rate, cost, price, inflation, etc.) one can establish how sensitive the results are to any changes in this element. *Fourth,* it could be of benefit to policy-makers deciding on the ratios of how rent should be shared between governments and investors. *Finally,* the model generates a present value for the royalty and expresses it in various ways that can assist both investors and governments in assigning a value to the mineral rights for negotiation purposes. Given these applications, the model is an extremely useful decision-making tool.

7.1.2 Mineral project details

Five mineral projects were used in this analysis: a large South African Witwatersrand type gold mine; a greenstone type gold mine; a large limestone project; a medium-sized underground coal mine and the copper mine taken from the study by the Colorado School of Mines. Apart from the copper mine, the information for the other projects were obtained from a combination of the following sources: South African mining houses, annual mine reports, statistics published by Statistics South Africa, Department of Minerals and Energy and the Chamber of Mines. Although the specifications in table 7.1 are reasonably accurate simulations of the real-life situation, certain assumptions were made to simplify the cash-flow calculations. The model may not reflect the reality of the mineral markets fully. Nevertheless, these deviations will not affect the validity of the observations that appear later in this chapter.

Table 7.1 Project specifications

Specifications	Gold (Greenstone)	Gold (Witwatersrand)	Limestone	Coal	Copper
Mineral lease area (ha)	635	2 000	1 330	4 462	2 000
Measured reserves	967 000 oz	9 500 000 oz	25 000 000 t	30 000 000 t	2 500 000 000 lb.
Price (1996)	US$387,82/oz	US$387,82/oz	US$52,10/t	US$43,17/t	US$1,043/lb
Cash-flow duration	20 years	20 years	20 years	20 years	20 years
Capital:					
Pre-mining (US$)					
Year 0	3 093 200	51 264 000	6 000 000	15 000 000	10 000 000
Year 1	186 000	-	-	-	15 000 000
Year 2	-	-	-	-	-
Development (US$)					
Year 0	2 675 315	110 000 000	10 000 000	10 000 000	250 000 000
Year 1	10 161 352	110 000 000	10 000 000	5 000 000	250 000 000
Year 2	-	100 000 000	5 000 000	-	-
Year 3	-	50 000 000	-	-	-
Year 4	-		-	-	-
Year 5	-	-	-	-	-
Plant and equipment	5% Revenue	5% Revenue	5% Revenue	5% Revenue	5% Revenue
Production					
Year 0	-	-	-	-	-
Year 1	16 000 oz	-	500 000 t	-	90 000 000 lb.
Year 2	32 000 oz	-	500 000 t	1 000 000 t	110 000 000 lb.
Year 3	32 000 oz	200 000 oz	1 000 000 t	1 200 000 t	110 000 000 lb.
Year 4	43 600 oz	300 000 oz	1 000 000 t	1 200 000 t	110 000 000 lb.
Year 5	43 600 oz	400 000 oz	1 000 000 t	1 200 000 t	110 000 000 lb.
Years 6 –11	43 600 oz	450 000 oz	1 000 000 t	1 200 000 t	110 000 000 lb.
Years 12+	45 000 oz	450 000 oz	1 000 000 t	1 200 000 t	110 000 000 lb.
Operating costs	US$175/oz	US$230/oz	US$22.92/t	US$8,00/t	US$0,45/lb
SA lease formula		$y=15-\frac{90}{x}$			
SA Royalty used	2,5%Revenue		3,75%Revenue	3,75%Revenue	3,75%Revenue

7.1.3 Explanation of the terms used in the model (in alphabetical order)

Actual loan repayment: Annual repayment of loan *less* interest accrued.

Annual repayment of loan: The annual amount in equal payments necessary to repay the loan: $Repayment = loan\,amount\left[\frac{i(1+i)^n}{(1+i)^n - 1}\right]$ where i is the annual US interest rate and n is the number of years in which the loan must be repaid. The model assumes that loans must be paid back over five years from the date on which the financier supplies the capital. The debt-equity ratios allow for fifty per cent equity finance with the remaining fifty percent being financed by a US loan. Finance will be made available when required.

Average effective tax rate: The discounted net present value (NPV) of all taxes *divided* by the discounted NPV of taxable income, is expressed as a percentage.

Another method frequently used to calculate effective tax rates is the internal rate of return (IRR) derived tax rate. This method uses the following formula in order to calculate the effective tax rate:

$IRR\,based\,tax\,rate = \frac{Before\,tax\,IRR - After\,tax\,IRR}{Before\,tax\,IRR} \times 100$. The study by the World Bank (1990) compared tax rates using the IRR-based tax rate. It is not important which of the two methods are used for comparison purposes, provided the same method is used consistently throughout the analysis.

Capital index: Where a country allows capital indexing, the model uses the host country's consumer price index to inflate the capital annually.

Cash flow *after* all taxes: The nominal gross revenue *less* total capital costs, value-added tax, import duties, export tax, royalty, nominal operating cost, annual repayment of loan, income tax and withholding or dividend tax.

Cash-flow duration: The number of years over which the projects are analysed. This duration is not necessarily the life of mine.

Commodity price: The average price received for mineral production in 1996.

Consumer price index (CPI): The 1996 consumer price index for the various countries as published by the International Monetary Fund.

Country risk: See discount rate.

Development capital: Costs associated with purchasing mining assets, gaining access to and exposing the ore body. It includes all excavations, such as shafts, underground tunnels, removal of overburden or waste rock and surface infrastructure, such as roads, railway lines, etc. The model does not provide for any post-production capital expenditure or extensions to the mineral lease areas necessary for expansion of initial capacity.

Discounted cash flow: Discounted cash flow after all taxes.

Discount rate: The discount rate used in the model is a function of financial, business, and country risks. Financial risk is determined by the capital structure adopted by the firm. Inflation and the corporate cost of capital are the key variables influencing financial risk. The *Weighted Average Cost of Capital* model (WACC) as described by Smith (1995) determines the discount rate in the model. The cost of capital is expressed as an interest rate and is calculated using the following formula proposed by Sani (1977):

$$r_{WACC} = r_e p_e + r_d p_d + r_p p_p \quad \text{where} \quad r_e = f + R\beta$$

$$\textbf{Corresponding nominal discount rate} = r_{WACC} + i + C$$

Where: r_{WACC} = Weighted average cost of capital expressed as a percentage;

$r_{e,d,p}$ = Cost of equity capital, debt and preferred stock expressed as a percentage;

$p_{e,d,p}$ = Proportions of equity capital, debt and preferred stock that make up the corporate capital ($p_e + p_d + p_p = 1,0$);

f = Risk-free rate (based on US government bond or treasury rates)

R = Risk premium of market returns above long-term, risk-free rates. This rate is classified according to a scale of 1 to 10 depending on the risk class of the project. Investors will not invest in risky mineral projects unless provision is made for a *'risk premium'* in the form of a higher expected rate of return. Determination of the risk premium is generally subjective. A risk premium of ten per cent was used in all the cash flows which point to the high risk associated with developing a new mine in a developing country.

ß = Beta factor for the common stock expresses the variability of the common stock with respect to the variability of the market as a whole. A beta factor of 1,0 was used for all projects in order to allow for effective comparison.

i = Inflation, as indicated by the US Consumer Price Index (CPI).

C = Country risk. The countries were selected in a manner that they have similar risk profiles. This requirement allows for a standard rate of three per cent for all cash flows.

In order to avoid unacceptable variations in the discount rates for the selected countries, a decision was made that a United States loan would finance the debt proportion of the capital. This decision standardised the discount rate used in the model to thirteen per cent (in real terms) for all countries. Applying this *'considered'* discount rate to all countries meant that a base in which *'all things are equal except for allowable deductions, corporate taxes and mineral royalties'* while at the same time compensating for each country's unique inflationary environment, was created and from which effective comparison of results could be made.

Most of the risk to the potential investor can be catered for in the decision-making process to a certain extent. Geological risk, for example, can be reduced by additional exploration or prospecting activities. Political, commercial and security risks can be accommodated

by allowing for an appropriate discount factor in a cash-flow calculation. These risks are well quantified by various risk-rating organisations, such as the London-based Control Risks Group, CRM International and other credit agencies. Country-risk assessment is therefore an important variable in the discounted cash-flow method and assessments of the individual countries on a continual basis. Information on risk management was readily available and the topic needs no further discussion at this stage.

Depreciation: Depreciable assets fall into two broad categories. The rules of the countries selected treat pre-mining, development and construction costs similarly while equipment and plant costs fall into a different category. Each category normally has its own rules allowing for different depreciation rates for different items. This model assigns an average amortisation period to each category for simplicity reasons.

Distributable earnings: Means profit after tax *less* withholding or dividend taxes.

Escalation: The percentage increase or decrease above or below the US consumer price index.

Export tax: The product of the export tax rate and nominal gross revenue.

Import duties: The product of the average import duty rate and plant and equipment costs.

Income tax payable: Means the income tax rate multiplied by the taxable income.

Inflation: The 1996 consumer price index for the United States of America as published by the International Monetary Fund.

Interest accrued: The interest accrued in year n is calculated as follows:

$$\left[\left(Loan\ balance\ at\ (n-1) \times US\ \text{int}erest\ rate\right) + \left(Loan\ amount\ at\ (n-1) \times US\ \text{int}erest\ rate\right)\right]$$

Investor NPV: The discounted net present value of the return on the investment after all costs and taxes have been subtracted.

Investor share of wealth: The discounted net present value of the investor's share of the wealth (net present value of the project) divided by the sum of the discounted net present values of the project and the state's share of the wealth, expressed as a percentage.

IRR for project: The Internal Rate of Return (IRR) is the discount rate applied to the undiscounted cash-flow after all taxes for which the net present value of the cash flow stream is equal to zero.

Lease formula: Before the enactment of the Minerals Act No. 50 of 1991, South African uranium, precious metal and precious stone mines had to pay a lease consideration for the right to mine these commodities, regardless of who owned the mineral rights. If the mineral rights were state-owned, the mines were exempted from royalties. However, if the mineral rights were owned privately, the mine had to pay royalties to the owner over and above the lease consideration. With the introduction of the Minerals Act, the lease consideration was converted into a royalty for those mines mining state-owned mineral rights. Mines over privately-owned mineral rights are no longer required to pay the lease consideration. The lease consideration payable was based on the following formula:

$$\textit{Lease consideration rate } y = a - \frac{ab}{x}$$ where

a = the marginal rate, normally ranging from 10 to 30, but very often 15

b = lease-free revenue portion, normally ranging from 6 to 8

x = profit to revenue ratio, expressed as a percentage

Life of mine: The life of the mine is calculated as measured reserves divided by the maximum production rate.

Loan amount: Development capital multiplied by the debt finance ratio of fifty per cent.

Loan balance: The outstanding loan amount at the end of the previous year less the actual loan repayment for the present year.

Measured reserves: The *in situ* demonstrated mineral content that has been measured, evaluated and found to be currently economically viable.

Mineral lease area: The area over which a mining concession has been granted.

Minor taxes as a percentage of total taxes: The ratio of the sum of value-added (VAT) or sales tax, import duties, export taxes and withholding taxes on dividends to the nominal state's share of the wealth generated, expressed as a percentage.

Nominal commodity price: The average price received for mineral production in 1996, adjusted for inflation and escalation. The nominal price in year n is calculated by the following formula:

$$Commodity\ price\ in\ base\ (1996)\ year \times \left[(1 + US\ CPI)(1 + revenue\ escalation)\right]^{n}$$

Nominal gross revenue: Annual production multiplied by the nominal commodity price for that year.

Nominal operating cost per unit: The average operating cost per mineral production unit in 1996, adjusted for inflation and escalation. The nominal operating cost in year n is calculated by the following formula:

$$Operating\ cost\ per\ unit\ in\ base\ (1996)\ year \times \left[(1 + US\ CPI)(1 + cost\ escalation)\right]^{n}$$

Nominal operating cost: Annual production multiplied by the nominal operating cost for that year.

Nominal state share: The sum of the following sources of state revenue: royalty,

income tax, VAT, import duties, export tax and withholding or dividend tax.

Nominal working profit: Means nominal gross revenue less VAT, import duties, export tax, royalty, operating costs and interest accrued.

NPV of total state share: The discounted net present value of total host government receipts.

Operating (working) costs: The total cost of producing a saleable mineral product, excluding taxes and fixed capital expenditure but including working capital. The definition includes labour, maintenance, beneficiation, rehabilitation, transport and similar costs incurred before the point of sale.

Operating ratio: The ratio, expressed as a percentage, of the nominal operating profit to the nominal gross revenue.

Plant and equipment capital: Capital spent on the establishment of facilities for the extraction and treatment of the mineral, including vehicles, machinery, buildings and other depreciable assets obtained in connection therewith. The total amount is normally very difficult to determine unless a comprehensive breakdown of costs is available. Statistics South Africa, in its quarterly statistical release P2042, publish statistics on the average distribution of capital expenditure for the South African mining sector. According to this publication, capital expenditure on plant, machinery, equipment, furniture and vehicles was consistently around five per cent of mining turnover for the past number of years. The model uses this information in its calculation rather than doing a complete breakdown of capital expenditure. A zero-salvage value is assigned to these assets at the end of their useful lives in the cash-flow calculation.

Plant and equipment depreciation: Plant and equipment expenditure multiplied by the corresponding depreciation factor. The model uses the straight-line method, but where an accelerated-method is applies, the duration has been reduced to allow for a greater write-off in early years.

Pre-mining and development depreciation: Pre-mining and development expenditure *multiplied* by the corresponding depreciation factor. When countries have an accelerated-method, the period has been reduced to allow for the greater capital write-off in early years.

Pre-mining capital: Capital spent on advanced exploration, feasibility study and acquisition of mineral rights.

Production: The annual quantity of saleable product produced from a mineral resource.

Profit after tax: Taxable income less income tax payable.

Profit to revenue ratio: The taxable income divided by the nominal gross revenue, expressed as a percentage.

Reserves: Measured reserves on the date of commencement of the project.

Risk-free rate: See discount rate. The 1996 government bond or treasury rate as published by the International Monetary Fund.

Risk premium: See discount rate.

Royalty: The product of the mineral royalty rate and nominal gross revenue.

Royalty NPV: The discounted net present value of total mineral royalty payments over the life of the mine.

State share of wealth: The discounted net present value of the state's share of the wealth (NPV of total state share) divided by the sum of the discounted net present value of

the project (investor NPV) and the state's share of the wealth, expressed as a percentage.

Taxable income: Means nominal working profit *less* unredeemed capital expenditure *less* total depreciation.

Total capital costs: The sum of pre-mining, development, construction, plant and equipment capital. The model excluded working capital because it was treated as working cost for calculating the taxable income.

Total depreciation: The total depreciable amount of pre-mining, development, plant and equipment capital expenditure.

Unredeemed capital expenditure: Capital not redeemed in current year plus the amount carried-over from the previous year.

US Interest rate: The 1996 nominal interest rate for the United States of America as published by the International Monetary Fund.

Value-added tax payment: The product of the value-added or sales tax rate and plant and equipment costs.

7.2 ANALYSES OF MINERAL RENT DISTRIBUTION

As in chapter six with the derivation of the competitive investment framework, the results obtained from the cash-flow calculations needed to be analysed and organised in a manner that allowed for effective comparison and meaningful interpretation. The objective was to determine a recipe for sharing rents in a typical developing country. This rent-sharing ratio was an important input factor for determining the optimal rent that should be produced from South African mineral resources.

The method used for determining the competitive mineral framework in chapter six was

to exclude those indicators greater than one standard deviation away from the average in order to calculate a new range and average to compare with the South African situation. The same strategy was followed in this chapter. Before the results of the cash flows were combined into table 7.3, each of the mineral projects was analysed individually (table 7.2) in order to establish the merits of having a separate set of rules for each mineral type.

7.2.1 Analysing the cash-flow results

The distribution of the rent summarised in table 7.2 shows clearly that the corporate income tax is by far the most important contributor to state revenue. On average about eighty per cent of all the revenue received by the host government over the life of a mineral project comes from this source. As mentioned in chapter six, the corporate tax rate was the first instrument introduced to the foreign investor and was widely used as a direct comparison tool for determining the tax competitiveness of a country. It seemed that most host countries were very aware of the importance of this tax because it was not necessary to exclude any of the countries for developing the framework in table 7.3 in order to assess the South African situation. South Africa's income tax receipts (67 per cent of all revenue collected) compared fairly well with that of the framework.

The second most important minerals tax instrument is the royalty. Ghana was the only exception to this rule, where mineral royalties were still considered an equally important instrument to corporate taxation. The direct comparison method in chapter six indicated that Ghana and Indonesia appeared to have excessive royalty rates. The cash-flow results underscored the fact that Ghana's royalty regime was not competitive. The results produced by the model revealed that the Indonesian royalty regime was, with the exception of coal royalties, highly competitive. This also showed how misleading the direct comparison method was in evaluating marginal rates. After excluding all Ghanaian and Indonesian coal royalties, a new average of six per cent of total state revenue with a range of zero to 17 per cent described the competitive framework. This showed that, on average, if a host country wanted to have a competitive royalty regime, its government should not collect more than 17 per cent of its share of the rent in the form of mineral royalties. Although South Africa's take from royalties was significantly higher than the

average of 6 per cent, the country's average of 16 per cent just fell within the range of the competitive framework. Gold and copper royalties were above the range and it had to be concluded that South Africa's royalty regime needed further investigation.

The remainder of the state's share of mineral rent was made up of minor taxes such as minimum taxes (Mexico and Indonesia), additional profits taxes (Mexico and Ghana), capital gains taxes (Indonesia), fuel taxes (most countries), withholding taxes (Indonesia), import/export taxes (Indonesia) and payroll taxes (most countries). Although these *'nuisance'* taxes were usually charged at low rates, they had a potentially severe impact on the way in which a host country shared in the rent. Investors preferred a simple tax regime where these minor taxes were restricted to a minimum. Table 7.2 indicated that they made up a relatively small proportion of the total tax burden. It seemed that Indonesia had targeted these taxes to raise more income for the government from the mining industry. Indonesia's proportions for witwatersrand gold and limestone mines are more than one standard deviation away from the average for the selected countries and was therefore removed for the purpose of establishing the competitive framework in table 7.3. South Africa's average rent derived from these minor taxes also fell in that category. Its seventeen per cent take was way above the competitive average of eight per cent and it also fell outside the upper limit (16 per cent) of the range. The South African tax authorities need to look at its minor tax collection instruments and eliminate those taxes that result in the country not being competitive in this regard. This observation supported the analysis in chapter six, which identified the 12,5 per cent tax on distributable earnings as a major constraint to investors.

Table 7.2 True tax competitiveness

Description	Argentina	Peru	Chile	Mexico	Indonesia	Ghana	Average (6 countries)	Standard Deviation
Distribution of taxes								
Greenstone gold								
Income tax (%)	86	95	95	77	76	46	79	18
Royalty (%)	9	0	0	8	10	46	12	17
Minor taxes (%)	5	5	5	15	14	8	9	4
Witwatersrand gold								
Income tax (%)	76	91	91	76	67	28	72	23
Royalty (%)	15	0	0	12	17	66	18	24
Minor taxes (%)	9	9	9	12	17	5	10	4
Limestone								
Income tax (%)	86	95	95	77	63	47	77	19
Royalty (%)	8	0	0	7	4	44	11	17
Minor taxes (%)	5	5	5	15	33	9	12	11
Coal								
Income tax (%)	91	97	97	80	55	58	80	19
Royalty (%)	6	0	0	5	35	32	13	16
Minor taxes (%)	3	3	3	15	9	11	7	5
Copper								
Income tax (%)	81	93	93	79	69	36	75	21
Royalty (%)	12	0	0	9	15	58	16	22
Minor taxes (%)	7	7	7	13	16	7	10	4
Distribution of taxes								
Averages								
Income tax (%)							77	20
Royalty (%)							14	19
Minor taxes (%)							10	6
Distribution of wealth								
Greenstone gold								
State's share (%)	36	32	36	42	43	57	41	9
Investor's share (%)	64	68	64	58	57	43	59	9
Witwatersrand gold								
State's share (%)	55	51	50	83	71	100	68	20
Investor's share (%)	45	49	50	17	29	0	32	20
Limestone								
State's share (%)	36	32	36	41	48	56	42	9
Investor's share (%)	64	68	64	59	52	44	59	9
Coal								
State's share (%)	35	32	37	43	53	52	42	9
Investor's share (%)	65	68	63	57	47	48	58	9
Copper								
State's share (%)	39	39	36	63	53	78	51	17
Investor's share (%)	61	61	64	37	47	22	49	17
Distribution of wealth								
Averages								
State's share (%)							49	13
Investor's share (%)							51	13
Effective tax rate (%)								
Greenstone gold	39	32	37	44	48	84	47	19
Witwatersrand gold	49	41	41	69	65	100	61	23
Limestone	39	32	37	43	57	78	48	17
Coal	37	31	36	43	65	62	46	14
Copper	47	42	40	70	66	100	61	23
Effective tax rate (%)								
Average							53	19
Corporate tax rate (%)	33	30	35	34	35	35	34	2

Continuation of Table 7.2

Description	Argentina	Peru	Chile	Mexico	Indonesia	Ghana	Average (6 countries)	Standard Deviation
Royalty analysis Greenstone gold								
Revenue (%)	1.5	0	0	1.5	2.0	12.0	2.8	4.6
Production ($/oz)	2.34	0	0	2.34	3.12	18.72	4.42	7.13
Operating cost (%)	3.3	0	0	3.3	4.4	26.6	6.3	10.1
Taxable income (%)	3.4	0	0	3.3	4.6	35.1	7.7	13.5
Witwatersrand gold								
Revenue (%)	1.5	0	0	1.5	2.0	11.2	2.7	4.2
Production ($/oz)	2.11	0	0	2.11	2.81	15.75	3.80	5.97
Operating cost (%)	2.5	0	0	2.5	3.4	18.9	4.6	7.2
Taxable income (%)	6.5	0	0	6.2	8.8	81.8	17.2	31.8
Limestone								
Revenue (%)	1.5	0	0	1.5	1.0	12.0	2.7	4.6
Production ($/ton)	0.32	0	0	0.32	0.21	2.55	0.57	0.98
Operating cost (%)	3.4	0	0	3.4	2.3	27.3	6.1	10.5
Taxable income (%)	3.2	0	0	3.1	2.4	32.6	6.9	12.7
Coal								
Revenue (%)	1.5	0	0	1.5	13.5	12	4.8	6.3
Production ($/ton)	0.26	0	0	0.26	2.34	2.08	0.82	1.08
Operating cost (%)	8.1	0	0	8.1	72.8	64.8	25.6	33.7
Taxable income (%)	2.1	0	0	2.0	22.3	19.2	7.6	10.3
Copper								
Revenue (%)	1.5	0	0	1.5	2.4	12.0	2.9	4.6
Production ($/lb)	0.01	0	0	0.01	0.01	0.05	0.01	0.02
Operating cost (%)	3.5	0	0	3.5	5.6	27.8	6.7	10.6
Taxable income (%)	4.7	0	0	4.5	7.8	56.4	12.2	21.8
Royalty analysis Averages								
Revenue (%)							3.2	4.9
Production ($/unit)							N/A	N/A
Operating cost (%)							9.9	14.4
Taxable income (%)							21.5	15.6

Source: Appendix A

Notes: N/A Not applicable

The reason investors place their capital in new greenfields mineral projects, is to create wealth for themselves. They therefore require a reasonable return on their investment. The distribution of rent between the country hosting the mineral resource and the investor, is therefore of critical concern to investors. However, this does not mean that investors are reluctant to share the wealth with the host country. By and large, they accept their responsibility of ploughing some of their rents back into the host country, if a mine produces bonanza profits. The recipe for the distribution of rent between the investor and the host country must be equitable to both parties at all times. The results emanating from the model are most interesting, because it attempts to describe this optimal sharing of mineral rents. The initial results summarised in table 7.2 suggest an equal split of the wealth. However, an equal split of rents would ignore the fact that the Latin American countries were prepared to accept a much smaller proportion than that of the investor.

Ghana was again an extreme case, largely because of the country's very high turnover royalties. Although most of the mineral projects in Ghana had reached a stage where they had become profitable, the royalty payments early in the lives of mines when they had not yet recovered the initial investment, resulted in unacceptably low returns because of the time value of money. Applying the usual criteria in order to develop a competitive framework, it appeared that, on average, about forty per cent of the wealth generated should find its way to state coffers while the investor should retain sixty per cent for its effort. Table 7.3 suggests that the opposite was true for South Africa where the ratios were turned around (except for greenstone gold, coal and lime where the split was approximately equal) with the government receiving a higher percentage of the wealth than what the investor received for taking the risk to invest locally. This trend was also visible in the effective tax rate that is discussed in the next paragraph.

Table 7.3 Determination of the true tax competitiveness of South Africa

Description	Maximum (Mean + σ)	New range	New average	SA Green	SA Wits	SA Lime	SA Coal	SA Copper	SA Average
Distribution of taxes									
Income tax (%)	97	28 – 97	77	86	71	66	71	60	71
Royalty (%)	33	0 – 17	6	11	24	16	11	22	17
Minor taxes (%)	16	3 - 16	8	3 (14*)	6 (16*)	18	19	18	13 (17*)
Distribution of wealth									
State's share (%)	N/A	32 – 43	38	49	66	48	47	56	53
Investor's share (%)	N/A	43 - 68	59	51	34	52	53	44	47
Effective tax rate (%)	66	32 - 48	39	54	61	54	50	71	58
Corporate tax (%)	36	30 - 35	34	51-255/x	51-255/x	35	35	35	-
Royalty analysis					15-90/x				
Revenue (%)	8.1	0 – 2.4	0.9	2.5	3.1	3.8	3.8	3.8	3.4
Production ($/unit)	N/A	N/A	N/A	$3.90^{(1.56)}$	$2.83^{(1.41)}$	$0.81^{(0.16)}$	$0.67^{(0.13)}$	$0.02^{(0.01)}$	N/A
Operating cost (%)	24.3	0 – 22.3	3.1	5.5	3.1	8.6	20.4	8.7	9.3
Taxable income (%)	37.1	0 –35.1	6.1	5.7	14.1	8.4	5.4	12.6	9.2

Source: Table 7.2

Notes: Investor's share cannot have a maximum.

Minimum investor's share is calculated as follows:

Minimum = Mean – average standard deviation = 51 – 13 = 38%

Unit royalties in brackets are the average of the competitive framework

* STC option

Direct comparisons between statutory mineral royalty and corporate tax rates of different countries were hampered because depreciation, resource allowances, tax breaks, and other allowable deductions were not accounted for. The method was misleading and the only way to take these factors into account was to build these criteria into a cash-flow model. Once the model had processed all this information, one could use several techniques to compare results. The model described in this chapter compared results on a net present value basis. An analysis of the effective tax rates in table 7.2, revealed a small gap between the corporate tax and effective tax rates in most Latin American mineral projects, proving that policy makers and legislators have succeeded in their quest to become competitive in recent years. The impact of minor taxes on the effective tax rate could be perceived in Mexico and Indonesia where the effective tax rates were significantly higher than corporate tax rates. Ghana had a dismal performance and, with the exception of its coal project, all the other mineral projects were excluded because they are higher than one standard deviation above the average. South Africa's effective tax rates for all mineral types were consistently higher than the suggested average of 39 per cent, which underlined the fact that the state was demanding too high a share of the rent. An interesting observation from the South African results was that it also applied in the case of gold mines, despite the many publications on the fairness of its sliding-scale tax system. However, the initial objective of the sliding-scale style of taxation was to keep marginal mines in production. The results would therefore be very different if the parameters of a marginal mine were built into the cash flow.

The analysis revealed no evidence for gold mines to be treated differently from other mines for income tax and royalty purposes. The sliding-scale nature of the South African gold mines is only of benefit to the mines when profits are very low. In the long term it is not advantageous for the country to subsidise these mines because *'financial engineering'*, instead of economic restructuring, is often considered the solution when gold prices are depressed. When the gold price is high, *'financial engineering'* encourages overspending on capital items in order to lower the tax payment. The assumption is not that formula-type taxation should be abolished in South Africa. However, had the minimum tax recommended by the Corbett (1936) Commission of Inquiry been implemented, this situation would not have occurred.

The model also produced royalty information expressed in terms of revenue, units of production, operating cost, taxable income and the size of the mineral lease area. This information was calculated by dividing the total royalties paid over the life of the mine into total revenue, units produced, taxable income and lease area respectively. The rate per hectare derived from dividing the total royalty into the mineral lease area, was left out of the comparison because mineral lease areas were seldom equal to the mineralised area. If the mineral lease area was significantly larger than the mineralised area, the rate per hectare valuation would be distorted. The royalty on production ($/unit) appears in table 7.2 for country comparison purposes but are indicated as not applicable the final analysis (Table 7.3) because the units of production is not the same for all the mineral types.

The Ghanaian regime (table 7.2) was again not competitive because most of Ghana's indicators were greater than one standard deviation from the average. The framework in table 7.3 suggests that South Africa was on the upper side of the competitive range but there was room for improvement of its royalty system. The cash-flow results suggest that a royalty, when charged on revenue, should not exceed 2,4 per cent. The average royalties for revenue, operating cost and taxable income-based royalties, were 0,9, 3,1 and 6,1 per cent respectively. The South African results showed that the government expected about three per cent royalties, if revenue-based, while royalties on taxable income and operating cost averaged about ten per cent. On the basis of this information, the competitiveness of the current South African royalty system was judged to be reasonable. It still remained on the upper side of the framework and could therefore not be classified as investor-friendly.

7.3 MATTERS ARISING FROM THE ANALYSIS OF THE CASH-FLOW INFORMATION

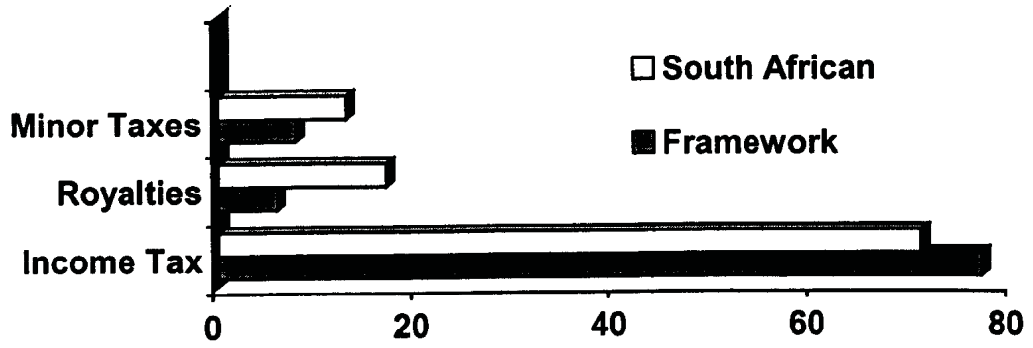
The results of the various cash flows in appendix A were discussed in the previous paragraph are significant in that they highlighted some shortcomings in certain areas of the South African taxation regime and its administration. More specifically, it highlighted areas of research that fell outside the scope of this research, but that could be investigated

in future. The most important areas were summarised in this section.

7.3.1 Distribution of taxes received by the government

Income tax is by far the most important contributor to state revenue. This is clearly evident in figure 7.1, which illustrates that South Africa still regards mineral royalties as a significant source of state revenue. Although its royalty share of sixteen per cent falls inside the suggested range of between zero and seventeen per cent, it is too high for the country to be considered attractive by investors and needs to be refined to improve competitiveness.

Figure 7.1 Graph showing sources of state revenue



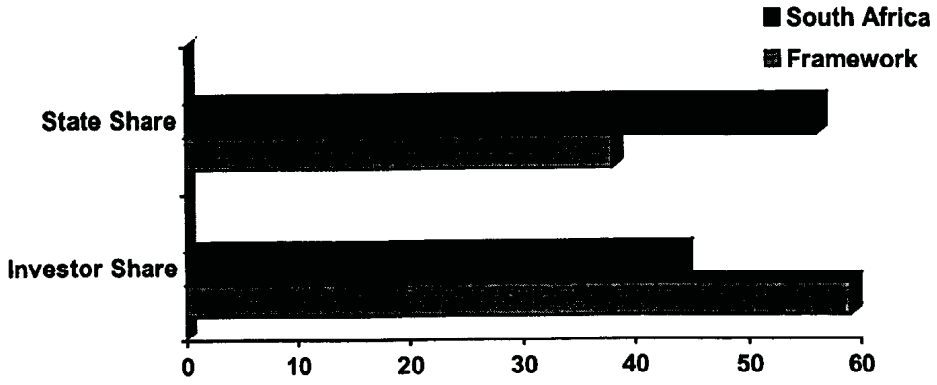
Source: Table 7.3

The royalty issue will be discussed further in the next chapter. However, an area that requires further research is the magnitude and extent of South Africa's minor taxes. The impact of these taxes is out of the competitive range if secondary tax on companies is applied to the two gold projects. The thirteen per cent average is misleading because the secondary tax is already *'built'* into the gold formula. It seems that the 12,5 per cent secondary tax on companies, which is a withholding tax on dividends, is a significant contributor in making the total tax package unacceptably high. Chapter nine contains a brief discussion of the impact of minor taxes on South Africa's tax competitiveness.

7.3.2 Sharing of rent between the government and the investor

The study highlighted that the investor was entitled to a greater share of the mineral rents derived from mining and, as illustrated in figure 7.2, suggested a split of about 60 to 40 in favour of the investor. Splitting the investor's share of the rent among other recipients (see chapter three) is also a subject which requires further research. Figure 7.2 clearly reveals the inverse relationship between the investor's and state's shares of rent. The situation in South Africa is the opposite of the sixty-forty split (in favour of the investor) suggested by the framework. In order for the country to become more competitive in this regard, the state will have to sacrifice some of its income in favour of the investor.

Figure 7.2 Rent sharing between the state and the investor



Source: Table 7.3

7.3.3 Effective tax rates

The question frequently asked in earlier chapters about the competitiveness of the combined impact of the South African mining tax system on new mineral projects, can now be answered. The truth is that South Africa's average effective tax rate (as defined in paragraph 7.1.3) of 61 per cent is significantly above the framework's average of 39 per cent, which suggests that the country still has a long way to go before it can be considered *'attractive'*. This supports the argument of inequitable sharing of rent in the previous paragraph and underlines the importance of research in this field.

CHAPTER EIGHT

AN INTERNATIONALLY COMPETITIVE AND FAIR ROYALTY FOR SOUTH AFRICAN MINERAL RESOURCES

This chapter must be read in conjunction with chapter three, which contains a discussion on the mineral royalty as a rent-capturing instrument, the subtle differences between the various instruments, South African historical issues related to its lease and royalty systems and the impact of the mineral policy on future royalties. The information in chapters three to seven provides the basis for the work in this chapter, that is deriving a formula that will capture royalties in a fair and internationally competitive manner. The formula applies equally to private and state-owned mineral rights and its use could be extended to capture lease revenue for the *'right to mine'* because of the built-in rent sharing mechanism.

8.1 THE GROUND RULES

Any new mineral royalty formula must comply with certain requirements against which its performance can be measured continuously so that it can be adjusted and refined whenever necessary. The requirements for the royalty formula derived in this chapter is summarised briefly as follows:

8.1.1 It must comply with the mineral policy

Since outright selling of state-owned mineral rights is in conflict with the objectives of the Mineral Policy (1998), any transaction over these mineral rights must be based on regular lease instalments in return for the right to mine and remove the minerals from the land. Preferably, the state or any other mineral resource owner must share in the risks of mining, but must also benefit from any price increases and future discoveries. As mentioned in chapter three, there is no reason why a royalty policy should compromise only a single instrument. The policy can be a combination of the

traditional methods and may even include an initial payment or minimum royalty.

South Africa's system of mineral rights and its long mining history demand a royalty regime that takes its unique circumstances into account. The mineral lease system has served the country for a century and any new thinking in this regard must be based on past experience. Uniqueness also means recognising the special characteristics of the mineral resource. However, environmental costs are included in operating costs and need not be included in the royalty equation. The same principle applies to land degradation as a result of mining where landowners receive separate compensation funded by the investor's share of economic rent.

A major requirement of the mineral policy is the immediate vesting in the state of the *'right to mine and prospect for all minerals'*. The objective for the reintroduction of these rights is a first step towards a situation where all mineral rights belong to the state, which is the long-term objective of the mineral policy. This constitutes a repeat of the mining lease history that allowed for a separate layer of mineral rights ownership over and above the compensation payable to the owner of the mineral resource. Another important policy statement is the provision for pre-determined standard terms and conditions for all prospecting and mining licences. The absence of a model mining agreement and standardised mineral royalties have forced mining companies to embark on long and costly negotiations with government.

The new mineral policy has provided for a situation in which state officials, after consulting registered holders of rights, determine the prospecting fees and mineral royalties for all minerals, regardless of their ownership status. This provision may violate an individual's property right that is legally protected in terms of the new constitution. Although the researcher is not qualified to express a legal opinion in this regard, some form of sharing will be proposed later on in this chapter. Finally, the mineral policy calls for a financial disincentive or mineral rights tax over privately-owned mineral rights in order to encourage registered owners to hand the rights over to the state. This issue has been discussed in detail by Minnitt and Cawood (1999) who suggest that the creation of a geographic information system, dubbed the REGAL

system, will be a more successful policy instrument than a financial disincentive.

8.1.2 It must be internationally competitive

Another requirement is that the royalty formula must be *'world class'* and compare with the best and most friendly investment codes in the developing world today. This does not mean the lowest possible rate because, while very low rates may be extremely friendly, it will certainly not be responsible to the public and it can definitely not be classified as optimal. International competitiveness is determined by direct comparison of rates, establishing the impact of mineral royalties on the net present value of a typical minerals project and how they impact on the ultimate sharing of wealth between the investor and the country hosting the mineral resource.

8.1.3 It must be good

The principles of a good minerals taxation regime apply equally to mineral royalties. The royalty derived in this chapter must be neutral, efficient, fair, clear and non-disruptive to both government and industry. Special attention must be paid to the clarity standard, which relates to the ease of administering the royalty and the transparency of the entire royalty regime.

8.2 AN APPROPRIATE METHOD FOR COLLECTING MINERAL ROYALTIES

A wide selection of fiscal instruments is available to policy-makers when they decide on a suitable royalty instrument. The simplest is the unit-based or production royalty. However, it has a major disadvantage because of its insensitivity to price changes. To simply escalate a mineral royalty is inappropriate considering the cyclical nature of mineral prices. Revenue-based royalties are linked to market prices and are certainly more justified than unit-based royalties. It is no wonder that it is currently the most popular and widely used royalty instrument in both the developing and developed mineral producing countries. This does not imply that a method allowing for profits

participation should not be considered. Profit-based royalties can be beneficial to both miner and resource owner if the structure of the royalty adequately protects the resource owner against loss of income. Its major disadvantage is the complexity of its calculation, which makes it difficult to administer. Another variety is the sliding-scale or formula-based royalty. The South African gold mining lease system and the Ghanaian royalty are examples of sliding-scale royalties, based on profits and revenues respectively. The disadvantage of the South African system is that the resource owner may not receive any consideration at all, while the minimum rate for the Ghanaian system is so high that it is skewed in favour of the resource owner. The optimal balance between the two methods will require some compromise in the structure of the formula.

8.2.1 Lessons from the past

Before looking at a new formula for capturing mineral royalties, one should first consider historic events that led to the current structure of the gold mining lease formula and royalties applicable to other mines. The first point to note is the decision to treat certain minerals differently to others, for example the gold mines in South Africa that pay according to a sliding-scale formula based on profits. Other mines normally pay revenue-based royalties and there is no economic evidence to justify preferential treatment for gold mines. Ultimately, payment should be based on *'the ability to pay'* principle regardless of the mineral being mined. The ability to pay depends on the fairness of the royalty instrument, revenue received for the mineral production and the cost to deliver production at the point of sale. South African gold mines receive preferential treatment because government policies are aimed at maintaining employment levels, regardless of mine profitability.

Under the previous laws, gold mines had to pay a lease consideration to the state for the *'right to mine'*, not for the mineral rights, which could have been owned privately or publicly. If the state owned the mineral rights, no royalty was payable over and above the lease consideration. However, if the mineral rights were privately owned, the mine owner had to compensate the owner of the rights in addition to the lease

consideration. When the right to mine principle expired in 1994 with the introduction of the Minerals Act No. 50 of 1991, the lease consideration concept was abolished and mines over privately-owned mineral rights no longer had to pay a lease consideration to the state. The lease formula was retained over state-owned mineral rights but it is currently a royalty payment, instead of compensation for the right to mine. Before tampering with the present royalty system, let us consider how the lease formula evolved. The first mining lease was issued by the Union of South Africa in 1910 to Government Gold Mining Areas and had the following formula:

$y = 5.467 + 1.06487x - 53.66/x$ **when x was less than 36.1702, or**

$y = 82.5 - 1446.81/x$ **when x was greater than 36.1702**

Both formulae were subject to a minimum lease rate (y) of 10.75%

Where y is the lease rate and x the profit to revenue expressed as a percentage.

An examination of the above formulae reveals the following important issues:

- An appreciation for mine profitability and its impact on the *'ability to pay'* principle;
- The importance of connecting a minimum rate to a profit-based formula;
- There is no provision for any lease-free revenue.

By taking the above observations into account, the two formulae and the provision for a minimum lease rate, could have been simplified as follows:

$$y = 10.75 + \ldots$$

Mr IJ Haarhoff proposed a similar scheme for collecting royalties for all mineral types in his 1917 submission to the Frames (1917 and 1918) Commission of Inquiry. His method (which was an alternative to the lease consideration concept) was based on revenue and not profits, similar to the Ghanaian royalty of today. It is not known if he had access to the classical theory of mineral rent, but his argument was based on the

approach of Sorley (1889). Sorley's definition of rent included two key components, that is fixed or Ricardian rent (periodic payments to the landlord regardless of the levels of production) as well as excess rents determined by the relationship between the costs of production and the market price. Taussig (1911) expanded Sorley's concept that royalties were a combination of fixed payments (per ton) and variable payments according to the quality of minerals and ease of extraction. He appreciated the reality that the owner of a high-quality mineral resource was entitled to a higher royalty or mineral rent. Although the committee members were not interested in Mr Haarhoff's argument at the time, in the researcher's opinion, his scheme would have been, a greater success than the traditional sliding-scale formula. Although Mr Haarhoff did not supply the Commission with a formula, the key words of his submission contained the following critical issues:

- The state must not become involved with the physical mining of minerals. It should impose a royalty on privately-owned mines rather than looking at increased state involvement, such as creating state mines and giving itself the right to mine minerals.
- The royalty must be levied on revenue, but at the same time recognise profitability.
- The government must exercise some discretion when revenue-based royalties result in a mine becoming unprofitable.

Taking cognisance of the above, Mr Haarhoff's scheme will probably take on the following format if it were to be expressed in a formula:

y = a + allowance for higher royalties in times of high profitability
Subject to the provision that a special royalty can be negotiated with the government for extraordinary mineral projects.

Before continuing with South African lessons from the past, it is necessary to consider the work done by Bradley (1986) and how his views relate to those of Haarhoff. *First*, Bradley found that *"The different and sometimes conflicting criteria for royalties can best*

be satisfied by a system that incorporates more than one royalty instrument". p. 5. Second, he advocated a trade-off between flexibility on the one hand and a standardised royalty on the other. *Third,* he recommended that the preferred royalty instrument should be a combination of a basic *ad valorem* royalty and a net value royalty. *Finally,* he stated that his two-part royalty system should apply equally to gold as to other metallic minerals. All these recommendations were evident in Haarhoff's supposedly unimportant contribution to the Commission. In retrospect it seems that the Commission would have done well to listen to him.

By 1918 the two lease formulae allowing for different degrees of profitability as implemented on Government Gold Mining Areas were combined into a single formula for Craigie Mines Limited. It reads as follows:

$$y = 46 - 960/x$$

Subject to a minimum lease rate (y) of 12.5%

Effectively, the formula had the following format:

y = 12.5 + allowance for higher royalties in times of high profitability

The practice of attaching a minimum royalty to the lease formula has disappeared since then, probably because the mines experienced very difficult times in the early nineteen twenties. The Soloman (1922) Commission of Inquiry mentioned in their report to the government of the day that falling commodity prices, which marginalised many mines, led to pay disputes that ultimately resulted in the big strike of gold and coal mine workers in 1922. The researcher suspects that the labour unrest, which was characterised by extreme violence, forced the government to abolish the minimum consideration in order to make more cash available to the mines to meet worker demands.

Although a minimum rate no longer applied to the lease consideration, it was still valid for the income tax regime through a standard tax rate for all mines that lasted until

1936. (See table 1.2 that explains how corporate income taxes evolved in South Africa). Another significant event in the evolution of the South African mining tax system came with the abolition of the gold standard in 1932. The government of the day developed a formula that allowed it to share in any excess profits that could result from higher gold prices after 1932. The significance of the formula was that profits after 1932 were linked to a standard per ounce of gold as well as to the grade of the ore mined. The reader must refer to chapter one for an explanation of how this complex fiscal instrument worked. We can learn from this instrument, especially if it is expressed as follows:

y = minimum or standard tax + mechanism to pay higher taxes when profits are in excess of historic standards

From 1936 onwards, mines had a choice to pay the standard tax plus an adjustment on additional profits or to change to an the following all-inclusive formula:

$$y = 40 - 500/x$$

This was partly a contradiction of the recommendations by the Corbett (1936) Commission of Inquiry. Although the Commission investigated mining income taxes and not mineral royalties, the principle applied equally. The Commission pushed for a minimum corporate tax rate of fifteen per cent over and above a sliding-scale tax formula, similar to the lease consideration formula. The chief objective of the sliding-scale formula on top of the minimum tax was to capture a share of the excess profits for the state and **not to support marginal mines which had to pay the proposed fifteen per cent minimum tax.** The formula would then have read as follows:

y = a + allowance for higher taxes in times of high profitability

In essence, the above-mentioned formula was the same as the one based on Mr Haarhoff's ideas. For some reason, probably because of the declared Union policy of protecting employment opportunities by prolonging the lives of gold mines, the

government did not reintroduce the minimum payment concept. It accepted the arguments in favour of a separate taxation system for gold mines and introduced a (modified) lease consideration formula for corporate income tax purposes. Had the minimum been reintroduced in 1936, the present resistance to formula-type taxation would not have occurred. The Margo (1987) Commission of Inquiry questioned the appropriateness of such a system and was clearly against the extension of this style of taxation to other minerals.

8.2.2 The structure of the formula

The lessons from the past showed that an appropriate mineral royalty formula should incorporate a minimum royalty connected to a suitable mechanism for capturing excess rents. The basic structure should resemble the following formula derived from Mr Haarhoff's submission to the Frames Commission of Inquiry in 1917:

y = a + allowance for higher royalties in times of high profitability
Subject to the provision that a special royalty can be negotiated with the government for extraordinary mineral projects.

From the above discussion it appears that several attempts have been made to adopt formulae that would provide for minimum payments, but none could be sustained for a significant duration. The first step in deriving a formula of this nature is to investigate the minimum rate at which royalties should be charged. The competitive framework developed in chapter six using the direct comparison method (table 6.4) suggests that mineral royalties should range from zero to three per cent with an average rate of 1,3 per cent. The more sophisticated approach in chapter seven (table 7.3) indicates a range of zero to 2,4 percent with an average of 0,9 per cent. One could argue that, because both methods give an average of about one per cent, there is no need for further research and to simply introduce a mineral royalty of one per cent on all minerals. However, the lessons from the past clearly underline government's philosophy that it has a right to share in excess rents. There is a definite case for the one per cent average royalty to be implemented as a minimum royalty in South Africa

for the following reasons:

- Revenue-based royalties are frequently encountered in most mineral lease agreements over state-owned mineral rights. These rates range from one per cent (gold by-product production at Okiep Copper Mines) to five per cent which is the current maximum royalty rate. The one per cent minimum royalty also complies with the recent agreement between Impala Platinum Mines and the Bafokeng Tribe, which is a transaction over privately-owned mineral rights. The royalty at Impala was fixed at twenty-two per cent of taxable income, subject to a minimum royalty of one per cent of revenue. There is a good precedent that supports the one per cent minimum royalty payment. The one per cent royalty on the value of the minerals mined dates back to 1897 (Nathan, 1944) and was applicable to base metals on **both crown and private land** in South Africa. It is important to note that the state attempted to share in the royalties over privately-owned mineral rights from the earliest days of the South African mining history and in 1999, we are again investigating ways of sharing rent on all categories of land.

- The new mineral policy of 1998 provides for a situation where state officials, after consulting registered holders of rights, determine the prospecting fees and royalties for all minerals, regardless of ownership status. This will make some form of sharing necessary over privately-owned mineral rights. The minimum may well be channelled to the owner of the mineral rights while the state would retain the royalties over and above this amount as compensation for the *'right to mine'* as confirmed in the White Paper.

- Following acceptance of the one per cent minimum royalty rate, the formula will change as follows:

y = 1 + allowance for higher royalties in times of high profitability

Subject to the provision that a special royalty can be negotiated with the government for extraordinary mineral projects.