# Temporal shift in willingness-to-pay for rural feeder service to bus stop

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## ARTICLE INFO

## ABSTRACT

This paper reports an investigation on the temporal stability of Willingness to Pay (WTP) values with reference to rural feeder service in India. A stated choice experiment was designed and the data were analysed by developing econometric models. The WTP values calculated from the econometric models developed in the current work are compared with the WTP values reported in a previous study for the same geographical catchments to investigate the temporal change in WTP over the period 2005–2014. The feeder service was introduced in the catchments during this period. The WTP values reported in the previous study were also projected using inflation rate to have an estimate of WTP value under current scenario. Subsequently, a comparison is made considering three sets of WTP values: (i) reported in the previous study, (ii) calculated from the current choice experiment, and (iii) estimated using inflation rate. The findings indicate that the change in WTP is not only related to the inflation but also changes in the decision-making environment, like the experience of using the feeder service non-existent earlier. The study clearly justifies the need for re-estimating WTP values by carrying out independent choice experiments rather than projecting values using inflation rate, especially when there are other potential factors (as in this case the experience of using the feeder service) influencing the decision making process.

## 1. Introduction

In India, nearly 69% of the country's population is located in rural areas (Census of India, 2011), and the rural population predominantly consists of low income households with negligible car ownership. As a result, the rural population is predominantly dependent on the public transportation system. Traditionally, the lack of road infrastructure has been a key concern in rural India affecting the economic growth, agricultural productivity, employment, education, and health services. Realizing the importance of the rural roads, in the year 2002, the Government of India initiated a rural road development program called as 'Pradhan Mantri Gram Sadak Yojana' (PMGSY). PMGSY has played a significant role in improving the rural road infrastructure. PMGSY roads also facilitated the operation of feeder services connecting villages to the nearest bus stops. For a rational planning of feeder services, it was necessary to estimate the Willingness to Pay (WTP) of rural commuters for the different attributes of feeder service. Accordingly, a Stated Preference (SP) study was conducted to estimate the WTP values in 2005 (Das et al., 2009) for hypothetical feeder service as they were not operational. Presently, the feeder service is operational on several PMGSY roads in rural India. However, these services are largely operated by unorganized sectors in a haphazard manner necessitating improvement of the service. It is important to know the present WTP values for the evaluation of alternatives improvement proposals. Practitioners have often used inflation rate to project WTP values from one time frame to another (Johnston et al., 2015). However, any changes in the decision-making environment influences an individual characteristic and decision-making process so also the WTP value (Polyzou et al. 2011). In the present contest, experience of using the feeder service (not available during earlier study) a potential change, influencing decision-making and WTP values other than the inflation is investigated. No investigation has been reported in the literature on the change in WTP due to the combined effect of inflation and experience of actually using the service, especially in the context of transportation services in rural areas. Therefore, in the current work, the WTP values are calculated again by carrying out a fresh behavioural study and a comparison is made to investigate the effect of inflation and/or the experience of using the present service over time on the change in WTP.

Hereafter the paper is organized in six sections. Section 2 includes a brief outline of the study area. The methodology followed for carrying out the work is discussed in Section 3. While Section 4 includes development of database, the analysis of data including the development

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**Table 1**
Descriptive statistics of the study routes.

| Name of the route | Benapur-Dhaneswarpur | Shrirampur-Mahatapnagar | Phulpahari-Benasuli |
| --- | --- | --- | --- |
| No of villages serving | 54 | 18 | 17 |
| Total population | 17,258 | 26,435 | 8408 |
| Length of feeder route (km) | 24 | 13.5 | 9.1 |
| Type of feeder vehicle operating | Trekker | Tempo | Tempo |

of econometric models is discussed in Section 5. The results and discussions are included in Section 6, and finally, key findings and future work are outlined in Section 7.

## 2. Study area

The geographical catchments of three operational feeder routes which are located in West Midnapur district of West Bengal, India are considered in the present work. Presently, commuters access the bus stops using feeder service, walking, bicycle and motorized two-wheeler. Bicycle is generally available to nearly all households, and the availability of motorized two-wheeler is limited. The descriptive statistics of the study routes are given in Table 1. Trekker and Tempo are two small types of vehicle with seat capacity of 6 and 10 respectively, and these are used widely as feeder vehicles in India. The routes are part of the blocks of district West Medinapur which were previously considered as the study area by Das et al. (2009). It may be mentioned that the catchments considered in present and previous studies are located in the same geographical area i.e. West Midnapore District in West Bengal near to IIT Kharagpur.

## 3. Methodology

The methodology followed to re-estimate the WTP values are discussed in this section. The section includes brief discussions on type of data, design of survey instrument, and theoretical background of econometric modelling.

### 3.1. Type of data

The RP and/or SP data collected from commuters have been used in diverse fields for calculation of WTP values (Louviere, 1988a; Jose Holguin-Veras 2002; Hensher 1994). In general RP data are used for demand modelling. On the contrary, SP data are considered to be effective for the valuation of attributes (Louviere, 1988a). Although it is not advisable to use stand-alone SP models for predictions, it can be very effective for WTP calculation (Hensher and Sullivan 2003). As the focus of the present study is to estimate WTP values, SP data is preferred over RP data.

SP data may be collected in the form of rating, ranking, and choice. Among these elicitation techniques, Stated Choice (SC) experiments provide a framework for studying the relative marginal disutility of variations in attributes, and their correlations (Louviere et al. 2000). SC methods are well established and suitable for understanding and predicting consumer trade-offs and choices in marketing research. They have been used extensively to model the behaviour of individuals (Hensher 2001a; Hensher and Sullivan, 2003). Therefore, in the present work, SC method is adopted to elicit preferences by generating hypothetical profile of feeder service using various attributes and their levels.

### 3.2. Design of the survey instrument

A stated choice instrument was designed to collect behavioural data with suitable attributes and their levels describing alternative feeder services to bus stop. Well-designed SC experiments require extensive pre-testing to identify attributes, levels, and important interactions (Louviere, 1988b). The choice instruments in this study were subjected to considerable scrutiny before collection of data.

### 3.2.1. Attributes and levels

A proper specification of the attributes and their levels has greater implications for the design and implementation of stated choice experiment (SCE) for producing proper SCE results. In the present work, feeder service attributes for SC survey were chosen based on literature, expert's judgments and reconnaissance survey. The selected attributes include (1) Span of operation, (2) Walking distance, (3) Waiting time, (4) In-vehicle travel time, (5) Travel comfort, and (6) Fare.

The span of operation is an important consideration, and it was observed from the field that feeder service is generally operated from 6 am to 6 pm. The travel time was also considered in the present study as a substantial variation of travel time was observed among different modes while travelling from villages to bus stop. In rural areas, small vehicles with a seat capacity of 6–10 are generally used for feeder service. Although, travelling as standee is not feasible in such vehicles, they are often congested (say, 4 persons occupying a place which is officially for 3 persons as per seat capacity specified by the manufacturer), and passengers are also found travelling on footboard. Footboard travel is unsafe as passengers stand on the steps and the body remains exposed outside the vehicle. In order to make a realistic representation of the present feeder service, the attributes considered by Das et al. (2009) were marginally modified to include "Span of Operation" and "In-vehicle travel time". Also, footboard travel was added as another level for describing the attribute "Travel comfort". The attributes and their levels considered in the present study are summarized in Table 2. The fare levels are considered separately for short tip (up to 10 km) and long trip (beyond 10 km) based on the present fare levels.

### 3.2.2. Design of choice set

While conducting design of experiments with attribute levels, researchers have used several design techniques such as full factorial design, fractional factorial design, D-optimal design, etc. Among the available 'design of experiment (DOE)' techniques, a full factorial design produces a large number of choice scenarios which is not practical to manage in the context of the present study with six attributes and three to four levels of the attributes. Whereas, a fractional factorial design considerably reduces the size of the design by considering the main effects and higher order interaction effects (Hensher et al., 2005). On the contrary, the efficient designs do not merely try to minimize the correlation in the data for estimation purposes but aim to result in data

**Table 2**
Attributes and their levels.

| Attributes | Levels |
| --- | --- |
| Span of operation | 16 h: Feeder Service is available from 5AM to 9PM<br>14 h: Feeder Service is available from 6AM to 8PM<br>12 h: Feeder Service is available from 6AM to 6PM<br>10 h: Feeder Service is available from 6AM to 12PM again 2PM to 6PM |
| Walking distance | 0–0.5 km, 0.5–1 km, 1–1.5 km, 1.5–2 km |
| Waiting time | 0–15 min, 15–30 min, 30–45 min, 45–60 min |
| In-vehicle travel time per km | 1.5 min, 2 min, 2.5 min, 3 min |
| Travel discomfort | Comfortable seating, Congested seating, Footboard travel |
| Fare per km | Rs.1.0, Rs.1.50, Rs.2.0, Rs.2.50.(For Long Distance), Rs.2.0, Rs.2.50, Rs.3.0, Rs 3.5 (For Short Distance) |