CONTENTS

Preface

CHAPTER ONE

PROBLEM OF WATER: DEMAND-SIDE MANAGEMENT

1.1. Introduction 1
1.2. Water statistics 5
1.3. Supply verses demand-side management 6
1.4. Factors influencing demand 10
1.5. The causes of crisis 12
1.6. Significance of the study 13
1.7. A Profile of the Selected Cities 15
   1.7.1. Bangalore 16
   1.7.2. Chennai 18
   1.7.3. Hyderabad 21
   1.7.4. Kolkata 25
1.8. Objective of the study 26
1.9. Conclusion 29

CHAPTER TWO

LITERATURE SURVEY

2.1. Introduction 30
2.2. Urban residential water demand 31
2.3. Macro and micro level studies 34
2.4. Contingent Valuation Method 35
   2.4.1. CVM: Different designs 37
   2.4.2. CVM: Caveats 43
2.5. Demand-side management and estimation 44
2.6. WTP: Urban residential water 52
2.7. Water pricing issues 58
2.8. Water pricing in practice 66
2.9. Reform trends 70
2.10. Conclusion 71
CONTENTS

CHAPTER THREE

ECONOMETRIC MODELS
AND ESTIMATION PROCEDURE

3.1. Introduction 73
3.2. Analytical framework 74
   3.2.1. Analytical framework for demand functions 75
   3.2.2. Method of estimation 79
   3.2.3. Feasible generalized least square method 79
   3.2.4. Direct maximum likelihood method 83
   3.2.5. Hypotheses testing 86
3.3. Analytical model for WTP 87
   3.3.1. Analytical model for WTP 90
   3.3.2. Estimation of the logit model 97
   3.3.3. Hypotheses tests for the logit model 102
3.4. Methodology and data collection 104
   3.4.1. Methodology 105
   3.4.2. Contingent valuation method 108
   3.4.3. Advantages of CVM 109
   3.4.4. Collection of data using CVM 110
   3.4.5. Pilot survey 115
3.5. Specification of variables 116
3.6. Specification of the model 124
   3.6.1. Demand function equations 124
   3.6.2. General hypotheses: SURE model 126
   3.6.3. Estimation: Total demand for water 134
   3.6.4. Hypotheses: Total demand for water 135
   3.6.5. Equation related to WTP 136
   3.6.6. General hypotheses: WTP 137
3.7. Conclusion 142
## CONTENTS

**CHAPTER FOUR**

**EMPIRICAL ESTIMATION OF DEMAND AND WTP**

<table>
<thead>
<tr>
<th>Section</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1. Introduction</td>
<td>145</td>
</tr>
<tr>
<td>4.2. Analysis of data</td>
<td>148</td>
</tr>
<tr>
<td>4.3. Maximum likelihood estimates for demand analysis</td>
<td>149</td>
</tr>
<tr>
<td>4.3.1. Unrestricted SURE model analysis</td>
<td>150</td>
</tr>
<tr>
<td>4.3.1.1. Pooled data</td>
<td>150</td>
</tr>
<tr>
<td>4.3.1.2. Bangalore city</td>
<td>157</td>
</tr>
<tr>
<td>4.3.1.3. Chennai city</td>
<td>162</td>
</tr>
<tr>
<td>4.3.1.4. Hyderabad city</td>
<td>165</td>
</tr>
<tr>
<td>4.3.1.5. Kolkata city</td>
<td>171</td>
</tr>
<tr>
<td>4.3.2. Restricted SURE model analysis</td>
<td>175</td>
</tr>
<tr>
<td>4.3.2.1. Pooled data</td>
<td>176</td>
</tr>
<tr>
<td>4.3.2.2. Bangalore city</td>
<td>181</td>
</tr>
<tr>
<td>4.3.2.3. Chennai city</td>
<td>185</td>
</tr>
<tr>
<td>4.3.2.4. Hyderabad city</td>
<td>188</td>
</tr>
<tr>
<td>4.3.2.5. Kolkata city</td>
<td>194</td>
</tr>
<tr>
<td>4.4. Total demand for water</td>
<td>199</td>
</tr>
<tr>
<td>4.4.1. Unrestricted case</td>
<td>200</td>
</tr>
<tr>
<td>4.4.2. Restricted case</td>
<td>209</td>
</tr>
<tr>
<td>4.5. Variable-wise demand comparison across cities</td>
<td>218</td>
</tr>
<tr>
<td>4.6. Maximum likelihood estimates for WTP</td>
<td>223</td>
</tr>
<tr>
<td>4.6.1. WTP estimation: Pooled data</td>
<td>228</td>
</tr>
<tr>
<td>4.6.2. WTP estimation: Bangalore city</td>
<td>232</td>
</tr>
<tr>
<td>4.6.3. WTP estimation: Hyderabad city</td>
<td>235</td>
</tr>
<tr>
<td>4.6.4. WTP estimation: Kolkata city</td>
<td>238</td>
</tr>
<tr>
<td>4.7. Factors influencing willingness to pay</td>
<td>242</td>
</tr>
<tr>
<td>4.8. Tests for contemporaneous correlation</td>
<td>246</td>
</tr>
<tr>
<td>4.9. Conclusion</td>
<td>247</td>
</tr>
</tbody>
</table>

Pages 145 - 251
CONTENTS

CHAPTER FIVE

POLICY ISSUES

5.1. Introduction 252
5.2. Basic findings 253
5.3. General observations 257
5.4. The need for reforms 258
  5.4.1. Reforming the tariff structure 260
  5.4.2. Promoting conservation 267
  5.4.3. Strategies for conservation 272
5.5. Policy guidelines and implications 278
5.7. Political economy of urban water 284
5.8. Few observations and conclusion 289

Bibliography 291 - 296

Appendix 297 - 311