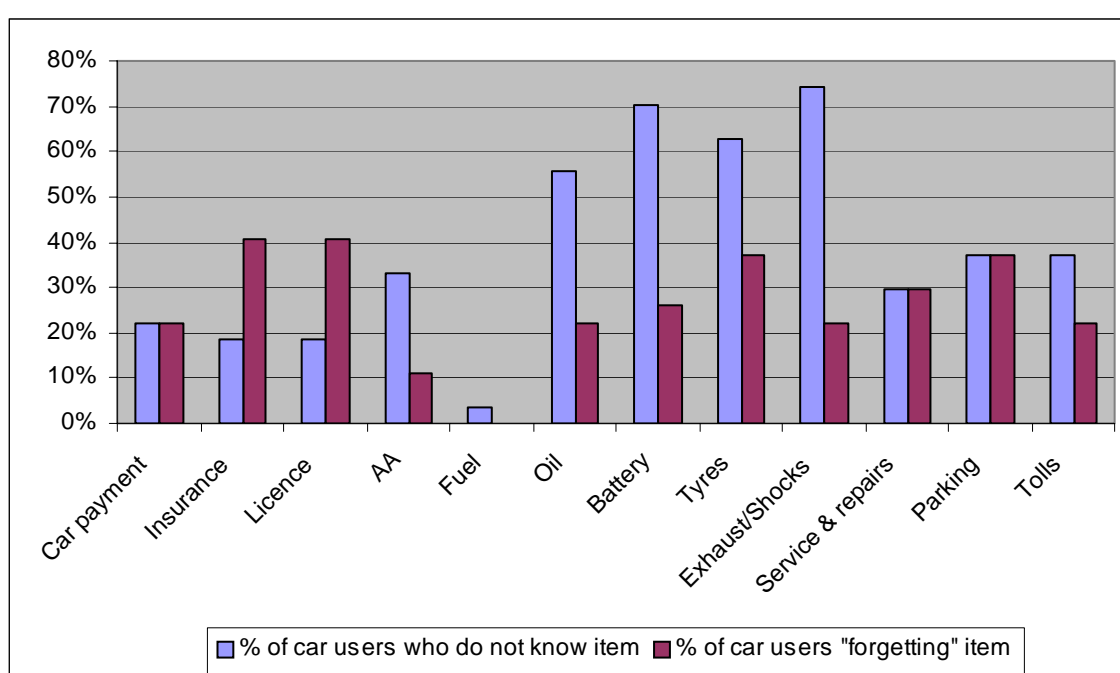

Figure 7. Percentage of car users who did not know or forgot car expenditure items (2006, n=27p).

Fuel is the only expenditure item that is generally known and considered by almost all respondents when estimating total expenditure levels. *Regular* monthly or annual expenditures such as car payments, insurance and licence fees are generally known by respondents, but tend frequently to be forgotten during the initial estimate. Since these can be significant costs their omission can lead to significant underestimation of expenses by car owners.

Irregular, episodic expenses like lubricants, tyres, batteries, and exhaust/shock absorbers were simply not known by more than half the sample of car owners. Perhaps more surprisingly, *regular* but *highly variable* operating costs such as services, parking, and tolls were either not known or not considered by up to 40% of respondents. This provides some support for the notion that many car users perceive neither the fixed costs of car use, nor some of the variable cost (notably parking costs) when making travel decisions – a habit that not only leads to the over consumption of car travel (Vuchic 2001) but clearly extends to the answering of expenditure questions in travel surveys.

4.4 Impact of underreporting on transport expenditure policy indicator

The measurement error with regard to transport expenditure ultimately affects the accuracy of any policy indicators that are calculated from it. To investigate the size of this inaccuracy the proportion of household income spent on transport – the typical benchmark indicator used in South Africa – was calculated for every household in the sample, using the estimated and imputed values of transport expenditures. The results are shown in table 3 for public transport and car using households.

Table 3. Inaccuracies in transport expenditure policy indicator.

Subgroup	Average % of income spent on transport (estimated transport expenditure)	Average % of income spent on transport (imputed transport expenditure)
Public transport using households	14.2%	23.3%
Car using households	10.0%	14.9%

Underreporting of a household's travel expenditure leads to underestimation of the proportion of income spent on transport. The magnitude of the error can be relatively large, as shown by the data in table 3. It is also different for public transport and car using households in the sample. For the latter group, using the (more accurate) imputed expenditure value produces an expenditure indicator five percentage points higher on average than when using the initial estimate of expenditure. For public transport users, this difference is nine percentage points. Even though the absolute error due to underreporting of public transport costs tends to be lower than for car costs, the impact on the policy indicator is more significant because of the smaller incomes it is compared to.

5. CONCLUSION: TOWARDS A MORE USEFUL TRANSPORT EXPENDITURE POLICY INDICATOR

What then are the implications of the survey test reported upon in this paper for the development of a more useful transport expenditure policy indicator, and for improved methods of travel expenditure data collection? With regard to a more useful policy indicator, and reflecting upon the conclusions drawn in the authors' paper at last year's conference (Venter and Behrens 2005), it is suggested that one way of avoiding non-monotonicity problems would be for the indicator to be restricted to households earning less than a specified income. This way wealthier households choosing to spend large portions of their disposable income on numerous or luxury cars would not inflate the percentage expenditure on travel expenditure for whole, unstratified populations. Understanding the expenditure choices of such wealthy households could be argued to be of relatively minor important in the prevailing policy environment which emphasizes poverty alleviation and affordability. It is important that household income be used as the population filter, rather than car ownership, as, of greater policy importance, some lower middle-income households might be forced to use cars due to inadequate public transport services and thus spend more than they would otherwise wish.

Further to this, the survey test findings indicate that even though car users are more prone to significantly underestimate their travel expenditures, restricting the indicator to just public transport users will not necessarily yield a more reliable indicator. Because incomes are smaller and the policy indicator is expressed as a percentage of income spent on transport, even small estimation inaccuracies (relative to higher income car-using households) can yield significant error. Given that the expenditure benchmark is more frequently aimed at assessing the affordability or subsidy requirements of public transport, its sensitivity to measurement error is a cause for concern, so it is to how data collection and measurement can be improved that we now turn.

The survey test shows that a single question on travel expenditure (as was the case in the National Household Travel Survey of 2003) is likely to yield unreliable data. To improve data reliability, a number of expenditure-linked questions are necessary to ensure that respondents consider all expenditure items. Good practice guidelines suggest that respondents should not be asked to recall information from long ago without providing specific retrieval clues (see, for instance Zmud 2003). The survey test undertaken supports this by demonstrating (with the caveat of a small unrepresentative sample) that recall accuracy improved, or at least the recalled amount of travel expenditure increased, when respondents were prompted to recall specific cost items or trips by household members on specific public transport modes.

6. REFERENCES

[1] DoT, 2005: National Household Travel Survey 2003: Technical report, Department of Transport, Pretoria.

[2] Venter C and Behrens R, 2005: Transport expenditure: Is the 10% policy benchmark appropriate?, 24th South African Transport Conference: Transport Challenges for 2010, Pretoria.

[3] Vuchic V, 2001: Transportation for Livable Cities, Center for Urban Policy Research, New Brunswick.

[4] Zmud J, 2003: Designing Instruments to Improve Response, in Transport Survey Quality and Innovation, Stopher P and Jones P (editors), Pergamon, Oxford, UK: 89-108