

# Tools for Education Policy Analysis

**Alain Mingat**  
**Jee-Peng Tan**

*with*

**Shobhana Sosale**



**THE WORLD BANK**

# Contents

<b>Foreword</b>	<b>xiii</b>
<b>Acknowledgments</b>	<b>xv</b>
<b>Chapter 1</b>	
<b>Introduction</b>	<b>1</b>
<b>Chapter 2</b>	
<b>Diagnosing Structural Weaknesses in Education— Implications for Project Selection: A Two-Part Module</b>	<b>9</b>
Part A: Concepts for Analyzing Structural Weaknesses	9
Part B: Extensions of the Basic Concepts	14
<b>Chapter 3</b>	
<b>Analyzing Costs in Education: A Three-Part Module</b>	<b>19</b>
Part A: Unit Costs Estimation and Analysis	20
Part B: Cost Analysis at the School Level	30
Part C: Application to Actual Data	35
Endnotes	39
<b>Chapter 4</b>	
<b>Conducting Cost-Effectiveness Analysis in Education: A Two-Part Module</b>	<b>41</b>
Part A: Basic Techniques in Cost-Effectiveness Analysis	43
Part B: Extensions of the Basic Techniques	58
Conclusion	71
Annex: Data for Cost-Effectiveness Analysis	72
Endnotes	74

<b>Chapter 5</b>	
<b>Managing Teacher Deployment and Classroom Processes:</b>	
<b>A Two-Part Module</b>	<b>75</b>
Part A: Analyzing Teacher Deployment Issues	76
Part B: Improving Teacher Management of Classroom Processes	88
Conclusion	100
Endnotes	101
<b>Chapter 6</b>	
<b>Assessing Policy Options for Teacher Training and Pay:</b>	
<b>A Two-Part Module</b>	<b>103</b>
Part A: Identifying a Teacher-Training Policy	104
Part B: The Economics of Teacher Pay	124
Conclusion	136
Endnotes	136
<b>Chapter 7</b>	
<b>Analyzing Equity in Education: A Two-Part Module</b>	<b>139</b>
Part A: The Distribution of Public Subsidies for Education	141
Part B: Disparities in Learning	154
Endnotes	162
<b>Chapter 8</b>	
<b>Addressing Policy Issues in Girls' Schooling:</b>	
<b>A Three-Part Module</b>	<b>163</b>
Part A: Diagnosis of the Problem	164
Part B: Identification of Possible Solutions	173
Part C: Consolidation of the Analysis for Policy or Project Design	187
Endnotes	199
<b>Chapter 9</b>	
<b>Performing Economic Analysis of Educational</b>	
<b>Technology: A Two-Part Module</b>	<b>201</b>
Part A: Assessing Delivery Options Using Student Learning as an Outcome Measure	203
Part B: Assessing Delivery Options Using Labor Market Performance as an Outcome Measure	223
Endnotes	233

<b>Chapter 10</b>	
<b>Conducting Comparative Policy Analysis in Education: A Three-Part Module</b>	<b>235</b>
Part A: Making Simple Comparisons of Education Indicators	236
Part B: Going beyond Simple Comparisons	242
Part C: Compiling Country Profiles from Comparative Analysis	258
Annex: Data Issues in Comparative Policy Analysis in Education	261
Endnotes	263
<b>Appendix A</b>	
<b>Regression Analysis</b>	<b>265</b>
The Simple Two-Variable Linear Model	265
Multivariate Linear Models	271
Extensions to the Classical Linear Model	275
More Sophisticated Models in Regression Analysis	280
Endnotes	284
<b>Appendix B</b>	
<b>Instructions for Drawing Graphs in Excel (Version 5.0)</b>	<b>287</b>
<b>Appendix C</b>	
<b>Instructions for Performing Array Formulas in Excel</b>	<b>289</b>
<b>Index</b>	<b>291</b>
<b>Tables</b>	
<b>Chapter 2</b>	
Table 2.A.1.1: Gross Enrollment Ratios by Population Group in Country A	10
Table 2.A.1.2: Enrollments in the Last Grade of Primary Education and First Grade of Secondary Education by Population Group in Country A	10
Table 2.A.1.3: Number of Students by Repetition Status and Grade	11
Table 2.A.1.4: Age Distribution of Students and Nonrepeaters by Grade	12
Table 2.A.1.5: School-age Population by Single Years of Age	12

Table 2.A.1.6: Population, Nonrepeaters, and Enrollment by Grade	13
Table 2.A.1.7: Social Disparities in Enrollment Rates and Their Point of Origin in the Education System	13
Table 2.B.2.8: Selected Characteristics of National, Private, and Community Secondary Schools in Country B	15
Table 2.B.2.9: School-age Population by Single Years of Age and Income Groups	16
Table 2.B.2.10: Age Distribution of Students by Grade	16
Table 2.B.2.11: Number of Students and Repeaters by Grade and Income Group in Primary Education	17
Table 2.B.2.12: Number of Students and Repeaters by Grade and Type of School in Secondary Education	17
Table 2.B.2.13: Population, Nonrepeaters, and Enrollment by Grade and Income Group in Primary and Secondary Education	17
Table 2.B.2.14: Sample Means of Student Performance and Parental Income by School Type	18
<b>Chapter 3</b>	
Table 3.A.1.1: Selected Data on Enrollments and Aggregate Public Spending on Education in a Hypothetical Country	21
Table 3.A.1.2: Unit Cost Estimates by Component and Level of Education	22
Table 3.A.2.3: Number of Students and Teachers in Basic Education in a Hypothetical Country	25
Table 3.A.2.4: Teacher Salaries and Distribution of Teachers by Qualification in a Hypothetical Country	25
Table 3.A.2.5: Estimates of Aggregate and Unit Costs in Cycles 1 and 2 of Basic Education in a Hypothetical Country	26
Table 3.B.1.6: Hypothetical Data Relating to Costs and Performance in 16 Schools	32
Table 3.C.1.12: Names and Definitions of Variables	36
Table 3.C.1.13: Annual Salaries of Teachers and Nonteaching Staff by Qualification	37
<b>Chapter 4</b>	
Table 4.A.1.1: Data on 301 Classes of Fourth Graders	45
Table 4.A.1.2: Marginal Impact on Test Scores of Selected School Inputs	48
Table 4.A.2.3: Salary Scale of Teachers by Years of Formal Education, Pre-Service Teacher Training, and Teaching Experience	50

Table 4.A.3.4: Computing the Annual Marginal Cost of Increasing Teacher Qualification	52
Table 4.A.3.5: Annualized Cost of Increasing In-Service Teacher Training and Textbooks Availability	53
Table 4.A.3.6: Marginal Cost of Reducing Class Size	54
Table 4.A.3.7: Marginal Cost of Changing the Various School Inputs	55
Table 4.A.4.8: Comparing Cost-Effectiveness across School Inputs	56
Table 4.B.1.9: Data on a Sample of 4,043 First Graders	60
Table 4.B.1.10: Defining Dummy Variables for Preschool Exposure	61
Table 4.B.1.11: Defining Interaction Variables for Preschool and Language Group	63
Table 4.B.2.12: Regression Estimates of the Correlates of First Graders' Year-End Test Scores	65
Table 4.B.2.13: Consolidating the Regression Results	66
Table 4.B.3.14: Data for Computing the Marginal Cost of Inputs per Pupil	67
Table 4.B.3.15: Marginal Cost per Pupil of Various School Inputs	68
Table 4.B.4.16: Comparing Cost-Effectiveness across Inputs	69
<b>Chapter 6</b>	
Table 6.A.2.1: Regression Results of Outgoing Scores against a Set of Explanatory Variables	110
Table 6.A.3.2: Data on Teacher Salary, Experience, and Training Level in Country X	113
Table 6.A.4.3: Marginal Cost of Increasing Level of General Education of Teachers in Country X	115
Table 6.A.4.4: Computing the Total Cost of Increasing Teacher Qualification	117
Table 6.A.4.5: Marginal Cost of Increasing Textbooks and Teaching Material	117
Table 6.A.4.6: Calculating the Marginal Cost of Changing Class Size	118
Table 6.A.4.7: Marginal Costs of Changing the Various School Inputs	119
Table 6.A.4.8: Variations in Per-Pupil Spending in Country X	121
Table 6.A.4.9: Comparing Cost-Effectiveness across School Inputs	122

Table 6.B.1.10: Primary School Teacher Salaries in Two Countries	127
Table 6.B.1.11: International Primary School Teacher Salaries in Comparative Perspective	129
Table 6.B.4.12: Basic Data for Projecting Resources for the Sector	133

**Chapter 7**

Table 7.A.1.1: Enrollment Rates and Public Subsidies per Student in a Hypothetical Country	142
Table 7.A.1.2: Distribution of Educational Attainment and Public Subsidies for Education in a Population Cohort of 100	143
Table 7.A.1.3: Cumulative Distributions of Cohort Population and the Corresponding Education Subsidies Accumulated by the Cohort	143
Table 7.A.2.4: Distribution of Enrollments by Level of Education and Income Group in a Hypothetical Country	145
Table 7.A.2.5: Enrollments and Public Subsidies by Level of Education	146
Table 7.A.2.6: Aggregate Public Subsidies for Education Received by Each Income Quartile	146
Table 7.A.2.7: Distribution of Public Subsidies for Education by Income Group	147
Table 7.A.3.8: Distribution of Enrollments and School-Age Population by Income Group and Selected Features of Primary, Secondary, and Higher Education	148
Table 7.A.3.9: Student Flow by Income Group in a Population Cohort of 100	149
Table 7.A.3.10: Distribution of Resources in a Population Cohort by Income Group	150
Table 7.A.3.11: Comparing the Distribution of Subsidies and the Distribution of the Population	151
Table 7.A.4.12: Enrollment Rates and Public Subsidies per Student under the Base Case	153
Table 7.A.4.13: Enrollment Rates and Public Subsidies per Student Year under Alternative Policy Options	153
Table 7.A.4.14: Cumulative Distribution of Cohort Population and Aggregate Public Subsidies Corresponding to Selected Policies in Education	154
Table 7.B.1.15: Variables in the Data Set for Problem 1	157
Table 7.B.1.16: Predicted Endsore Values Based on Regression Results from Step 1	157

Table 7.B.1.17: Simulations of Endscores According to Inscore and Pedagogical Method for Children from Poor Families	159
Table 7.B.1.18: Simulated Differences in Endscores for Selected Students from Poor Families	159
Table 7.B.2.19: Variables in the Data Set for Problem 2	161

## Chapter 8

Table 8.A.1.1: Gross Enrollment Ratio and Girls' Share of Enrollment in Country A and Comparator Countries	166
Table 8.A.2.2: Gross Enrollment Ratio among Boys and Girls by Level of Education	167
Table 8.A.2.3: Gross Enrollment Ratios by Level of Education for Urban and Rural Boys and Girls, Country Y	168
Table 8.A.3.4: Basic Data for Estimating the Student Flow Profile in Country Y	169
Table 8.A.3.5: Grade-Specific Enrollment Rates by Gender and Geographic Location	170
Table 8.A.3.6: Summary Indicators of the Schooling Careers of Boys and Girls in Urban and Rural Areas in Country Y	170
Table 8.A.3.7: Simulations of Rural Girls' Enrollment Rates in Form One	171
Table 8.B.1.8: Suitability of Household and School-Based Survey Data for Analyzing Selected Issues in Education	174
Table 8.B.3.9: Regression Estimates of the Probability of Ever Being Enrolled in Grade One, Rural Girls and Boys in Country Y	177
Table 8.B.4.10: Marginal Impact of Selected Variables on Enrollment Probabilities among Rural Boys and Girls, Country Y	179
Table 8.B.5.11: Data for Simulating Girls' Entry Rate to Grade 1 in Country Y under Selected Supply- and Demand-Side Conditions	181
Table 8.B.5.12: Simulation of Boys' and Girls' Grade-One Enrollment Probabilities under the Combined Influence of Various Supply- and Demand-Side Conditions	182
Table 8.B.6.13: Data for Simulating Girls' Entry Rate to Grade One in Country Y When the School Is Equipped with Toilet Facilities	184
Table 8.B.6.14: Predicted Probability of Ever Being Enrolled in Grade One under Various Supply-Side Conditions	185



Table 8.B.7.15: Simulated Probability of Ever Being Enrolled under Various Demand-Side Conditions	188
Table 8.C.1.16: Entry Rates across Localities in Country Y	190
Table 8.C.2.17: Actual and Simulated Entry Rates to Grade One	191
Table 8.C.2.18: Decomposition of Observed Regional Deviations in Entry Rates to Grade One Relative to the Country Average	193
Table 8.C.2.19: Identifying Appropriate Domains of Intervention across Localities	193
Table 8.C.3.20: Assessing the Scope for Action through Selected Supply-Side Interventions	195
Table 8.C.4.21: Selected Information about the Costliness and Impact of Two Potential Interventions	197
Table 8.C.5.22: Qualitative Rankings of Selected Aspects of Potential Policy Options	197

## **Chapter 9**

Table 9.A.1.1: Cost-Related Data for Traditional Classroom Instruction	204
Table 9.A.1.2: Recurrent Cost per Pupil of Traditional Classroom Instruction	205
Table 9.A.2.3: Capital Cost of Classroom Facilities	207
Table 9.A.3.4: Investment and Operating Costs of a Three-Tier Structure of Computer-Assisted Instruction	208
Table 9.A.3.5: Incremental Annual Capital and Recurrent Costs of Computer-Assisted Instruction	209
Table 9.A.4.6: Simulation of the Incremental Direct Cost per Student Associated with Computer-Assisted Instruction	209
Table 9.A.5.7: Simulation of the Unit Cost of TCI and CAI under Various Input Options	215
Table 9.A.6.8: Variables in the Hypothetical Data Set for Part A, Problem 6	217
Table 9.A.6.9: Predicted OUTSCORE Values for Various INSCORE Values for Pupils Exposed to TCI and CAI	218
Table 9.A.7.10: Simulation of the Unit Costs of TCI and CAI under Various Input Options	220
Table 9.A.8.11: Simulated Average Unit Costs and OUTSCORE under TCI and CAI for Pupils with an INSCORE of 100	221
Table 9.A.8.12: Unit Costs and OUTSCORE Corresponding to Input Mixes on the Combined Production Frontiers of TCI and CAI for Pupils with an INSCORE of 100	222

Table 9.B.1.13: Hypothetical Cost Data for Polytechnic and Distance Courses in Accountancy	224
Table 9.B.1.14: Student Flow Characteristics Associated with the Three Options for Accountancy Training	225
Table 9.B.2.15: Direct Social and Private Costs of Accountancy Training via Three Delivery Modes	225
Table 9.B.3.16: Variables in the Hypothetical Data Set for Part B, Problem 2	228
Table 9.B.3.17: Simulated Annual Earnings of Graduates by Years of Experience	230
Table 9.B.4.18: Opportunity Costs of Accountancy Training	231
Table 9.B.4.19: Full Costs of Accountancy Training via Three Delivery Modes	232
Table 9.B.5.20: Estimates of Rates of Return to Accountancy Training via Three Delivery Modes	232

## Chapter 10

Table 10.A.1.1: Education Indicators Corresponding to Four Selected Dimensions of Education	236
Table 10.A.1.2: Data on Selected Education Indicators for a Sample of Countries	237
Table 10.A.1.3: Choice of Appropriate Comparator Groups for Countries C3 and C22	238
Table 10.A.1.4: Comparative Data for Evaluating C3's and C22's Public Spending on Education as a Percentage of GNP	239
Table 10.A.2.5: Selected Education Indicators for C3 and C22 Relative to the Relevant Country Group Averages	241
Table 10.B.1.6: Public Spending per Pupil by Level of Education in C5, C10, C21, and C26	243
Table 10.B.1.7: Average Public Spending per Pupil by Level of Education in Countries with per Capita Incomes Comparable to C5, C10, C21, and C26	244
Table 10.B.1.8: Public Spending per Pupil as a Multiple of the Corresponding Average for the Relevant Comparator Group	244
Table 10.B.2.9: Actual and Simulated Shares of Workforce in Industry and Higher Education Enrollment Ratios in Country X	247
Table 10.B.3.10: Primary School Teacher Salaries in Two Countries	249
Table 10.B.3.11: Indexes of Relative Teacher Pay in Selected Countries	253

Table 10.C.1.12: Country X's Educational Profile in Comparative Perspective	260
<b>Appendix A</b>	
Table 1: Data on Height and Weight for Eight Men	266
Table 2: Mean Height and Weight in a Sample of Men and Women	273
<b>Figures</b>	
<b>Chapter 5</b>	
Figure 5.B.4.1: Relationship between Unit Spending and Test Scores	98
Figure 5.B.4.2: Relationship between Unit Spending and Test Scores (with Three Details Also Shown)	100
<b>Chapter 6</b>	
Figure 6.A.1.1: Understanding the Marginal Perspective	106
Figure 6.B.3.2: Locating Teacher Salary of Country X in National and International Perspectives	132
Figure 6.B.4.3: Locating Teacher Salary of Country X in an International Perspective	134
<b>Appendix A</b>	
Figure 1: Plot of Height against Weight	266
Figure 2: Distribution of Estimates of $b$	269
Figure 3: Relating Weight to Height among Men and Women	274
Figure 4: Relation between Student Learning and Teacher's Years of Schooling	276
Figure 5: Nonlinear Relationships in Regression Analysis	277
Figure 6: Specifying a Nonlinear Relationship between $X$ and $Y$ Using Dummy Variables	278
Figure 7: Example of Logistic Functional Form	281
Figure 8: Example of Multiequation Regression Model	282