

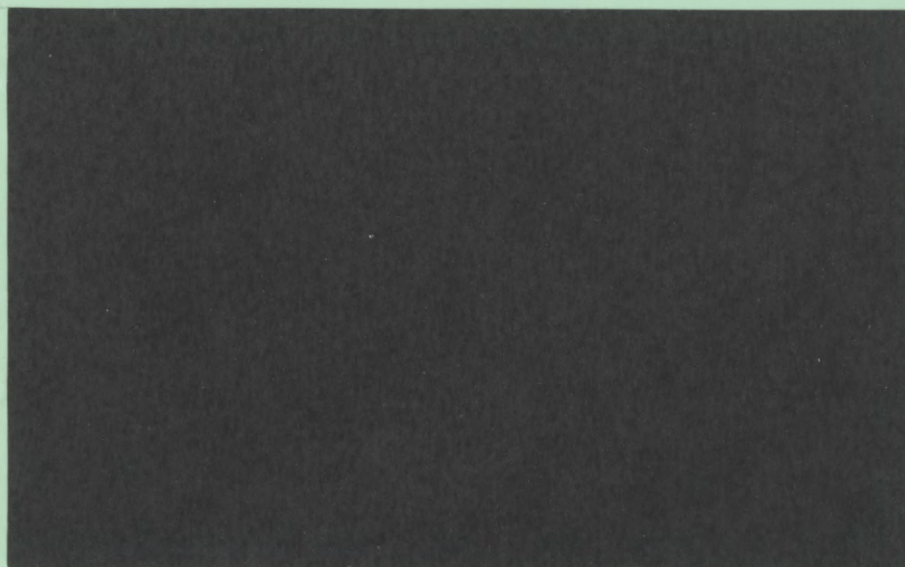
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WP89

WORLD EMPLOYMENT PROGRAMME RESEARCH

Working Papers

FOUNDATION OF
AGRICULTURAL ECONOMICS
WITHDRAWN
MAR 15 1982



International Labour Office, Geneva

WEP 2-23/WP. 109

WEP 2-22/WP. 89

WORLD EMPLOYMENT PROGRAMME RESEARCH

Working Paper

TECHNOLOGY AND EMPLOYMENT PROGRAMME
INCOME DISTRIBUTION AND EMPLOYMENT PROGRAMME

PASSENGER TRANSPORT IN KARACHI:
A NESTED LOGIT MODEL

by

Mateen Thobani

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December 1981

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ISBN 92-2-102989-1

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PREFACE

This working paper is the ninth study completed in the context of a research project on technology, products and income distribution. This is a research project being carried out jointly by the Technology and Employment Programme and the Income Distribution and Employment Programme of the ILO's World Employment Programme. Some 8 to 10 country case studies, prepared under this project, are planned to be published in a single volume towards the end of 1982.

The central objective of the project is to determine the extent to which an improvement in income distribution (including, inter alia, the alleviation of poverty in the rural areas of developing countries) is likely to be consistent with the consumption of goods and services produced using labour-intensive technologies, thereby generating employment. Such consistency between the consumption and production sides of the economy has been a crucial assumption in the formulation of employment-oriented development strategies, although it has not yet been rigorously tested. After the completion of all the case studies, it is anticipated that it may be possible to formulate recommendations regarding policy in respect of the improvement and expansion of marketing channels for appropriate products (i.e. products that satisfy basic needs) and how consumers can be induced to buy these products which, given their income, satisfy their basic needs most efficiently.

This paper is the result of the author's graduate work at Yale University. It provides an analysis which demonstrates that the addition of buses would be cost effective. Further, the model simulates the impact of the increased bus service on the demand for other modes of transport - a useful result for planners. The household survey conducted for this study shows that a smaller percentage of the poorest income group has a bus available to it as compared to the middle income groups. This suggests that there is a frustrated demand for buses. Simulations of the model support this result by showing that about 18% more trips by bus would have been undertaken had the bus been available to everyone in the sample.

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ACKNOWLEDGEMENTS

The study was begun while I was a Visiting Economist at the Applied Economics Research Centre, Karachi University. Having been brought up in Karachi, I tended to look upon Karachi's problems through jaded eyes. Credit for bringing the problem to my attention goes to James Knowles, who, as Visiting Professor to the Centre, was only too aware of the inadequate transport system in Karachi. He impressed upon me the need for developing an economic framework within which to analyse the problem and the importance of a household survey towards this end. I would also like to thank him for his guidance in designing the study and implementing the survey.

I am grateful to the Applied Economics Research Centre, particularly to Hafiz Pasha, for use of the Centre's facilities and for reducing the demands on my time so that I could devote my efforts towards the study. I would like to thank all my colleagues, research assistants and the support staff of the Centre for their helpful advice and for bearing with my demands. I suspect that for many of them the transport problems were very close to heart. At the risk of omitting the names of others who put in much work on the study, I would like to give special thanks to three research assistants: Sabihuddin Butt, Shaista Usmani and Arif Zaman, all of whom went beyond their call of duty.

Foremost among the individuals and agencies who helped in the data gathering effort is Mohiyudin Siddiqui of the Master Plan Office. In addition to all current material he made available to me all past material that had not mysteriously disappeared or had been eaten by white ants. Other institutions to whom I am grateful for their help and use of data are the Sind Regional Planning Office, the Karachi Urban Transport Corporation, the Karachi Bus Owners' Association and Pakistan National Motors.

At Yale, I would like to thank Herbert Scarf who, while not playing an active role in this study, steered me in the right direction and gave me encouragement when it was most needed. John Quigley served as my mentor and guide in a field that was new to me - urban economics. I am extremely grateful to him for the help that he managed to give despite his many commitments.

I would furthermore like to thank T.N. Srinivasan who, during the last stages of the study served as my main source of advice and feed-back and made himself very accessible to me. Richard Levin, who was kind enough to read the manuscript at short notice, made several insightful comments and suggestions. Others from whom I have benefitted from conversations are Kim Peck, Randy Olsen and John Beggs on the Yale faculty. Amongst my peers I have had useful discussions with Paul Pfleiderer and Mark Grinblatt.

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CHAPTER 1

THE PROBLEM

A. Introduction

From a fishing town of less than a half million inhabitants in 1947, Karachi has grown to a thriving metropolis of six million. The six percent average annual growth rate of population during the last two decades has resulted in increasing problems in city services, particularly passenger transport. This paper identifies some of the major problems besetting Karachi's transportation system and, based on an analysis of household data, suggests some remedies to ease the situation.

Most people in Karachi will be quick to point out that Karachi has an acute transportation problem. The major problem is one of a shortage of public transportation as demonstrated by overcrowded buses and throngs of people seen every morning waiting for some means of transportation. Other problems include the total unavailability of public transport (especially buses) in some areas, the dangers involved in using public transport, the lack of clear sidewalks, and the congestion along certain roads during peak hours. A detailed description of the Karachi transport sector follows in the next section.

The main objective of this study is to make suggestions on how to improve the transport situation in Karachi. While there is no dearth of such suggestions from Karachi resi-

dents, it is necessary to provide a framework within which the consequences of the recommendations may be evaluated. Do the benefits to residents from the suggested changes outweigh the costs? What is the effect of the policy change on the demand for each mode? In order to answer these questions, the paper estimates a joint choice probabilistic model of mode ownership and mode to work.

The advantages to such a model will become clear later. One of the advantages that is worth pointing out at this stage is that the model may be estimated using a relatively small sample.

A 400 household survey was conducted for the purpose of this study. In addition to questions on income and expenditure, there were detailed questions regarding the travel behavior of each member of the household. The sample was stratified by categories of income and distance to the center of city.

Concern in Karachi's transport system is not new. Several studies¹ have made recommendations to reduce the problems, the most notable being those by the Master Plan Office (MPO) of the Karachi Development Authority. Evolved out of a United Nations Development Program grant to the city, the MPO has published many reports on Karachi's transport system. Most of these studies were done jointly with experts

¹ See, for example, Esesjay (1975).

from the United Nations and two international consulting firms, PADCO and TERPLAN. Many of the recommendations made in this paper are similar to their proposals. This study strengthens some of the conclusions reached by other studies. However, it goes one step further in that it measures the effects of carrying out the proposals on the pattern of demand for various modes, and conducts a cost benefit analysis of one of the major recommendations.

Outside the developed countries, few studies have attempted to measure such parameters as the value of time or demand elasticities of various modes which are useful in evaluating policy changes. To my knowledge, none of the studies used probabilistic models which are best suited to infer the value of time. This is the first study of its kind to allow one to compare travel demand behavior in a developing country with those in developed countries. It also makes a contribution to the small but growing literature on multimodal probabilistic models and the yet smaller field of joint choice probabilistic models.

B. The Transport Sector in Karachi

Buses, with their regulated fares of 25 paisa to Rs. 1.00 (100 paisa = Rs. 1.00 = 10c US), are by far the most important mode of transportation for the majority of the residents. Yet this is precisely the mode of transport where the supply has lagged behind its demand over the years.

Table 1 shows the growth of various motorized vehicles in Karachi. The data on buses, in addition to private and public city buses, includes buses belonging to various organizations and businesses, inter-city buses, and contract carriers. The latter are private buses typically hired by a community where commuters pay a fixed sum of money per month and are guaranteed a seat. In 1979, of the total of 7530 buses, only 1760 were available for public transportation within the city (Table 2). While the total number of registered buses has been growing fairly rapidly, the number of city buses available for public transit has shown little growth. Bus capacity has been increasing somewhat with the introduction of the newer Fiat buses. However, the Bedford buses are still by far the most popular.

TABLE 1

REGISTERED MOTOR VEHICLES BY TYPE

Year	Cars	Motor Cycles	Taxis	Motor Rickshaws	Buses	Trucks	Others	Total
1971	27432	15609	3366	6458	1296	3714	1157	59032
1972	32109	21634	3772	6458	1174	4022	2110	71279
1973	34339	25913	3956	6561	1215	4400	2034	78418
1974	38495	31214	4331	6855	1595	5158	3292	90940
1975*	33143	31766	3334	6404	1472	3955	3293	83367
1976	37200	41140	2836	6532	2853	4304	5103	99968
1977	61321	61139	5481	6266	4133	5431	4569	148340
1978	73668	82037	6154	6466	4853	6245	8109	187532
1979**	133134	116030	11858	13860	7530	13784	16832	313028

Source: Motor Vehicles Registry Data

* the decline is due to the discontinuance of registering very old cars.

** the increase is partly due to stricter enforcement of registration.

About two-thirds of the city buses are privately owned (Table 2). In absolute terms, the number of private city buses decreased from 1200 in 1955 to 800 (of which 700 were on the road) in 1971. By 1979, of the 1163 privately registered city buses, about 800 were on the road. The decline in private buses since 1955 despite rapid population growth is primarily caused by the fare structure which has been kept very low due to political reasons. At a fare of US one cent for a three mile bus trip in December 1974, a World Bank study found Karachi fares to be the lowest in the world. In 1956, bus fares were reduced from an average of four paisa per passenger mile to two and a half paisa per passenger mile. In June 1979, fares averaged about five paisa per passenger mile. Presently they stand at about eight paisa per passenger mile².

In the public sector, only 350 of the 600 buses owned by the public sector were on the road in September 1979. Others were unoperational for lack of spare parts or other repairs. While a marked improvement from the early 70s when less than 200 of a total fleet of 800 public sector buses were typically on the road, it is not surprising to find the private sector better able to maintain its buses despite low fares. Of the 350 public buses on the road in 1979, 100 were used exclusively by students at a fare of 25 paisa regardless of distance.

² Per capita income in Pakistan is \$ 245 per year.

TABLE 2
COMPOSITION OF REGISTERED VEHICLES
(1979)

PUBLIC TRANSPORT	
1) Buses	1760
a) private	1163
b) public	597
2) Minibuses	2908
3) Taxis	11858
4) Motor Rickshaws	13860
Sub-total	30386
PRIVATE TRANSPORT	
1) Cars and jeeps	133134
2) Motor cycles	116030
Sub-total	249164
CARGO AND OTHERS	
1) Trucks	13784
2) Vans and Pickups	13924
3) Other buses	5770
Sub-total	33478
TOTAL MOTORIZED VEHICLES	313028
ANIMAL DRIVEN VEHICLES	
1) Donkey carts	1530
2) Tongas	180
3) Victoria	142
4) Camel carts	100
TOTAL	1952

Source: MPO (1979).

Bus frequencies are generally good. Most routes have a headway of less than half an hour. Based on household interviews conducted for this study in the summer of 1979, the average waiting time for a trip to work by bus was 8.5 minutes for areas within three miles of the center of city, 10.4 minutes for areas between three and five miles, and 13.7 minutes for areas further than five miles. However, these may underestimate the waiting time since some poten-