

INTERNATIONAL MONETARY FUND



# Export and Import Price Index Manual

Theory and Practice

International Labour Office

International Monetary Fund

Organisation for Economic Co-operation and Development

eurostat

Statistical Office of the European Communities (Eurostat)

United Nations Economic Commission for Europe



The World Bank

2009

# Contents

<b>Foreword</b> . . . . .	<b>.xi</b>
<b>Preface</b> . . . . .	<b>.xiii</b>
A. Export and Import Price Indices and Unit Value Indices . . . . .	xiii
B. The <i>Export and Import Price Index Manual</i> . . . . .	xiv
C. Background to the Present Revision . . . . .	xv
D. Organization of the Revision . . . . .	xxi
E. Acknowledgments . . . . .	xxii
<b>Reader's Guide</b> . . . . .	<b>.xxv</b>
A. An Overview of the Sequence of Chapters . . . . .	xxv
B. Alternative Reading Plans . . . . .	xxviii
C. A Note on the Bibliography . . . . .	xxix
<b>1. A Summary of Export and Import Price Index Methodology</b> . . . . .	<b>.1</b>
A. Introduction . . . . .	1
B. Unit Value Indices and Price Indices . . . . .	2
C. The Uses of XMPIs . . . . .	8
D. Concepts, Scope, and Classifications . . . . .	10
E. Source Data: Weights . . . . .	13
F. Source Data: Prices . . . . .	17
G. Transfer Prices . . . . .	21
H. Missing Prices and Adjusting Prices for Quality Change . . . . .	21
I. Commodity Substitution and New Goods . . . . .	27
J. Basic Index Number Formulas and the Axiomatic and Economic Approaches to XMPIs . . . . .	28
K. Elementary Price Indices . . . . .	48
L. Basic Index Calculations . . . . .	54
M. Organization and Management . . . . .	57
N. Publication and Dissemination . . . . .	57
O. Terms of Trade . . . . .	58
Appendix 1.1: An Overview of the Steps Necessary for Developing XMPIs . . . . .	59
<b>2. Unit Value Indices</b> . . . . .	<b>.71</b>
A. Introduction . . . . .	71
B. International Recommendations . . . . .	73
C. Unit Value Indices and Their Potential Bias . . . . .	74
D. Evidence of Unit Value Bias . . . . .	80
• E. Strategic Options: Compilation of Hybrid Indices . . . . .	81
F. Strategic Options: Improve Unit Value Indices . . . . .	85
G. Strategic Options: Move to Establishment-Based Price Surveys . . . . .	87
H. Summary . . . . .	88
Appendix 2.1: On Limitations to the Benefits of Stratification . . . . .	90
<b>3. The Price and Volume of International Trade: Background, Purpose, and Uses of Export and Import Price Indices</b> . . . . .	<b>.91</b>
A. Background and Origins of Price Indices . . . . .	91
B. Official Price Indices . . . . .	92
C. International Standards for Price Indices . . . . .	94
D. Purpose of Export and Import Price Indices . . . . .	96
E. Family of XMPIs . . . . .	99

<b>4. Coverage, Valuation, and Classifications</b> . . . . .	<b>101</b>
A. Introduction . . . . .	101
B. Coverage . . . . .	101
C. Valuation . . . . .	104
D. Classifications . . . . .	113
<b>5. Data Sources</b> . . . . .	<b>116</b>
A. Administrative Sources . . . . .	116
B. Survey Sources . . . . .	120
C. Summary . . . . .	123
<b>6. Sampling Issues in Price Collection</b> . . . . .	<b>124</b>
A. Introduction . . . . .	124
B. Starting Position . . . . .	126
C. Goods: Testing Customs Elementary Aggregates for Multiple Elementary Items . . . . .	127
D. Goods and Services: Surveying Enterprises to Identify Elementary Items . . . . .	129
E. Common Problems in Price Survey Sampling . . . . .	131
F. Sample Design . . . . .	134
G. An Example of Sample Selection and Recruitment of Establishments . . . . .	140
H. Sample Maintenance and Rotation . . . . .	144
I. Summary of Sampling Strategies for the XMPI . . . . .	146
<b>7. Price Collection</b> . . . . .	<b>148</b>
A. Introduction . . . . .	148
B. Timing and Frequency of Price Collection . . . . .	148
C. Commodity Specification . . . . .	151
D. Collection Procedures . . . . .	153
E. Respondent Relations . . . . .	162
F. Verification . . . . .	162
G. Related Price Issues . . . . .	163
<b>8. Treatment of Quality Change</b> . . . . .	<b>164</b>
A. Introduction . . . . .	164
B. What Is Meant by Quality Change . . . . .	168
C. An Introduction to Methods of Quality Adjustment When Matched Items Are Unavailable . . . . .	174
D. Implicit Methods . . . . .	177
E. Explicit Methods . . . . .	185
F. Choosing a Quality-Adjustment Method . . . . .	195
G. High-Technology and Other Sectors with Rapid Turnover of Models . . . . .	198
H. Long-Run and Short-Run Comparisons . . . . .	205
Appendix 8.1: Data for Hedonic Regression Illustration . . . . .	210
<b>9. Commodity Substitution, Sample Space, and New Goods</b> . . . . .	<b>212</b>
A. Introduction . . . . .	212
B. Sampling Issues and Matching . . . . .	213
C. Information Requirements for a Strategy for Quality Adjustment . . . . .	216
D. The Incorporation of New Goods . . . . .	217
E. Summary . . . . .	223
Appendix 9.1: Appearance and Disappearance of Goods and Establishments . . . . .	224
Appendix 9.2: New Goods and Substitution . . . . .	228
<b>10. XMPI Calculation in Practice</b> . . . . .	<b>230</b>
A. Introduction . . . . .	230

B. Calculation of Price Indices for Elementary Aggregates . . . . .	231
C. Calculation of Higher-Level Indices . . . . .	248
D. Data Editing . . . . .	263
<b>11. Treatment of Specific Products and Issues . . . . .</b>	<b>269</b>
A. Introduction . . . . .	269
B. Agriculture, SITC 0 . . . . .	270
C. Clothing, SITC 84 . . . . .	274
D. Crude Petroleum and Gasoline, SITC 33 . . . . .	275
E. Metals, SITC 68 . . . . .	276
F. Electronic Computers, SITC 75 . . . . .	276
G. Motor Vehicles, SITC 78 . . . . .	278
H. Services . . . . .	280
I. Pricing Issues of Importance in International Trade . . . . .	282
<b>12. Errors and Bias in XMPIs . . . . .</b>	<b>287</b>
A. Introduction . . . . .	287
B. Errors and Bias . . . . .	289
C. Use, Coverage, and Valuation . . . . .	291
D. Sampling Error and Bias on Initiation . . . . .	292
E. Sampling Error and Bias: The Dynamic Universe . . . . .	293
F. Price Measurement: Response Error and Bias, Quality Change, and New Goods . . . . .	293
G. Substitution Bias . . . . .	295
H. Administrative Data . . . . .	296
I. World Commodity Prices . . . . .	297
<b>13. Organization and Management . . . . .</b>	<b>298</b>
A. Introduction . . . . .	298
B. Organizational Structure and Resource Management . . . . .	299
C. The Sampling Process . . . . .	303
D. The Initiation Process . . . . .	303
E. The Repricing Process . . . . .	304
F. The Estimation Process . . . . .	307
G. The Publication and Documentation Process . . . . .	308
H. Quality Assurance . . . . .	309
<b>14. Publication, Dissemination, and User Relations . . . . .</b>	<b>311</b>
A. Introduction . . . . .	311
B. Types of Presentation . . . . .	311
C. Dissemination Issues . . . . .	317
D. User Consultation . . . . .	319
E. Press Release Example . . . . .	320
<b>15. The System of Price Statistics . . . . .</b>	<b>322</b>
A. Introduction . . . . .	322
B. Major Goods and Services Price Statistics and National Accounts . . . . .	323
C. International Comparisons of Expenditure on Goods and Services . . . . .	357
<b>16. Basic Index Number Theory . . . . .</b>	<b>358</b>
A. Introduction . . . . .	358
B. Decomposition of Value Aggregates into Price and Quantity Components . . . . .	359
C. Symmetric Averages of Fixed-Basket Price Indices . . . . .	362
D. Annual Weights and Monthly Price Indices . . . . .	366
E. Divisia Index and Discrete Approximations . . . . .	376

F. Fixed-Base Versus Chain Indices. . . . .	379
Appendix 16.1: Relationship Between Paasche and Laspeyres Indices. . . . .	383
Appendix 16.2: Relationship Between Lowe and Laspeyres Indices. . . . .	383
Appendix 16.3: Relationship Between Young Index and Its Time Antithesis. . . . .	384
<b>17. Axiomatic and Stochastic Approaches to Index Number Theory. . . . .</b>	<b>386</b>
A. Introduction. . . . .	386
B. The Levels Approach to Index Number Theory. . . . .	388
C. First Axiomatic Approach to Bilateral Price Indices. . . . .	390
D. Stochastic Approach to Price Indices. . . . .	398
E. Second Axiomatic Approach to Bilateral Price Indices. . . . .	403
F. Test Properties of Young and Lowe Indices. . . . .	410
Appendix 17.1: Proof of Optimality of Tornqvist Theil Price Index in Second Bilateral Test Approach. . . . .	411
<b>18. Economic Approach. . . . .</b>	<b>413</b>
A. Introduction. . . . .	413
B. Economic Theory and the Resident's and Nonresident's Approach. . . . .	414
C. Setting the Stage. . . . .	415
D. The Export Price Index for a Single Establishment. . . . .	419
E. Superlative Export Output Price Indices. . . . .	425
F. Import Price Indices. . . . .	439
<b>19. Transfer Prices. . . . .</b>	<b>444</b>
A. The Transfer Price Problem. . . . .	444
B. Alternative Transfer Pricing Concepts. . . . .	446
C. Transfer Price Concepts When There Are No Trade or Income Taxes. . . . .	447
D. Transfer Pricing When There Are Trade or Profits Taxes and No External Market. . . . .	449
E. Which Transfer Prices Can Be Usefully Collected by Statistical Agencies?. . . . .	454
F. Conclusion. . . . .	459
<b>20. Exports and Imports from Production and Expenditure Approaches and Associated Price Indices Using a Simplified Example and an Artificial Data Set. . . . .</b>	<b>460</b>
A. Introduction. . . . .	460
B. Expanded Production Accounts for the Treatment of International Trade Flows. . . . .	462
C. The Artificial Data Set. . . . .	474
D. The Artificial Data Set for Domestic Final Demand. . . . .	483
E. National Producer Price Indices. . . . .	490
F. Value-Added Price Deflators. . . . .	492
G. Two-Stage Value-Added Price Deflators. . . . .	495
H. Final Demand Price Indices. . . . .	497
I. Conclusion. . . . .	500
<b>21. Elementary Indices. . . . .</b>	<b>501</b>
A. Introduction. . . . .	501
B. Ideal Elementary Indices. . . . .	503
C. Elementary Indices Used in Practice. . . . .	506
D. Numerical Relationships Between the Frequently Used Elementary Indices. . . . .	507
E. The Axiomatic Approach to Elementary Indices. . . . .	509
F. The Economic Approach to Elementary Indices. . . . .	511
G. Sampling Approach to Elementary Indices. . . . .	512
H. A Simple Stochastic Approach to Elementary Indices. . . . .	517
I. Conclusion. . . . .	518

<b>22. Quality Change and Hedonics.</b> . . . . .	<b>519</b>
A. New and Disappearing Items and Quality Change: Introduction. . . . .	519
B. Hedonic Prices and Implicit Markets. . . . .	521
C. Hedonic Indices. . . . .	531
D. New Goods and Services. . . . .	538
Appendix 22.1: Some Econometric Issues. . . . .	538
<b>23. Treatment of Seasonal Products.</b> . . . . .	<b>546</b>
A. Problem of Seasonal Products. . . . .	546
B. A Seasonal Product Data Set . . . . .	548
C. Year-over-Year Monthly Indices. . . . .	548
D. Year-over-Year Annual Indices. . . . .	556
E. Rolling-Year Annual Indices. . . . .	558
F. Predicting Rolling-Year Index Using Current-Period Year-over-Year Monthly Index. . . . .	561
G. Maximum Overlap Month-to-Month Price Indices. . . . .	564
H. Annual Basket Indices with Carryforward of Unavailable Prices. . . . .	569
I. Annual Basket Indices with Imputation of Unavailable Prices. . . . .	571
J. Bean and Stine Type C or Rothwell Indices. . . . .	572
K. Forecasting Rolling-Year Indices Using Month-to-Month Annual Basket Indices. . . . .	574
L. Conclusions. . . . .	579
<b>24. Measuring the Effects of Changes in the Terms of Trade.</b> . . . . .	<b>581</b>
A. Introduction. . . . .	581
B. The Effects of Changes in the Real Price of Exports. . . . .	584
C. The Effects of Changes in the Real Price of Imports. . . . .	591
D. The Combined Effects of Changes in the Real Prices of Exports and Imports. . . . .	594
E. The Effects on Household Cost-of-Living Indices of Changes in the Prices of Directly Imported Goods and Services. . . . .	597
F. Conclusion. . . . .	602
<b>Glossary.</b> . . . . .	<b>603</b>
<b>Bibliography.</b> . . . . .	<b>629</b>
<b>Index.</b> . . . . .	<b>644</b>
<b>Tables</b>	
2.1. Illustration of Unit Value Bias. . . . .	75
5.1. Example of Assigning Weights. . . . .	121
5.2. Data Sources for Export and Import Price Indices. . . . .	123
6.1. Unit Values and Product Mix. . . . .	130
6.2. Using Price Surveys and Customs Unit Values in the Same "Hybrid" Index. . . . .	132
6.3. Step 1 for Establishment Sample Selection. . . . .	141
6.4. Step 2 for Establishment Sample Selection. . . . .	141
6.5. Selection of Products Using the Ranking Method. . . . .	143
7.1. Price-Determining Characteristics. . . . .	152
8.1. Estimating a Quality-Adjusted Price. . . . .	176
8.2. Example of Overlap Method of Quality Adjustment. . . . .	177
8.3. Example of the Bias from Implicit Quality Adjustment for $r_2 = 1.00$ . . . . .	182
8.4. Hedonic Regression Results for Dell and Compaq PCs. . . . .	190
8.5. Example of Long-Run and Short-Run Comparisons. . . . .	206
9.1. Sample Augmentation Example. . . . .	221
10.1. Calculation of Price Indices for an Elementary Aggregate. . . . .	233
10.2. Properties of Main Elementary Aggregate Index Formulas. . . . .	235
10.3. Imputation of Temporarily Missing Prices. . . . .	241
10.4. Disappearing Commodities and Their Replacements with No Overlap. . . . .	242

10.5.	Disappearing and Replacement Commodities with Overlapping Prices . . . . .	244
10.6.	Calculation of a Weighted Elementary Index . . . . .	245
10.7.	Calculation of Unit Value Index for Sample Commodity Category. . . . .	247
10.8.	The Aggregation of the Elementary Price Indices. . . . .	251
10.9.	Price Updating of Weights Between Weight and Price Reference Periods. . . . .	253
10.10.	Calculation of a Chained Index. . . . .	256
10.11.	Calculation of a Chained Index Using Linking Coefficients. . . . .	257
10.12.	Decomposition of Index Change from January 2002 to January 2003. . . . .	262
15.1.	Production Account for an Establishment, Institutional Unit, or Institutional Sector. . . . .	327
15.2.	Production Account with Product Detail for an Establishment or Local Kind of Activity Unit . . . . .	328
15.3.	Industry/Activity Production Account with Detail for Products and Market/Nonmarket . . . . .	329
15.4.	Use of Income Account for Institutional Units and Sectors. . . . .	332
15.5.	Use of Income Account with Product Detail for Institutional Units and Sectors. . . . .	334
15.6.	Use of Income Account with Product Detail for the Total Economy. . . . .	335
15.7.	Capital Account . . . . .	337
15.8.	Capital Account with Product Detail. . . . .	338
15.9.	External Account of Goods and Services. . . . .	339
15.10.	External Account of Goods and Services with Product Detail. . . . .	339
15.11.	The Supply and Use Table (SUT). . . . .	342
15.12.	Location and Coverage of the Major Price Indices in the Supply and Use Table. . . . .	348
15.13.	Definition of Scope, Price Relatives, Coverage, and Weights for Major Price Indices. . . . .	349
15.14.	Generation of Income Account for Establishment, Institutional Unit, or Institutional Sector .. . . .	352
15.15.	Generation of Income Account for Establishment and Industry with Labor Services (Occupational) Detail. . . . .	352
15.16.	A Framework for Price Statistics. . . . .	353
18.1.	Behavioral Assumptions for Resident's and Nonresident's Approaches. . . . .	415
20.1.	Domestic Supply Matrix in Current Period Values. . . . .	463
20.2.	Domestic Use Matrix in Current Period Values. . . . .	464
20.3.	Export or ROW Supply Matrix in Current Period Values. . . . .	464
20.4.	Import or ROW Use Matrix in Current Period Values. . . . .	464
20.5.	Domestic Supply Matrix in Current Period Values with Commodity Taxes. . . . .	469
20.6.	Export or ROW Supply Matrix in Current Period Values with Export Taxes. . . . .	469
20.7.	Import or ROW Use Matrix in Current Period Values with Import Taxes. . . . .	469
20.8.	Constant Dollar Domestic Supply Matrix. . . . .	470
20.9.	Volume Domestic Use Matrix. . . . .	470
20.10.	Volume ROW Supply or Export by Industry and Commodity Matrix. . . . .	470
20.11.	Volume ROW Use or Import by Industry and Commodity Matrix. . . . .	470
20.12.	Real Domestic Supply Matrix. . . . .	474
20.13.	Real Domestic Use Matrix. . . . .	475
20.14.	Real ROW Supply or Export by Industry and Commodity Matrix. . . . .	475
20.15.	Real ROW Use or Import by Industry and Commodity Matrix. . . . .	475
20.16.	Nominal Value Domestic Supply Matrix with Commodity Taxes. . . . .	476
20.17.	Nominal Value Domestic Use Matrix. . . . .	477
20.18.	Value ROW Supply or Export by Industry and Commodity Matrix. . . . .	477
20.19.	Value ROW Use or Import by Industry and Commodity Matrix. . . . .	477
20.20.	Industry <i>G</i> Final Demand Prices for All Transactions. . . . .	478
20.21.	Industry <i>G</i> Commodity Taxes. . . . .	478
20.22.	Industry <i>G</i> Quantities of Outputs and Intermediate Inputs. . . . .	479
20.23.	Industry <i>S</i> Final Demand Prices. . . . .	479
20.24.	Industry <i>S</i> Commodity Taxes. . . . .	481
20.25.	Industry <i>S</i> Quantities of Outputs and Inputs. . . . .	481
20.26.	Industry <i>T</i> Final Demand Prices. . . . .	482
20.27.	Industry <i>T</i> Commodity Taxes. . . . .	482

20.28. Industry $T$ Quantities of Outputs and Inputs . . . . .	483
20.29. Prices for Six Domestic Final Demand Commodities . . . . .	483
20.30. Quantities for Six Domestic Final Demand Commodities . . . . .	483
20.31. Total Expenditures and Expenditure Shares for Six Domestic Final Demand Commodities . . . . .	484
20.32. Fixed-Base Laspeyres, Paasche, Carli, and Jevons Indices . . . . .	484
20.33. Chained Laspeyres, Paasche, Carli, and Jevons Indices . . . . .	485
20.34. Asymmetrically Weighted Fixed-Base Indices . . . . .	485
20.35. Asymmetrically Weighted Chained Indices . . . . .	486
20.36. Symmetrically Weighted Fixed-Base Indices . . . . .	487
20.37. Symmetrically Weighted Chained Indices . . . . .	487
20.38. Single-Stage and Two-Stage Fixed-Base Superlative Indices . . . . .	488
20.39. Single-Stage and Two-Stage Chained Superlative Indices . . . . .	488
20.40. Diewert Additive Percentage Change Decomposition of the Fisher Index . . . . .	489
20.41. Van Ijzeren Additive Percentage Change Decomposition of the Fisher Index . . . . .	490
20.42. Fixed-Base National Domestic Gross Output Price Indices at Producer Prices . . . . .	490
20.43. Chained National Domestic Gross Output Price Indices at Producer Prices . . . . .	490
20.44. National Fixed-Base Export Price Indices at Producer Prices . . . . .	491
20.45. National Chained Export Price Indices at Producer Prices . . . . .	491
20.46. Fixed-Base National Domestic Intermediate Input Price Indices at Producer Prices . . . . .	491
20.47. Chained National Domestic Intermediate Input Price Indices at Producer Prices . . . . .	491
20.48. Fixed-Base National Import Price Indices at Producer Prices . . . . .	492
20.49. Chained National Import Price Indices at Producer Prices . . . . .	492
20.50. Fixed-Base Value-Added Price Deflators for Industry $G$ . . . . .	493
20.51. Chained Value-Added Price Deflators for Industry $G$ . . . . .	493
20.52. Fixed-Base Value-Added Price Deflators for Industry $S$ . . . . .	493
20.53. Chained Value-Added Price Deflators for Industry $S$ . . . . .	493
20.54. Fixed-Base Value-Added Price Deflators for Industry $T$ . . . . .	494
20.55. Chained Value-Added Price Deflators for Industry $T$ . . . . .	494
20.56. Fixed-Base National Value-Added Deflators . . . . .	494
20.57. Chained National Value-Added Deflators . . . . .	495
20.58. Fixed-Base Single-Stage and Two-Stage National Value-Added Deflators: Aggregation over Industries Method . . . . .	496
20.59. Chained Single-Stage and Two-Stage National Value-Added Deflators: Aggregation over Industries Method . . . . .	496
20.60. Fixed-Base Single-Stage and Two-Stage National Value-Added Deflators: Aggregation over Commodities Method . . . . .	496
20.61. Chained Single-Stage and Two-Stage National Value-Added Deflators: Aggregation over Commodities Method . . . . .	497
20.62. Fixed-Base and Chained Domestic Final Demand Deflators . . . . .	497
20.63. Fixed-Base and Chained Export Price Indices at Final Demand Prices . . . . .	498
20.64. Fixed-Base and Chained Import Price Indices at Final Demand Prices . . . . .	498
20.65. Fixed-Base and Chained GDP Deflators . . . . .	498
20.66. Fixed-Base GDP Deflators Calculated in Two Stages . . . . .	499
20.67. Chained GDP Deflators Calculated in Two Stages . . . . .	499
23.1. Artificial Seasonal Data Set: Prices . . . . .	549
23.2. Artificial Seasonal Data Set: Quantities . . . . .	550
23.3. Year-over-Year Monthly Fixed-Base Laspeyres Indices . . . . .	553
23.4. Year-over-Year Monthly Fixed-Base Paasche Indices . . . . .	553
23.5. Year-over-Year Monthly Fixed-Base Fisher Indices . . . . .	553
23.6. Year-over-Year Approximate Monthly Fixed-Base Paasche Indices . . . . .	554
23.7. Year-over-Year Approximate Monthly Fixed-Base Fisher Indices . . . . .	554
23.8. Year-over-Year Monthly Chained Laspeyres Indices . . . . .	554
23.9. Year-over-Year Monthly Chained Paasche Indices . . . . .	554
23.10. Year-over-Year Monthly Chained Fisher Indices . . . . .	554



23.11. Year-over-Year Monthly Approximate Chained Laspeyres Indices . . . . .	555
23.12. Year-over-Year Monthly Approximate Chained Paasche Indices. . . . .	555
23.13. Year-over-Year Monthly Approximate Chained Fisher Indices. . . . .	555
23.14. Annual Fixed-Base Laspeyres, Paasche, and Fisher Price Indices. . . . .	557
23.15. Annual Approximate Fixed-Base Laspeyres, Paasche, Fisher, and Geometric Laspeyres Indices. . . . .	557
23.16. Annual Chained Laspeyres, Paasche, and Fisher Price Indices. . . . .	557
23.17. Annual Approximate Chained Laspeyres, Paasche, and Fisher Price Indices. . . . .	558
23.18. Rolling-Year Laspeyres, Paasche, and Fisher Price Indices. . . . .	560
23.19. Rolling-Year Approximate Laspeyres, Paasche, and Fisher Price Indices. . . . .	562
23.20. Rolling-Year Fixed-Base Laspeyres and Seasonally Adjusted Approximate Rolling-Year Price Indices. . . . .	563
23.21. Month-to-Month Maximum Overlap Chained Laspeyres, Paasche, and Fisher Price Indices . .	567
23.22. Month-to-Month Chained Laspeyres, Paasche, and Fisher Price Indices. . . . .	568
23.23. Lowe, Young, Geometric Laspeyres, and Centered Rolling-Year,Indices with Carryforward Prices. . . . .	570
23.24. Lowe, Young, Geometric Laspeyres, and Centered Rolling-Year Indices with Imputed Prices. . . . .	572
23.25. Lowe with Carryforward Prices, Normalized Rothwell, and Rothwell Indices. . . . .	573
23.26. Seasonally Adjusted Lowe, Young, and Geometric Laspeyres Indices with Carryforward Prices and Centered Rolling-Year Index. . . . .	575
23.27. Seasonally Adjusted Lowe, Young, and Geometric Laspeyres Indices with Imputed Prices; Seasonally Adjusted Rothwell; and Centered Rolling-Year Indices. . . . .	577

## Figures

8.1. Quality Adjustment for Different-Sized Items. . . . .	186
8.2. Scatter Diagram of PC Prices. . . . .	189
8.3. Flow Chart for Making Decisions on Quality Change. . . . .	197
12.1. Outline of Sources of Error and Bias. . . . .	288
18.1. Laspeyres and Paasche Bounds to the Output Price Index. . . . .	421
22.1. Consumption and Production Decisions for Combinations of Characteristics. . . . .	522
23.1. Rolling-Year Fixed-Base and Chained Laspeyres, Paasche, and Fisher Indices. . . . .	561
23.2. Rolling-Year Approximate Laspeyres, Paasche, and Fisher Price Indices. . . . .	563
23.3. Rolling-Year Fixed-Base Laspeyres and Seasonally Adjusted Approximate Rolling-Year Price Indices. . . . .	564
23.4. Lowe, Young, Geometric Laspeyres, and Centered Rolling-Year Indices with Carryforward Prices. . . . .	571
23.5. Lowe, Young, Geometric Laspeyres, and Centered Rolling-Year Indices with Imputed Prices. . . . .	573
23.6. Lowe and Normalized Rothwell Indices. . . . .	574
23.7.A. Seasonally Adjusted Lowe, Young, Geometric Laspeyres, and Centered Rolling Indices. . . . .	576
23.7.B. Lowe, Young, Geometric Laspeyres, and Centered Rolling Indices Using X-1 I Seasonal Adjustment . . . . .	576
23.8.A. Seasonally Adjusted Lowe, Young, and Geometric Laspeyres Indices with Imputed Prices; Seasonally Adjusted Rothwell and Centered Rolling-Year Indices. . . . .	578
23.8.B. Lowe, Young, and Geometric Laspeyres Indices Using X-11 Seasonal Adjustment with Imputed Prices, and Centered Rolling-Year Indices. . . . .	578

## Boxes

15.1. Institutional Sectors in the <i>System of National Accounts 2008</i> . . . . .	325
15.2. Industry/Activity Coverage of the Producer Price Index Output Value Aggregate. . . . .	331
15.3. The Treatment of Housing and Consumer Durables in the 2008 SNA and CPIs. . . . .	333