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The World Copper Industry

Structure and Economic Analysis

Raymond F. Mikesell

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New York • London

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In memory of Orris C. Herfindahl, who was the inspiration for this book.



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Contents

Preface xv

Introduction 1

1 Overview 4

Brief History of Copper	4
World Copper Resources and their Locations	11
World Copper Consumption	13
World Copper Production	16
World Trade Patterns for Copper	17
Ownership Status of the World Copper Industry	28
Organization of the Copper Industry in the Major Producing Countries	31
Importance of Copper Exports for the Developing Countries	37
Appendix 1-1: Profiles of Selected Major Private Copper Producing Companies	38

2 The Physical Characteristics of the Copper Industry 45

Nature and Location of the World's Copper Deposits and Reserves	45
Exploration	52
The Nature of Mining Activities	56
Copper Metallurgy	59
Copper Smelting	63
Refining	70
Copper Fabrication	73
Substitution and Other Demand-Reducing Developments	75
Secondary Copper	76
Appendix 2-1: Definitions of Common Underground Mining Techniques	78

3	World Markets for Copper: An Institutional Analysis	79
	Types of Coppers Traded and their Markets	79
	World Pricing Systems for Copper	81
	Comparison of Copper Prices	86
	Contracts for the Sale of Copper	89
	Appendix 3-1: LME Contract Rules	94
4	Copper Prices and Costs: An Historical Review	102
	Brief Review of Copper Prices	102
	Competition and Market Power in the Copper Industry	106
	The Two-Price System	111
	Production Costs	116
	Some Unanswered Questions	129
5	U.S. Demand for Copper: An Introduction to Theoretical and Econometric Analysis	131
	Introduction	131
	Patterns of Copper Consumption	132
	Theoretical and Econometric Analysis of the Demand for Copper	144
	Results of Econometric Analyses of Demand for Copper	154
	Appendix 5-1: Technical Notes on the Analysis of the Relationship Between Short-Run and Long-Run Elasticities	158
	Appendix 5-2: Long-Run Substitution for Copper	160
	Conductor Applications	160
	Heat-Exchanger Applications	161
	Electroplating and Coatings	162
	Alloying Applications and Coatings	163
	Ordnance and Accessories	163
6	Quantitative Analysis of Supply	164
	Introduction	164
	Econometric Modeling of Copper Supply	167
	Econometric Copper Models	172
	Comments on Some Econometric Copper Models	174
	Recycling, Inventory Behavior, and Short-Run Copper Price Movements	182

	Econometric Copper Models and the Explanation of Copper Price Movements: Some Conclusions	185
7	International Copper Price Stabilization and Cartels	187
	Introduction	187
	The Benefits and Costs of Pure Price Stabilization Operations	189
	International Buffer Stock Operations in Copper Price Stabilization Programs Involving Supply Management	194 202
	Criticisms of Commodity Price Stabilization and Alternative Measures of Promoting LDC Objectives	203
	A Producers' Copper Cartel	204
	The Ability of a Producers' Cartel to Control Copper Prices	207
	The 1977 Proposal for a U.S. National Copper Stockpile	214
8	Investment in the Copper Industry: Practices and Approaches	216
	The Investment Decision-Making Process	217
	Overall Investment Strategy in the Mining Industry	220
	Investment Criteria for Individual Projects	222
	Exploration	228
	Mine Feasibility Study	233
	Capital Costs and Financing	235
	Investment Decisions by Government Mining Enterprises in Developing Countries	236
	Appendix 8-1: Simulated Cash Flow Analysis of a Hypothetical Copper Mine	238
9	Foreign Investment in Copper Mining	245
	Introduction	245
	Declining Foreign Investment Expenditures in Developing Countries	248
	How Important Is Foreign Direct Investment?	251
	Economic Issues in the Negotiation and Implementation of Mine Development Contracts	256
	The Content of Mine Development Agreements	256

x CONTENTS

- 10 Conflict Resolution in Mine Development Contracts:
 Some Recent Examples 271
- The Political and Economic Interests of Host
 Countries 272
- Conflicting Investment Conditions Demanded by Host
 Countries and by Foreign Investors 274
- Approaches to Reconciliation of Positions 275
- Specific Examples in Recent Agreements 284
- Conclusions 289
- Appendix 10-1: Kennecott's Experience with the
 Ok Tedi Prospect in Papua New Guinea: An
 Unsuccessful Negotiation of a Copper Investment 290
- Appendix 10-2: An Example of the Operation of the
 Garnaut-Clunies-Ross Tax Formula 295
- 11 Some Economic Issues in Nationalization, Exploration, and
 the Rate of Exploitation of National Mineral
 Resources 298
- National versus Foreign Ownership: An Economic
 Analysis 298
- Restrictions on Exploration 304
- The Economics of National Conservation of Diminishing
 Copper Resources 307
- Appendix 11-1: Conversion of a Short-Term Income
 Stream from a Depleting Mine to a Self-Maintaining
 Annuity 314
- 12 World Copper Resources, Mine Capacity, and Future
 Demand 316
- Estimates of World Copper Reserves 317
- Outlook for Productive Capacity 321
- Demand Forecasts 324
- Financing Future Copper Producing Capacity 326
- Sources of Financing for Expanding Copper and Other
 Nonfuel Mineral Producing Capacity 331
- International Action for Promoting Nonfuel Mineral
 Investments 333

13	Special Problems in the Future Supply of Copper	339
	The Future Contribution of Recycling to Copper Production	339
	Copper Resources of the Oceans	349
	Environmental Problems in Copper Production	357
14	Summary and Conclusions	364
	The Present State of the Copper Industry	364
	Costs and Prices	366
	Copper Modeling	367
	International Price Stabilization	368
	The Investment Decision in the Mining Industry	369
	Foreign Investment in the Copper Industry	370
	International Action	372
	Scrap	373
	Outlook for World Copper Demand and Primary Producing Capacity	374
	Index	377

TABLES

1-1	Copper Mine Production by Major Country and Region, Selected Years	10
1-2	World Copper Resources	12
1-3	Breakdown of Copper Consumption by End Uses, United States, Europe, and Japan, 1973	14
1-4	World Consumption of Refined Copper, 1929, 1957, 1965, 1973, and 1976	15
1-5	World Smelter and Refinery Production of Copper, 1976	18
1-6	World Copper Exports (Market Economies)	20
1-7	World Copper Imports (Market Economies)	25

xii CONTENTS

- 1-8 Mine Copper Production of Twenty-One Leading Privately Owned Mining Companies in 1974 30
- 1-9 Domestic Mine Copper Production of Leading U.S. Mining Companies, 1974 32

- 2-1 Most Commonly Occurring Copper Minerals 46

- 4-1 Average U.S. Producers' and LME Prices of Copper in 1957 Prices, 1957-77 120
- 4-2 Average Annual Compound Rates of Increase in Mine Copper Production 124

- 5-1 U.S. and World Comparative Trends in Refined Copper Consumption, 1963-74 133
- 5-2 Consumption of Copper in the United States, 1950-74 134
- 5-3 Consumption of Copper Products by Domestic Semifabricators, 1974 137
- 5-4 Production of Semifabricated Copper Products, 1966, 1970, 1974 138
- 5-5 U.S. Copper Consumption by Broad End-Use Categories, 1960-74 140
- 5-6 U.S. Semifabricator Demand for Refined Copper and Scrap, 1954-74 143
- 5-7 Price and Activity Elasticity Estimates from Various Studies 155

- 6-1 Refined Copper Stocks Held by Producers, Exchanges, and Merchants, and Average Annual LME Cash Prices, 1971-77 184

- 8-1 Unweighted Average Rate of Return on Stockholders' Equity 219
- 8-2 U.S. Primary Copper Production of Three Leading Copper Producers 220
- 8-3a Cash Flow for Hypothetical Mine 226
- 8-3b Net Cash Flow to Equity, Accounting Rate of Return to Initial Equity, Net Present Value at 14 Percent, and Internal Rate of Return, Assuming Accelerated Depreciation 227

- App. 8-1 Schedule of Capital Outlays—Total \$200 Million 239
- App. 8-2 Operating Statistics, Costs, Revenues, and Earnings—65-cent Copper 240

- App.
8-3 Earnings After Taxes for Hypothetical Copper Mine at Various Copper Prices 242
- App.
8-4 Cash Flow Analysis—65-cent Copper 243
- App.
8-5 Net Cash Flow and Internal Rate of Return to the Investor 244
- 9-1 Mining and Smelting: Value of U.S. Foreign Direct Investment, 1960, 1965, 1970, 1975, and 1976 249
- 9-2 Mining and Smelting: Capital Expenditures by Majority-Owned Foreign Affiliates of U.S. Companies, 1967–77 250
- 9-3 Outline of Requirements for Foreign Investment in Copper Mining in Selected Copper Producing Countries 258
- App.
10-1 Hypothetical Examples of Taxation of Increase of Accumulated Present Value 296
- App.
11-1 Savings Ratio Required for Converting a Mine with an n -Year Life with an Annual Net Income of \$1 Million to a Capital Investment with a Value Equal to the Initial Present Value of the Mine at the Social Rate of Discount (r) 315
- 12-1 Geographical Distribution of World Copper Reserves 319
- 12-2 Comparison of World Copper Reserve Estimates Since 1950 320
- 12-3 Required Copper Producing Capacity in Market Economies, 1985 and 2000 327
- 12-4 Required Additions to Copper Capacity in Market Economies, 1977–2000 328
- 12-5 Investment Requirements for Copper Capacity Additions in Market Economies 329
- 13-1 New Scrap Arisings and Copper Consumption in the United States, 1964–74 340
- 13-2 U.S. Direct Use of Scrap and Total Copper Consumption, 1971–74 341
- 13-3 Life Cycles of Copper Products in the United States and Proportion Recovered 343

- 13-4 Copper Recovered and Unrecovered from Obsolete
Copper Products, 1961–70 and Projected 1971–2000 346
- 13-5 Hypothetical Mineral Production from Nodules by
1985 355

FIGURES

- 2-1 Important copper producing regions of the non-
Communist world. 48
- 2-2 Technology of primary copper production. 72
- 3-1 Copper prices: quarterly data, January 1972–December
1977. 88
- 4-1 Copper prices: annual data, 1954–77. 103
- 4-2 Copper ore grade and productivity in the
United States. 125
- 5-1 Copper consumption in the United States, 1974. 136
- 5-2 General demand schedule for copper. 145
- 5-3 Short-run and long-run adjustment process in demand
for copper. 151
- 6-1 Schematic representation of the CRA copper model. 176
- 6-2 Copper price and consumption, actual and predicted,
1955–75. 181
- 6-3 Refined copper consumption, actual and predicted,
1955–75. 181
- 7-1 Random shifts in supply. Stabilization favors
producers. 191
- 7-2 Random shifts in demand. Stabilization favors
consumers. 192

Preface

THIS BOOK is a survey of the world copper industry and of the problems with which policy makers and students of the industry are currently concerned. My interest in the copper industry arose out of research on foreign investment in minerals, an interest that dates from my association with the President's Materials Policy Commission, as director of the commission's foreign resources division in 1951–52. Hence, readers will find a rather heavy emphasis on foreign investment in mining, especially in the Third World copper producing countries.

Although this book reflects information and suggestions from many individuals, I am solely responsible for all but two of the chapters. Chapter 2, which deals with the physical characteristics of the copper industry, including a description and evaluation of new metallurgical processes, is authored by John W. Whitney who is both a geologist and Ph.D. in mineral economics. Chapter 5, which is authored by Kirkor Bozdogan and Raymond S. Hartman, reflects the work of these economists on an econometric model of the copper industry prepared at Arthur D. Little, Inc. for the U.S. Environmental Protection Agency. This chapter, together with my own chapter 6 on the quantitative analysis of copper supply, is designed to provide the reader with an introduction to, and evaluation of, econometric commodity modeling techniques which have been applied to the copper industry. In preparing chapter 6, I received substantial assistance from Jos Bruggink, now with the Energy Study Center, Petten, the Netherlands.

The decision to undertake this study grew out of conversations with Orris C. Herfindahl and Sam Schurr of Resources for the Future. A large number of individuals have assisted me in dealing with various topics treated in this book. I would like first of all to acknowledge help from Hans Landsberg and John J. Schanz, Jr. of Resources for the Future, who reviewed the initial draft of my manuscript. Comprehensive critical reviews of my manuscript were undertaken at the request of RFF by Wolfgang Gluschke, United Nations Centre for Natural Re-

sources, Energy and Transport; Roger Sedjo of RFF; Simon Strauss, vice chairman of ASARCO; Gerhard Theibach of the World Bank; and John E. Tilton, professor of mineral economics, Pennsylvania State University. The detailed criticisms and suggestions by these reviewers were immensely valuable in preparing the final edition of the manuscript, and although they are in no way responsible for the errors and weaknesses that remain, their comments contributed greatly to improving the quality of this study.

In addition to the assistance from the reviewers, I gained important insights on exploration from Merwin Bernstein and Thomas N. Walthier of St. Joe Minerals. I obtained numerous ideas and encouragement from Charles F. Barber of ASARCO; Walter Chudson of the United Nations; Alun G. Davies of Rio Tinto-Zinc; Ross Garnaut of the Australian National University; Sacha Gueronik and Peter Parkinson of CIPEC; Taylor Ostrander of AMAX; Sir Ronald Prain, formerly Chairman of Roan Selection Trust; Marian Radetzki of the Institute for International Economic Studies (Stockholm); Harold J. Schroeder, U.S. Bureau of Mines; Milton Stern of Kennecott Copper Corporation; Alexander Sutulov, Centro de Investigacion Minera y Metalurgica, Santiago, Chile; Kenji Takeuchi and Bension Varon of the World Bank; George R. Westby, Southern Peru Copper Corporation; Stephen A. Zorn, Commodities Research Unit; and my colleagues at the University of Oregon, Eaton H. Conant and Robert E. Smith.

Research assistance, including preparation of some of the appendixes for this book, was provided by Jos Bruggink and Steve Staloff, former graduate students in economics at the University of Oregon who have since received their doctorates. My wife, Irene, provided constructive criticism and countless hours in reading the manuscript for preliminary editing. Without her patience and encouragement this book could never have been written. Finally, my secretary, Letty Fotta, rendered competent and tireless service beyond what any author has the right to ask.

March 1979

Raymond F. Mikesell
University of Oregon

THE WORLD COPPER INDUSTRY

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Introduction

OVER THE PAST decade, events relating to the world copper industry have generated widespread public interest, and hundreds of books have been written by economists, political scientists, environmentalists, commodity specialists, business executives, geologists, and engineers on topics of general interest concerned with this industry. In recent years more has been written about copper than about any other nonfuel mineral. The reasons are easy to understand. The prices of this important industrial commodity gyrated widely during the 1970s, and fears of inadequate copper supplies in 1973 and early 1974 quickly shifted to concerns about the effects of excessive copper supplies and low prices on employment and the financial welfare of the copper industry in the United States and Canada, and the impact on the economies of the principal copper producing countries in the Third World. Copper smelters constitute a serious environmental problem and current and proposed regulations by the Environmental Protection Agency have generated a heated debate between EPA and the environmentalists on the one hand, and industry spokesmen on the other. Foreign investments by large U.S. and European copper mining companies in Africa and Latin America have been expropriated by the governments of host countries to an extent not equaled for any other industry except petroleum. The justifications for the nationalization of American and European companies in Chile, Peru, Zambia, and Zaire, among others, have been the subject of intense debates among social scientists, politicians, and business leaders the world over. U.S. diplomatic relations with some of these countries have been considerably influenced by the treatment of U.S. investments in the copper industry. The 1978 invasion from Angola of Shaba Province in Zaire might not have generated the same degree of international concern and intervention if it had not threatened the bulk of the copper output from one of the world's leading copper producers. The debate within the United Nations Conference on Trade and Development (UNCTAD) in Geneva over methods for stabilizing the prices of

international commodities has centered in considerable measure on the stabilization of world copper prices. The establishment of the Inter-Governmental Council of Copper Exporting Countries (CIPEC) led to widespread concern in the developed countries that nonfuel mineral producing countries would be able to create cartels with market power similar to that exercised by OPEC. Finally, the U.S. copper industry has been the subject of a number of administration and congressional studies relating to the competitive structure of the industry, the need for import protection, and the creation of a national copper stockpile.

In light of these varied interests centered on copper, it seemed appropriate to write a book which would not simply review the major topics related to copper, but would provide a largely nontechnical basis for understanding them. An effort has been made to integrate the subject matter by showing the relationship between the physical characteristics of the industry and its market and industrial structure. These in turn are essential for understanding several policy issues relating to copper, including: (1) assuring adequate supplies at reasonable prices for meeting future world demand; (2) the role of foreign investment and measures for promoting it; (3) protecting the environment without endangering domestic supplies; (4) maintaining competition and an efficient price system; (5) encouraging resource conservation through recycling; and (6) moderating uneconomic price fluctuations.

Much of the analysis of the copper industry in this book also applies directly to other nonfuel minerals industries. This is particularly the case in the discussion of the economics of mining investment; measures for international price stabilization; foreign investment and its promotion; the economics of exhaustible resources; investment requirements for meeting future demand; and recycling. Even the physical characteristics, industrial structure, and market organization of copper have a great deal in common with such nonfuel minerals as iron ore, lead, zinc, and nickel.

Since this book covers a broad spectrum of disciplines ranging from geology and engineering to the economics of price stabilization and cartels, it is not intended to make an original contribution of interest to specialists in any area of the applied physical or social sciences. Rather, it is designed to acquaint the reader who may not be a specialist in mineral economics, geology, or mine engineering with the physical characteristics of the copper industry; to acquaint the reader who is not a mining company official or commodity specialist with the structure and operation of the world's copper markets; and to provide the reader who is not an econometric commodity model builder with the elements of quantitative analysis of the demand for and supply of copper.

The material in this book is in considerable measure oriented to policy issues rather than to description and theoretical analysis. However, the conclusions summarized in chapter 14 are more in the nature of findings than recommendations for specific policy actions. Special emphasis is given to the following policy issues: (1) the competitiveness of the U.S. copper industry; (2) the adequacy of world copper resources for meeting the long-run requirements of the market economies; (3) the possibilities for modifying sharp fluctuations in copper prices; (4) the likelihood of an effective world copper producers' cartel that would raise prices significantly above long-run equilibrium levels; (5) the outlook for the development of sufficient copper producing capacity for meeting world demand over the next two decades and the measures for assuring an adequate level of capacity; and (6) the role of foreign investment and measures for encouraging it. Our conclusions are broadly optimistic in terms of the long-run ability of the industry to supply world requirements and the feasibility of finding solutions to the industry's problems.