MINERAL ECONOMICS - CONTENTS

1	Mineral Economics – An Introduction	Philip Maxwell	1
	MINERALS AND THE WORLD I	E C O N O M Y	
2	Some Foundations	Philip Maxwell	1
3	Minerals and Development	Philip Maxwell	2
4	Trade in Minerals	Philip Maxwell	39
	MINERALS — CONSUMPTION, PRODUCT	TION AND MARKETS	
5	Mineral Demand – The Theory in Practice	Peter Howie	51
6	Mineral Supply – Exploration, Production, Processing and Recycling	Philip Maxwell	67
7	Mineral Markets, Prices and the Recent Performance of the Minerals and Energy Sector	Phillip Crowson	79
	MINERAL FINANCE AND INV	ESTMENT	
8	An Introduction to Mineral Finance	Pietro Guj and Allan Trench	107
9	Mineral Project Evaluation – Financial Modelling and Discounted Cash Flow Analysis	Pietro Guj	125
10	Mineral Project Evaluation – Dealing with Uncertainty and Risk	Pietro Guj	145
	MINERALS AND PUBLIC P	OLICY	
11	Mineral Policy – An Introduction	Philip Maxwell and Pietro Guj	179
12	Mineral Taxation and Royalties	Frank Harman and Pietro Guj	191
13	Mining, Sustainability and Sustainable Development	Roderick Eggert	215
	MINING AND LOCAL COMM	UNITIES	
14	Stakeholders, Local Communities and Regions	Philip Maxwell	231
15	Minerals and Regional Development	Philip Maxwell	237
16	Mining and Indigenous Populations	Philip Maxwell	253
17	Occupational Communities – The Mineral Sector Workforce	Philip Maxwell	269
	Glossary of Terms		281
	Subject Index		293
	Name Index		301

EXTENDED CONTENTS

Chapter 1 Mineral Economics – An Introduction	Philip Maxwell
Definitions of economics and the economic way of thinking	1
Economics and mineral economics	2
The focus of mineral economics	4
Some key questions in mineral economics	6
The structure of this volume	6
References	7
MINERALS AND THE WOR	RLD ECONOMY
Chapter 2 Some Foundations	Philip Maxwell
$\label{thm:mineral} Mineral exploitation, production, distribution, consumption, trade and the state of the distribution of the distributi$	and related economic concepts11
Measuring economic production and living standards	13
Economic growth and development	15
Periods of history and minerals	17
Mineral consumption and economic development	17
Complicating factors with mineral production and consumption	19
References	19
Chapter 3 Minerals and Development	Philip Maxwell
The importance of mining in different nations	21
The 'conventional' view – minerals are a blessing	22
An alternative view – minerals are a curse	23
Some background discussion	23
The resource curse thesis	27
Institutional and policy issues	29
Some case studies	31
The Australian experience	31
The case of Chile	34
The position of non-mineral economies	36
References	36
Chapter 4 Trade in Minerals	Philip Maxwell
Why trade takes place	39
Minerals and energy production and trade	40
Australian production and trade in minerals	42
Transport costs and the direction of minerals and energy trade	45

PRODUCTION AND MARI	(LIS
Chapter 5 Mineral Demand – The Theory in Practice	Peter Howie
Introduction	51
The final-product demand curve and the level of consumption	52
Final-product demand and its determinants	53
Mineral resources and derived demand	54
The mineral demand curve	54
Shifts in the mineral demand curve	56
Elasticity of mineral demand	57
Own-price elasticity of mineral demand in the short run	58
Income elasticity of mineral demand in the short run	61
Cross-price elasticity of mineral demand in the short run	61
Elasticity of mineral demand in the long run	62
Conclusions	64
References	64
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel 67
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel 67
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel 676768
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel 67 68 69
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel 67 67 68 69 ducts 70
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel
Chapter 6 Mineral Supply – Exploration, Production, Processing and Recycling Some introductory remarks	Philip Maxwel

Chapter 7 Mineral Markets, Prices and the Recent Performance of the	2
Minerals and Energy Sector	Phillip Crowson
Market structure – competitive markets	79
Market structure – imperfect markets	80
Departing from the competitive model	80
Alternative pricing arrangements	83
The rise and fall of cartels	85
Producer pricing	88
Exchanges	91
The London Metal Exchange	92
Recent trends in mineral markets	97
References	103
MINERAL FINANCE AND INVES	TMENT
Chapter 8 An Introduction to Mineral Finance	ietro Guj and Allan Trench
Financial objectives and financial management	108
The role of financial managers	109
Sources and application of funds	109
General considerations	110
Main sources of funds	110
Sources of equity	111
General considerations	111
Off-market sources of initial equity	111
On-market sources of equity	112
Resource sector initial public offerings are generally small	113
Criteria for inclusion in a stock market index	113
Innovative investment vehicles for the resources industry	114
Fiscal and policy incentives	114
Joint venture farm-outs	115
Specialty finance (royalty) companies	115
The cost of equity – balancing risk and return	115
Sources of debt	117
Some general considerations	117
Long-term debt	117
Short-term debt	118
Hybrids between equity and debt	119
Project finance	119

Some introductory considerations	119
Risk underpinning	120
The financial structure of mining companies	121
Cost of debt, financial leverage and financial risk	121
Financial structure of mining companies	121
Conclusions	122
References	123
Chapter 9 Mineral Project Evaluation – Financial Modelling and Discounted	
Cash Flow Analysis	Pietro Guj
What is it worth? – types and uses of financial valuations	
General issues	
Market- and cost-based evaluations	
Fundamental or technical evaluation	
Income-based valuations and discounted cash flow models	
The basic discounted cash flow model characteristics and structure	
Constructing a simple discounted cash flow model of a mine in nominal dollars	130
Project valuations are at a point in time – discounting cash flows	132
Reconciling cash and financial accounting accrual figures in a discounted cash flow model	
Modelling debt and financial leverage	
Converting a discounted cash flow model from nominal to real dollars	
Modelling the preproduction period	136
Comparison of mutually exclusive projects with different lives	140
Inherent weaknesses and common traps in discounted cash flow analysis	141
Conclusions	143
References	143
Chapter 10 Mineral Project Evaluation – Dealing with Uncertainty and Risk	Pietro Guj
Introduction – beyond discounted cash flow/net present value analysis	-
Risk analysis – identifying and quantifying financial risk: expected value, sensitivity and	
scenario analyses	146
Probabilistic financial models and Monte Carlo simulations	148
Attitudes to risk – from expected value to expected preference value (certainty equivalents) and pricing of risky projects	150
Understanding the nature of risk and risk-neutral expected returns	
From risk-neutral to risk-averse investment decisions	151
Risk preferences and the price of risky investment opportunities	152
Risk spreading through joint ventures	
Bayesian (decision trees) and progressive risk and value analysis	
Size distribution of mineral deposits and the Zipf law	

From static discounted cash flow / net present value to dynamic real option valuations	160
A different logic	160
Types of real options in mining projects	160
The market has been effective at setting real option values	161
Using the Black and Scholes formula to estimate the real option value of the Sally Malay project	162
Modern asset pricing using commodity forward prices	163
Fundamental real option principles – value consistency, no-arbitrage and replicating portfolios	163
Commodities forward prices as certainty equivalents	164
Using binomial lattices in valuing real options in practice	166
Valuing an expansion option with the binomial lattice and binomial tree methods using the 'risk-neutral' probability	168
Binomial lattice method	168
Binomial tree method	168
Valuing tonnage-grade trade-offs	170
Valuing a farm-in/out sequential/compound option	171
Differences between real option value using binomial trees and 'hybrid' real option value	
decision trees	
Strategic real option value considerations	
Conclusions	
Conclusions	
References	
MINERALS AND PUBLIC POLICY	175
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Piet	175 tro Guj
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy	175 tro Guj 179
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy The context of mineral policy	175 tro Guj 179 181
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy	175 tro Guj 179 181 183
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy The context of mineral policy Mineral policy in practice The transition of mineral policy since 1950	<i>tro Guj</i> 179 181 183
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy The context of mineral policy Mineral policy in practice The transition of mineral policy since 1950 The post-1960 surge in public ownership	<i>tro Guj</i> 179 181 183 185
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Piet The aims and practice of economic policy	tro Guj 179 181 183 185 185
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy The context of mineral policy Mineral policy in practice The transition of mineral policy since 1950 The post-1960 surge in public ownership	tro Guj 179 181 183 185 185
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Piet The aims and practice of economic policy	tro Guj 179 181 185 185 187
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pieronter of economic policy	tro Guj 179 181 185 185 187 187
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Piet The aims and practice of economic policy	tro Guj 179 181 185 187 187 188
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pier The aims and practice of economic policy	tro Guj 175 181 185 185 187 187 188 188
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Piet The aims and practice of economic policy	tro Guj 179 181 185 187 187 188 188
MINERALS AND PUBLIC POLICY Chapter 11 Mineral Policy – An Introduction Philip Maxwell and Pieron Philip Maxwell and Philip P	tro Guj 179 181 185 185 187 188 188 189 tro Guj 192

Contents of this chapter	192
A note on terminology	193
Economic rent	193
Economic rent and normal profit	193
Economic rent and scarcity	194
Economic rent, scarcity and the minerals sector	194
Pursuing economic rent	195
Design principles for the taxation of mineral rents	196
Economic efficiency	196
Equity	196
Administrative cost	197
Transparency	197
Stability	197
Taxes designed to capture economic rents	197
Evaluating mineral taxation and royalty systems	199
An initial assessment	199
Problem areas	200
International experience with the taxation of mining rents	201
Relevant constitutional powers in Australia	203
Ownership and control of mineral resources	203
Powers to raise mineral taxes	203
Current mineral taxation regimes in Australia	204
Tax and royalty regimes in the Australian states, the Northern Territory and the Commonwea	alth 204
Other issues in the collection and use of economic rents in Australia	209
Commonwealth company income tax	211
Deductibility of exploration expenditures	211
Depreciation of capital expenditures	211
Other issues	212
Mineral revenue policies for the future	213
Note on the literature	213
References	213
Chapter 13 Mining, Sustainability and Sustainable Development Ro	derick Eggert
Introduction	215
Sustainability and sustainable development	216
Mining and environmental sustainability	217
Mining and economic sustainability	
Mining and social/cultural sustainability	
Public policy – principles and concepts	220

Putting sustainability and sustainable development into practice in mining	222
Final thoughts	224
Notes on the literature	224
References	224
Appendix A: The Mining, Minerals and Sustainable Development project: nine key challenges.	225
Appendix B: The International Council on Mining and Metals sustainable development framev	vork 226
Appendix C: Summary findings of the Extractive Industries Review	226
Appendix D: Ten Principles of the Global Compact	227
MINING AND LOCAL COMMUNITIES	
Chapter 14 Stakeholders, Local Communities and Regions	Philip Maxwell
Mining and its stakeholders	231
Local communities and mines	232
Occupational, residential and Indigenous communities	233
Mining regions	234
Australia's regional framework and its mining regions	235
References	235
	Philip Maxwell
Some introductory considerations	237
Socio-economic indicators for local communities and regions	
Summary socio-economic measures for small areas	239
Economic impact assessment	241
Economic (export) base analysis	
Input-output analysis	243
Computable general equilibrium models	247
Social impact assessment	247
Origins and development	
Conducting a full social impact assessment	248
Some examples of recent social impact assessments	
References	
Appendix – the structure of and solution to the input-output model	250
	Philip Maxwell
The world's Indigenous populations	
Mining and the Indigenous world	
Indigenous Australia	
Some historical background	
Recent comparative data	256

In diagona or Arratualia, and maining	250
Indigenous Australia and mining	
An overview	
The Mabo case and more recent developments	
Indigenous employment policies	
Looking to the future	263
References	263
Appendix – two case studies	
Roebourne in the Pilbara	265
The Argyle diamond mine and the East Kimberley region	267
Chapter 17 Occupational Communities – The Mineral Sector Workforce	Philip Maxwell
Introduction	269
Mining's occupational community	269
Mining employment in developed and developing nations	270
The formal mining sector	271
Artisanal and small-scale mining	271
Mineral sector employment in Australia	273
Historical trends	273
Employment, value added and wages in mining	273
Occupational and educational structure	274
Location issues	274
Important mineral sector workforce issues	275
Gender imbalance	275
Maintaining a supply of well-trained professionals	275
The growth of fly-in, fly-out workforces	277
Summary and conclusion	279
References	279
Glossary of Terms	281
Subject Index	293
Name Index	301