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**TRANSPORTATION MODELS
OF TIME ALLOCATION**

A Contribution to Objective Consumption Theory

A thesis in partial fulfilment of the
requirements for the degree of Doctor
of Philosophy in Economics at Massey
University.

**IAN THOMAS MAHON
1990**

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To my Parents
of happy memory

ABSTRACT

This thesis investigates the optimal allocation of time by a rational agent in terms of his behaviour settings and social requirements. Time is considered as a scarce resource and as an objective measure of activities. Conceptually the models of time allocation are transportation models and share the same mathematical structure.

The findings of eco-behavioural science suggest that the behaviour of an agent, as an individual decision maker, will be shaped by environments. Behaviour settings, corresponding to sources in the transportation models, are used to define environments. As a member of society the agent is required to meet parameters of social position, a set of requirements corresponding to sinks in the transportation models. Time use studies provide quantitative measures of the agent's activities. Hence the model is able to specify constraints on the agent's time use in terms of behaviour settings and social relations.

The core model shows the relationship between groups, or classes, of agents and their lifestyles. The agent as rational decision maker is faced with the choice of meeting the demands of social position by activities in selected environments, while minimizing the total cost of the lifestyle. Each activity uses up time and incurs a money cost. The optimal solutions specify both the type and level of the activities which the agent undertakes in order to meet the parameters of social position. An equivalent program (the dual) exists. The agent is faced with the choice of maximising the net imputed value of time

use, so long as the net value of a unit of time is less than or equal to the per unit cost.

Conceptually there are two transportation models. Both are concerned with the particular case of a student as a rational decision maker. In the slack model the focus is on the activities of a particular student. By way of contrast the focus in the tight model is on the activities of the average student, and there is a time distribution not only at sources but also at sinks. This model is useful to social accounts. Three equivalent formulations of the transportation model are outlined.

A technology matrix, defined as the agent's socio-economic production function, denotes the set of production processes available to the agent, given behaviour settings (environments) and parameters of social position. An element of the socio-economic production function is termed an activity. The choice of certain activities by the agent represents a particular lifestyle described by a specific time distribution. Social income, defined as the value of social position plus net earned income is a scalar measure (in dollars) of the agent's lifestyle.

To show that the models are operational, simple 2×2 and 3×3 models are introduced and extended in the final three chapters. A methodology is developed for obtaining per unit costs. A step-by-step approach is used to derive a 5×5 cost matrix from two sets of actual data, obtained independently. The effects of changes in the parameters of the time allocation models are analyzed.

PREFACE

Economic investigations of time allocation can be regarded as a venture into relatively unexplored territory. When Soule (1955) stated that time was the scarcest resource, and proposed that time should be regarded as coordinate with land, labour and capital, he was breaking fresh ground.

While the transportation models of time allocation developed in this thesis represent a completely different approach from that of Soule, his questions raise some fundamental issues. From a wider perspective, so too do the questions suggested by Braudel in his masterly survey of the rise of capitalism. He pointed to the social dimension in economics and revealed the impact of capitalism on patterns of human activity.

The first part of the thesis introduces the research program and outlines the social and historical factors that shaped the environment in which workers carried out their activities. The section concludes with an outline of two significant, but different, models of time allocation. Each extends the boundaries of economics.

The transportation models of time allocation are developed in the second part of the thesis. The models owe much to the insights of the pathfinders, and are the outcome of wrestling with unanswered questions and answers unquestioned.

The starred sections (**) which begin in Chapter 4 provide a formulation of the models within the framework of activity analysis. This mode sheds light on the agent's production function. These more technical sections can be omitted in a first reading without loss of continuity.

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TABLE OF CONTENTS

Abstract	iii
Preface	v
Acknowledgements	vii
List of Tables	xiii

PART 1 BACKGROUND

CHAPTER 1 INTRODUCTION - THE RESEARCH PROGRAM	1
1.1 Outline of the Problem	1
1.2 Aims of the Research	5
1.3 Methodology	6
1.4 Formulation of the Problem	7
1.5 Significance of the Study	7
1.6 Assumptions and Limitations	8
CHAPTER 2 MEASUREMENT AND VALUATION OF TIME USE	10
2.1 Outline	10
2.2 Time use in Production	10
2.3 Summary	15

CHAPTER 3	SOME MODELS OF TIME ALLOCATION	16
3.1	Paradigms	16
3.2	The Becker model	17
3.3	The Fox-Moeseke model	22
3.4	The Moeseke model	26
3.5	Comparisons and Constrasts	35
3.6	Transportation models of Time Allocation	38
 PART 2		
TRANSPORTATION MODELS OF TIME ALLOCATION		
 CHAPTER 4	BEHAVIOURAL BACKGROUND TO THE MODELS	39
4.1	Introduction	39
4.2	Integration of Economics with other Disciplines	40
4.3	Behaviour and Environment	40
4.4	Time Use Studies	44
4.5	Requirements of Social Position	48
4.6	The Cost of an Activity	53
** 4.7	Activity Analysis	55

CHAPTER 5 FORMULATION**57**

5.1	Outline	57
5.2	Numerical Example	57
5.3	Core Model	64
5.4	Slack and Tight Models	66
5.5	The Transportation Problem	70
5.6	Standard Linear Programming Model	78
**5.7	Activity Analysis	80
**5.8	Changes in Technology	88

CHAPTER 6 ECONOMIC INTERPRETATION**92**

6.1	Introduction	92
6.2	Outline	92
6.3	Transportation Models - Economic Interpretations	94
6.4	Social Income and Savings	104
**6.5	Activity Analysis - Economic Interpretations	107

CHAPTER 7	NUMERICAL EXAMPLES (1)	2 X 2, 2 X 3 AND 3 X 3 MODELS	115
7.1	Introduction		115
7.2	The Slack Model		116
7.3	The Tight Model		132
7.4	Dimensionality Problem		147
7.5	The Per Unit Cost Matrix		150
**7.6	Activity Analysis		154
7.7	Summary		157
CHAPTER 8	NUMERICAL EXAMPLES (2)	5 X 5 AND 5 X 6 MODELS	159
8.1	Introduction		159
8.2	5x5 and 5x6 Slack Models		160
8.3	5x5 and 5x6 Tight Models		171
8.4	Derivation of the Cost Matrix		182
**8.5	Changes in Technology		197
CHAPTER 9	NUMERICAL EXAMPLES (3)	EFFECTS OF CHANGES IN THE PARAMETERS	200
9.1	Introduction		200
9.2	Effects of Changes in the Vector c		200
9.3	Effects of Changes in the Vector b		205
9.4	The Addition of a New Constraint		210
**9.5	Effects of Changes in the Technology Matrix A		213
9.6	Summary		224

SUMMARY AND CONCLUSIONS

227

LIST OF SYMBOLS AND NOTATION

231

REFERENCES

234

LIST OF TABLES

<u>Table</u>	<u>Description</u>	
3-1	Comparison of the Becker model and the Moeseke model	35
4-1	Environments classified by behaviour settings	43
4-2	Basic categories of time use	47
4-3	Classification of social requirements	50
5-1	Activity matrix	62
5-2	Cost matrix	63
5-3	Row and column arrays	79
5-4	Standard linear programming model	79
5-5	Technology matrix, A	87
5-6	The activity analysis model	87
7-1	2 x 2 activity matrix - slack model	117
7-2	2 x 2 cost matrix - slack model	118
7-3	2 x 2 new cost matrix (1)	121
7-4	2 x 3 activity matrix - slack model	124
7-5	2 x 3 cost matrix - slack model	124
7-6	3 x 3 activity matrix - slack model	126
7-7	3 x 3 new cost matrix (1)	127
7-8	2 x 2 activity matrix - tight model	135
7-9	2 x 2 cost matrix - tight model	135
7-10	2 x 2 new cost matrix (1) - tight model	136
7-11	2 x 2 new cost matrix (2) - tight model	139
7-12	Le Chatelier principle - summary of results	142
7-13	3 x 3 activity matrix - tight model	142

7-14	3 x 3 cost matrix - tight model	142
7-15	3 x 3 new cost matrix (1)	144
7-16	Space-time behaviour pattern	145
7-17	3 x 3 new cost matrix - tight model	146
7-18	Example 3 as a standard linear problem	147
7-19	Estimated dollar costs for the academic year	150
7-20	Estimated dollar costs for the academic year by behaviour settings	151
7-21	Minimum estimated costs for academic year	152
7-22	2 x 2 matrix of daily estimated dollar costs	153
7-23	2 x 2 matrix of estimated time spent on student activities in minutes	153
7-24	2 x 2 cost matrix in cents per minute	154
8-1	Statement of problem - slack model	160
8-2	5 x 5 activity matrix	161
8-3	5 x 5 cost matrix	161
8-4	Solutions to example 1	162
8-5	5 x 6 activity matrix	167
8-6	5 x 6 cost matrix	167
8-7	Changes in the cost of study on campus - solutions	170
8-8	Statement of problem - 5 x 5 tight model	175
8-9	5 x 6 activity matrix - tight model	181
8-10	Students' daily activity patterns	182
8-11	Classification of daily activities	183
8-12	Daily activities classified by social requirement categories	184
8-13	Estimates of proportion of social requirement allocated to behaviour settings	185
8-14	Matrix of daily estimated average time in minutes for activities	186

8-15	Minimum estimated dollar costs for the academic year	188
8-16	Minimum estimated dollar costs for the academic year by behaviour settings	189
8-17	Matrix of minimum estimated dollar costs for the academic year by social requirements and expenditure classifications	192
8-18	Matrix of minimum estimated dollar costs for the academic year by behaviour setting and social requirement	193
8-19	Components of dollar costs for the academic year	195
8-20	Matrix of daily estimated dollar costs	196
8-21	5 x 5 cost matrix	197
9-1	5 x 5 activity matrix	202
9-2	5 x 5 cost matrix	202
9-3	Effects of increases in state behaviour setting costs - optimal solutions	204
9-4	Effects of increases in state behaviour setting costs on shadow prices	204
9-5	Effects of increases in state behaviour setting costs on social income	205
9-6	Effects of changes in the distribution of endowments $c_{52} = -11.0$ cents/min	207
9-7	Effects of changes in the distribution of endowments - optimal solutions $c_{52} = -11.0$ cents/min	208
9-8	Effects of changes in the distribution of endowments $c_{52} = -8.5$ cents/min	208
9-9	Effects of changes in the distribution of endowments - optimal solutions $c_{52} = -8.5$ cents/min	209
9-10	The addition of a new constraint - optimal solutions	212
9-11	The addition of a new constraint - effects on social income	213
9-12	Changes in technology - solutions	216

9-13	Effects of an increase in the efficiency of meeting the academic social requirement	216
9-14	Effects of an increase in the efficiency of meeting the academic social requirement on shadow prices.	217
9-15	Changes in technology - no excess capacity	224