National Accounts

Environmental Economic Accounts

Mineral Accounts for South Africa: 1980–2007

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List of abbreviations and acronyms

AFS	Annual Financial Statistics Survey
DMR	Department of Mineral Resources (Department of Minerals and Energy prior to July 2009 (President's Minutes No. 690 of 2009)
EEA	Environmental Economic Accounts
GDP	Gross domestic product
LSS	Large Sample Survey
MPRDA	The Mineral and Petroleum Resources Development Act
OECD	Organisation for Economic Co-operation and Development
PGM	Platinum group metals
PMG	Parliamentary Monetary Group
R	South African Rand
RRR	Real rate of return
R/kg	Rand per kilogram
SAMI	South Africa's Mineral Industry
SARB	South African Reserve Bank
SEEA	System of Integrated Environmental Economic Accounting
SIC	Standard Industrial Classification of All Economic Activities
SDR	Social Discount Rate
US$	United Stats Dollar
Stats SA	Statistics South Africa
1993 SNA	1993 System of National Accounts

Executive summary

South Africa's mineral wealth is found in diverse geological formations, some of which are unique and extensive by world standards. For the purpose of the minerals account, some of the country's minerals include but are not limited to the list below:

- Gold – the unique and widespread Witwatersrand Basin yields some 96% of South Africa's gold output.
- Platinum group metals (PGM), chrome and vanadium – these minerals occur in the Bushveld Igneous Complex in Mpumalanga, Limpopo and North West. More than half of the world's chrome and proven platinum reserves are in this deposit.
- Bituminous coal and anthracite seams occur in the Karoo Basin in Mpumalanga, KwaZulu-Natal, Free State, Limpopo and Eastern Cape.

Due to the small domestic market for most commodities, South Africa's mineral industry is export-oriented. South Africa was ranked number two in 2007 in the production of gold and one of the largest exporters of gold[1]. With regard to mineral reserves, South Africa ranked number one in 2007. Another important export commodity is coal. Because of its vast mineral resource base, South Africa is to a large degree self-sufficient regarding the supply of minerals. According to the Stats SA (*Mining: Production and sales,* P2041, December 2008)[2], South Africa's sales of primary minerals totalled R224 438 million in 2007. The value of exports of primary minerals in 2007 totalled R161 756 million[1].

Gold

South African gold output steadily decreased from 675 tons in 1980 to 253 tons in 2007. South Africa's gold production decreased by 7% from 272 tons in 2006 to 253 tons in 2007, largely as a result of the mining of lower-grade ore, made economic by higher rand gold prices, as well as new safety procedures, which involved the temporary closure of a shaft where a fatal incident had occurred to facilitate an audit with a view to improving safety. The total output (sales) revenue of gold was R38 036 million in 2007.

Platinum group metals

PGM constitute a family of six chemically similar elements, which include platinum, palladium, rhodium, ruthenium, iridium and osmium. South Africa's PGM production decreased from 309 tons in 2006 to 304 tons in 2007. PGM export sales revenue in 2007 was R66 010 million, due to a higher average rand basket price for 2007[3]. PGM total output (sales) for 2007 amounted to R78 360 million.

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[1] Department of Minerals and Energy, 2007/2008. South Africa's Mineral Industry 2007/2008.
[2] Statistics South Africa, 2008. *Mining: Production and sales, 2008,* Statistical release P2041.
[3] Government Communication Information System, 2008/09. South African Yearbook 2008/09: Minerals, Energy and Geology.

Coal

In 2007, South African mines produced 248 million tons of coal. Of this figure, 183 million tons was used (sold) locally, at a value of R19 719 million, with export sales totalling 68 million tons at a value of R24 448 million[4]. South Africa has approximately 27 981 million tons of proven coal reserves, making it the eight-largest holder of proven coal reserves in the world and ranked number five in coal production[5].

Key findings

Gold production (extraction) has steadily declined over the period from 1980 to 2007. In 1980 the total production was 675 tons declining by 63% to 253 tons in 2007. With this decline in production (extraction) there was also a similar decline of 64% in the volume sold for gold over the same period from 675 tons to 243 tons. At this current extraction rate, proven gold reserves are estimated to last another 143 years (as at 2007). PGM showed a substantial increase in production (extraction) over the recorded period. In 1980 production of PGM in South Africa was at 114 tons, maintaining a steady increase of 166% to 304 tons for 2007. The volume sold also increased at a rate of 130% from 1980 to 2007. At the 2007 extraction rate, proven PGM reserves will last for another 230 years. Coal production (extraction) has experienced an increase over the same period from 1980 to 2007. In 1980 production (extraction) was 115 million tons and in 2007 production (extraction) has increased by 116% to 248 million tons. The volume sold showed an increase of 121% from 113 million tons in 1980 to 250 million tons in 2007. The estimated number of years to depletion for proven coal reserves in 2007 was 113 years.

For the same period gold output (sales) increased from R10 395 million in 1980 to R38 036 million in 2007. Intermediate consumption increased from R1 454 million in 1980 to R8 232 million in 1992. PGM output (sales) showed a large increase of from R851 million in 1980 to R78 360 million in 2007. Output (sales) showed a steady annual increase from 1980 to 1997 and from 1998 to 2007 the annual increases began by an average of between R2 000 million and R13 000 million. Intermediate consumption also showed a large increase from R128 million in 1980 to R5 237 million in 1997. Coal output (sales) experienced a large increase from R1 497 million in 1980 to R44 166 million in 2007. Coal intermediate consumption increased steadily from R507 million in 1980 to R3 816 million in 1992.

Gold mineral asset value for closing stock at 3%, 5% and just below 12% (see Annexure 1 – it explains the process of deriving at these social discount rates) for annual values showed a declining trend through the period 1980 to 2001. In 2001 the asset value for closing stock is negative. The closing stock begins to recover until 2006 but drops again in 2007. The closing stock for PGM at 3%, 5% and just below 12% at annual values all showed an increasing trend from 1980. From 1990 to 2000 the closing stock started on a declining trend where negative values are represented for the years 1993 to 2000, but from 2001 the closing stock for PGM showed a recovery trend up to 2007. The closing stock for coal for the period 1980 to 2007 has shown a positive trend for both annual and 5-year moving averages with only negative values in 1999, 2000 and 2004 at the discount rate of just below 12% for annual values and at 5-year moving average there are only negative values for 2003 and 2004 at just below 12%.

[4] Department of Minerals and Energy, 2007/2008. South Africa's Mineral Industry 2007/2008.
[5] Government Communication Information System, 2008/09. South African Yearbook 2008/09: Minerals, Energy and Geology.

The income component (X) for gold at a RRR of just below 12% decreased over the 27 years. The income component in 1980 was R6 509 million decreasing to -R3 912 million in 2007. The capital component also showed a decrease from approximately R2 million to R0 million. The capital depreciation factor remained unchanged from 1980 to 2007 at 0%.

The income component (X) for PGM at a real rate of return (RRR) of just below 12% increased over the 27 years from 1980 to 2007. The income component in 1980 was R401 million increasing to R14 589 million in 2007. The capital component remained unchanged at R0 million. The capital depreciation factor also remained unchanged at 0% in 2007.

The income component (X) for coal at a RRR of just below 12% increased over the 27 years from 1980 to 2007. The income component in 1980 was R220 million increasing to R4 980 million in 2007. The capital component also remained stable at R0 million. The capital depreciation factor remained unchanged at 0% for the 27 year period.

1. Introduction

The purpose of this discussion document is to present the updated mineral accounts for South Africa for the period of reference 1980 to 2007. This is the fourth document for mineral accounts that Statistics South Africa (Stats SA)[6] has compiled. The previous mineral accounts document also presented the physical, monetary and resource rent accounts. The three main differentiating features for this mineral accounts document is that there is a more in-depth analysis of the account, specifically regarding the results presented in the resource rent and monetary accounts. The results for the El-Serafy's Use-Cost method are presented in a table format where previously only the importance and methodologies were discussed. Finally there is geographical representation of the active mines in South Africa.

This discussion document first presents the importance of mineral accounts in South Africa. Section 3 presents the updated physical accounts for South Africa where the production (extraction) rate and years to depletion is shown. In section 4 the resource rent accounts are presented along with an in-depth analysis of the results. In section 5 the monetary accounts are presented where the monetary value of South Africa's proven gold, platinum and coal reserves are shown. The monetary accounts are drawn up with the assistance of the resource rent accounts. Section 6 focuses on the policy analysis of the mineral accounts, with the use of the El-Serafy's Use-Cost method.

In Annexure 1, a detailed description of the methodologies used to compile the accounts is given along with the methods used to perform a policy analysis for gold, platinum and coal in South Africa.

[6] A first discussion document was published in September 2002 and a report document in September 2004. A second discussion document was published in December 2008.

2. The importance of mineral accounts for South Africa

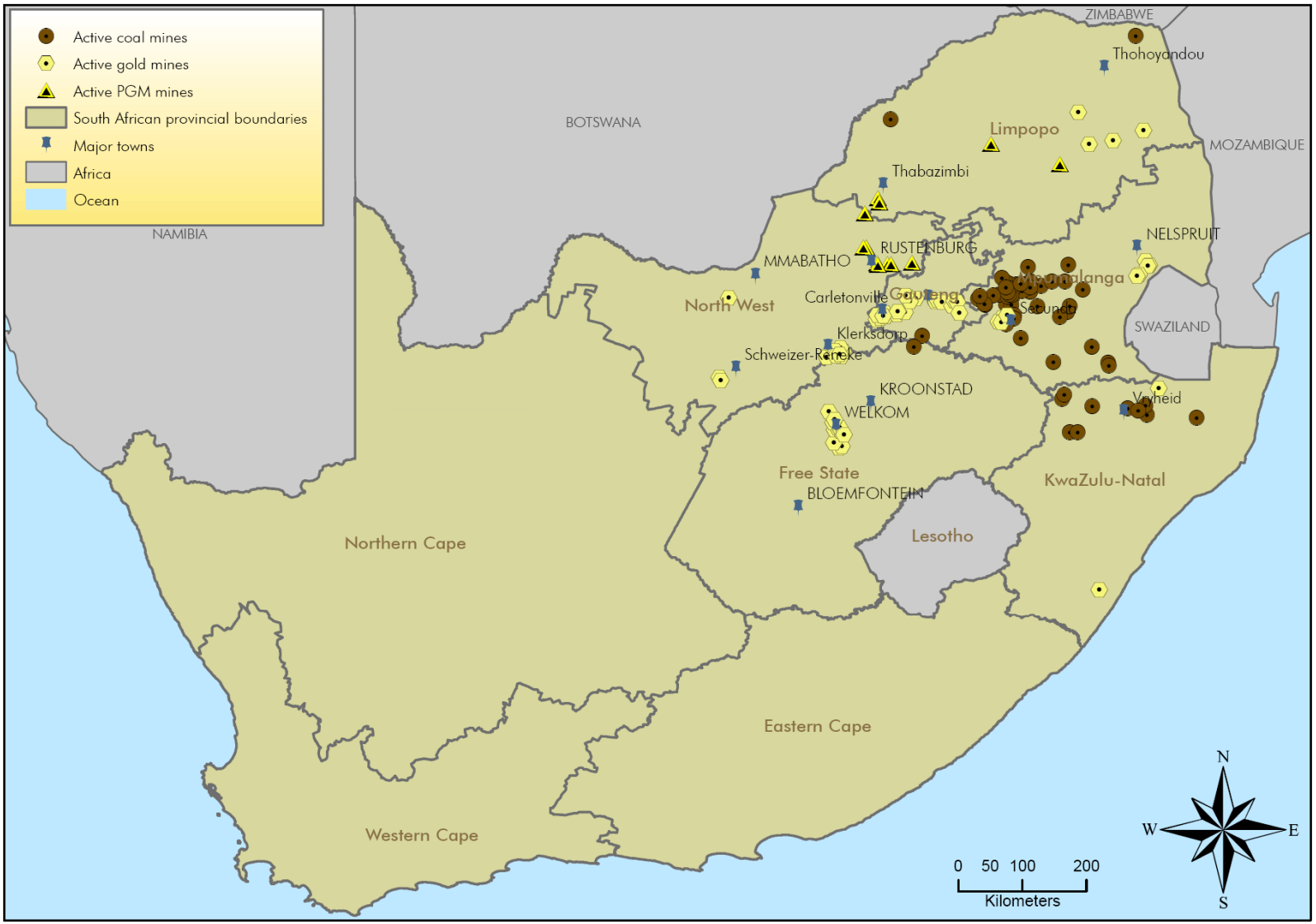
The South African mining industry's contribution to the gross domestic product (GDP) is just below 9% for 2007[7] and the sector provides employment to a large number of South African families. According to Stats SA (Quarterly Employment Statistics, P0277, September 2009), direct employment by the mining industry totalled 506 000 employees in December of 2007. According to the Chamber of Mines of South Africa it was estimated that another 165 000 workers were employed in associated industries that either supplied products to, or used products from the mining industry (bringing into effect the multiplier linkages of the industry) and in 2007 around five million people were directly dependent on mine employees for their daily subsistence. The mining industry accounted for 6% of those employed in the non-agricultural formal sector of the economy. The mining sector paid R 49 828 million in wages and benefits to employees, which accounted for about 6% of the total compensation paid to all employed people in the country for 2007[8]. This contributed substantially to domestic demand in the South African economy.

Some of the livelihoods and economies in South African mining towns are mostly, if not totally, reliant on the mines in and around the specific towns. Figure 1 illustrates the geographical positions of active gold, PGM and coal mines in South Africa. The majority of mining activities happen in Gauteng, Free State, Mpumalanga and KwaZulu-Natal. Figure 2 illustrates the active gold mines in Gauteng, which houses most of the active gold mines in South Africa. Figure 3 illustrates the active PGM mines in North West and Limpopo. Figure 4 illustrates all the active coal mines in Mpumalanga where the majority of South African coal mines are located. From these geographical maps, it is possible to see all the towns that have developed due to the mining activities in the areas where mines are located.

Through mineral accounting it is possible to measure the sustainability of the resources which will be depleted, and provides the information to government about who has to insure that there are sufficient jobs for the people that rely on the mining industry for employment. Some minerals, e.g. gold, are increasingly difficult to exploit due to the great depths at which they are situated and their fairly low-grade quality. If the resources are depleted or are no longer economically viable to extract, the mines could close down, resulting in job losses with no steady flow of income to the families of those who were previously employed by the mining industry. It becomes equally important to measure the physical volume of minerals that are left and hence calculate the years to depletion to enable planning for the future and insure the sustainability of not only the mining industry, but most importantly the sustainability of associated employment. This involves the necessity of calculating the resource rents produced through the mining activities and to calculate which percentage of these rents should be re-invested to maintain a constant stream of income (capital component) or the residual amount that can be consumed as current income (income component).

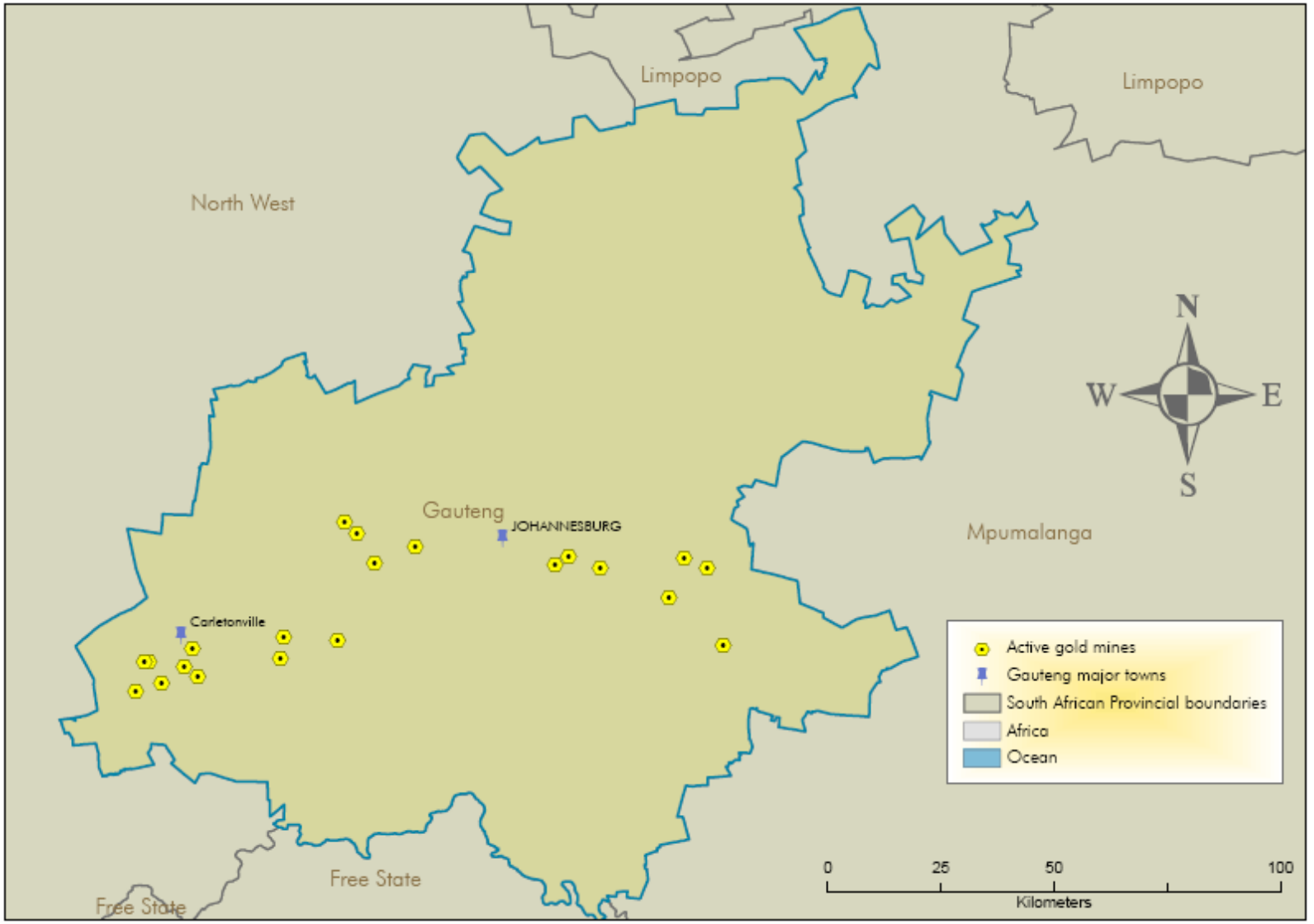
[7] Statistics South Africa, 2009. Gross domestic product, November 2009, Statistical release P0441
[8] Statistics South Africa, 2009. Quarterly Employment Statistics, September 2009, Statistical release P0277

Figure 1: Active gold, platinum group metals and coal mines in South Africa



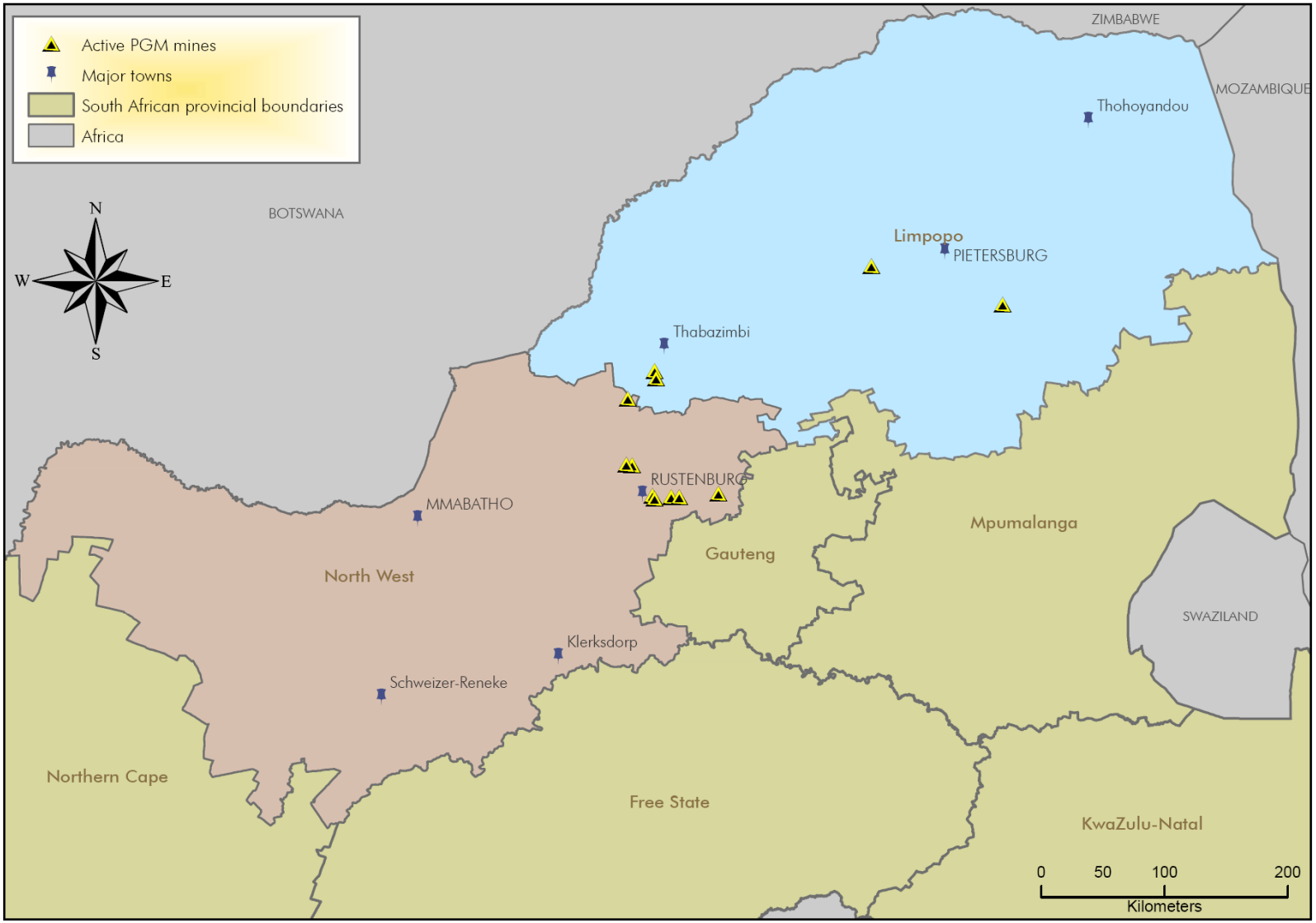
Data Source: Council for Geoscience and Statistics South Africa.

Figure 2: Active gold mines in Gauteng



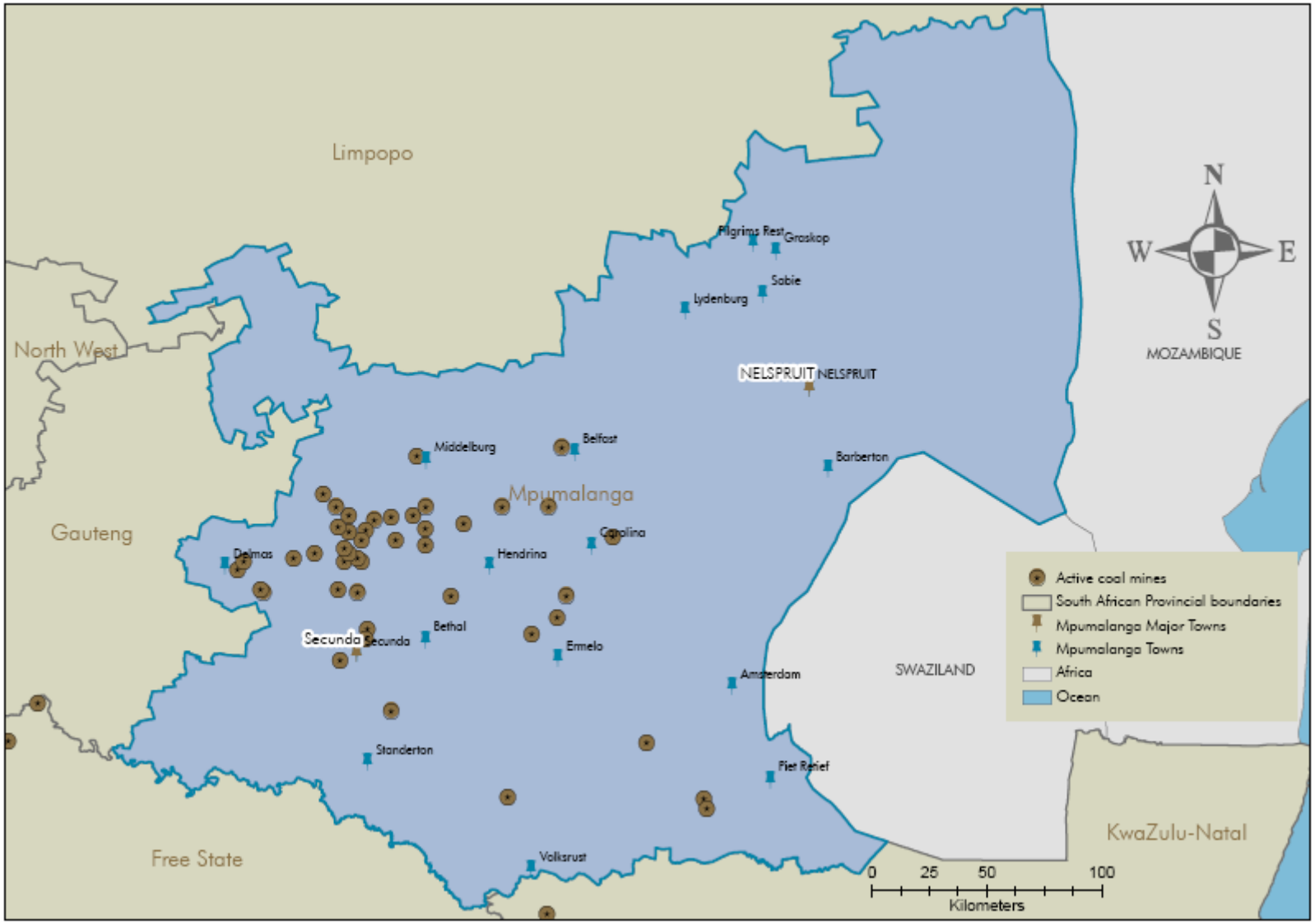
Data Source: Council for Geoscience and Statistics South Africa.

Figure 3: Active platinum group metals mines in North West and Limpopo



Data Source: Council for Geoscience and Statistics South Africa.

Figure 4: Active coal mines in Mpumalanga



Data Source: Council for Geoscience and Statistics South Africa.

3. Physical accounts for the South African mining industry

This section presents the updated physical accounts for gold, PGM and coal for the period of reference 1980 to 2007. The physical accounts consist of the following components: opening stock; production (extraction); closing stock (sub-soil assets); volume sold; net change in inventories; closing stock (including inventories); and years to depletion of the particular mineral. These different components enable the monitoring of the physical volumes of mineral resources.

3.1 Gold

Due to the small domestic market for most commodities, South Africa's mineral industry is export-oriented. South Africa was a leading gold producer, second to China in 2007, and one of the largest exporters of gold[9].

Physical accounts for gold are presented in Table 1. The clear trend that can be observed from Table 1 is the rate of production (extraction) of gold and how it has steadily declined over the observed period from 1980 to 2007. In 1980 the total production was 675 tons declining by 63% to 253 tons in 2007. With the decline in production (extraction) there was also a similar decline of 64% in the volume sold for gold over the same period from 675 tons to 243 tons. This has a direct effect on the years to depletion of gold which has steadily increased by 93% from 74 years in 1980 to 143 years left at the current extraction rate of 253 tons in 2007 (refer to Figure 5).

The decrease of South Africa's gold production by 7% from 272 tons in 2006 to 253 tons in 2007 according to the Department of Mineral Resources (DMR) was due to the mining of lower-grade ore, made economically viable by higher rand gold prices, as well as new safety procedures which involved the temporary closure of a shaft in order to facilitate a safety audit[9].

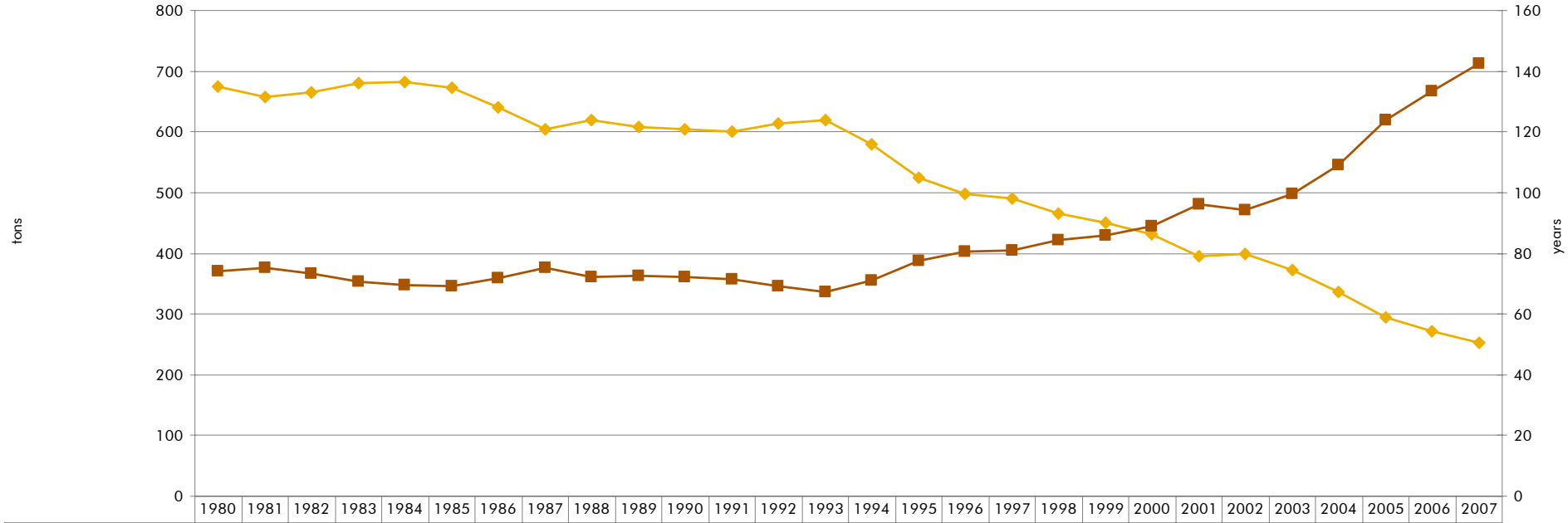
[9] Department of Minerals and Energy, 2007/2008. South Africa's Mineral Industry 2007/2008.

Table 1: Gold: physical accounts for South Africa, 1980–2007

	Tons								
Year	Opening stock*	Production* (extraction)	Discoveries	Other volume changes	Closing stock* (sub-soil assets)	Volume sold	Net changes in inventories	Closing stock* (including inventories)	Years to depletion*
1980	50 706	675	0	0	50 030	675	0	50 031	74
1981	50 030	658	0	0	49 373	661	-3	49 369	75
1982	49 373	664	0	0	48 708	662	3	48 711	73
1983	48 708	680	0	0	48 029	669	11	48 039	71
1984	48 029	682	0	0	47 347	685	-3	47 344	69
1985	47 347	673	0	0	46 674	677	-5	46 669	69
1986	46 674	640	0	0	46 034	642	-2	46 032	72
1987	46 034	604	0	0	45 429	602	2	45 432	75
1988	45 429	620	0	0	44 810	618	2	44 811	72
1989	44 810	608	0	0	44 202	606	2	44 204	73
1990	44 202	605	0	0	43 597	596	9	43 606	72
1991	43 597	601	0	0	42 996	601	0	42 995	72
1992	42 996	613	0	0	42 383	613	0	42 383	69
1993	42 383	619	0	0	41 763	619	0	41 764	67
1994	41 763	580	0	0	41 183	580	0	41 183	71
1995	41 183	524	0	0	40 659	524	0	40 659	78
1996	40 659	498	0	0	40 161	496	2	40 163	81
1997	40 161	491	0	0	39 670	508	-17	39 653	81
1998	39 670	465	0	0	39 205	465	0	39 206	84
1999	39 205	451	0	0	38 754	455	-4	38 750	86
2000	38 754	431	0	0	38 323	406	25	38 348	89
2001	38 323	395	0	0	37 928	387	8	37 937	96
2002	37 928	399	0	0	37 530	396	3	37 532	94
2003	37 530	373	0	0	37 157	376	-2	37 154	100
2004	37 157	337	0	0	36 819	347	-10	36 810	109
2005	36 819	295	0	0	36 525	270	25	36 549	124
2006	36 525	272	0	0	36 253	283	-11	36 242	133
2007	36 253	253	0	0	36 000	243	10	36 010	143

Notes: Discoveries = 0 due to confidentiality in mining industry; see Annexure 1, methodological notes, for the definition of the variables.
*Where figures have been rounded, discrepancies may occur with totals.
Source: Department of Minerals and Energy (SAMI 2007/2008, Statistical Tables 1985–2007). Calculations: Statistics South Africa.

Figure 5: Gold: production and years to depletion, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Production (extraction)	675	658	664	680	682	673	640	604	620	608	605	601	613	619	580	524	498	491	465	451	431	395	399	373	337	295	272	253
Years to depletion	74	75	73	71	69	69	72	75	72	73	72	72	69	67	71	78	81	81	84	86	89	96	94	100	109	124	133	143

Source: Department of Minerals and Energy (SAMI 2007/2008, Statistical Tables 1985–2007). Calculations: Statistics South Africa.

3.2 Platinum group metals

PGM constitute a family of six chemically similar elements, which include platinum, palladium, rhodium, ruthenium, iridium and osmium. South Africa's PGM production decreased from 309 tons in 2006 to 304 tons in 2007. PGM export sales revenue in 2007 was R66 010 million, due to a higher average rand basket price for 2007[10]. PGM total output (sales) for 2007 amounted to R78 360 million. The increase in production and sales volumes could mostly be due to the steady increase in the price and demand of PGM world wide. According to the DMR world demand for platinum, palladium and rhodium in 2007, climbed by 6% to 458 tons. This was caused primarily by a 9% increase in the demand for platinum.

Unlike gold, PGM has experienced a substantial increase in production (extraction) over the recorded period from 1980 to 2007. In 1980, production of PGM in South Africa was at 114 tons, production decreased in 1982 to 85 tons but showed a steady increase by 166% to 304 tons in 2007. The volume sold has also experienced an increase equating to 130% from 1980 to 2007. Figure 6 illustrates that increased production has decreased the years to depletion. In 1980 South Africa was standing at 656 years whereas in 2007 it was at 230 years to depletion, representing a 65% decrease in the depletion rate.

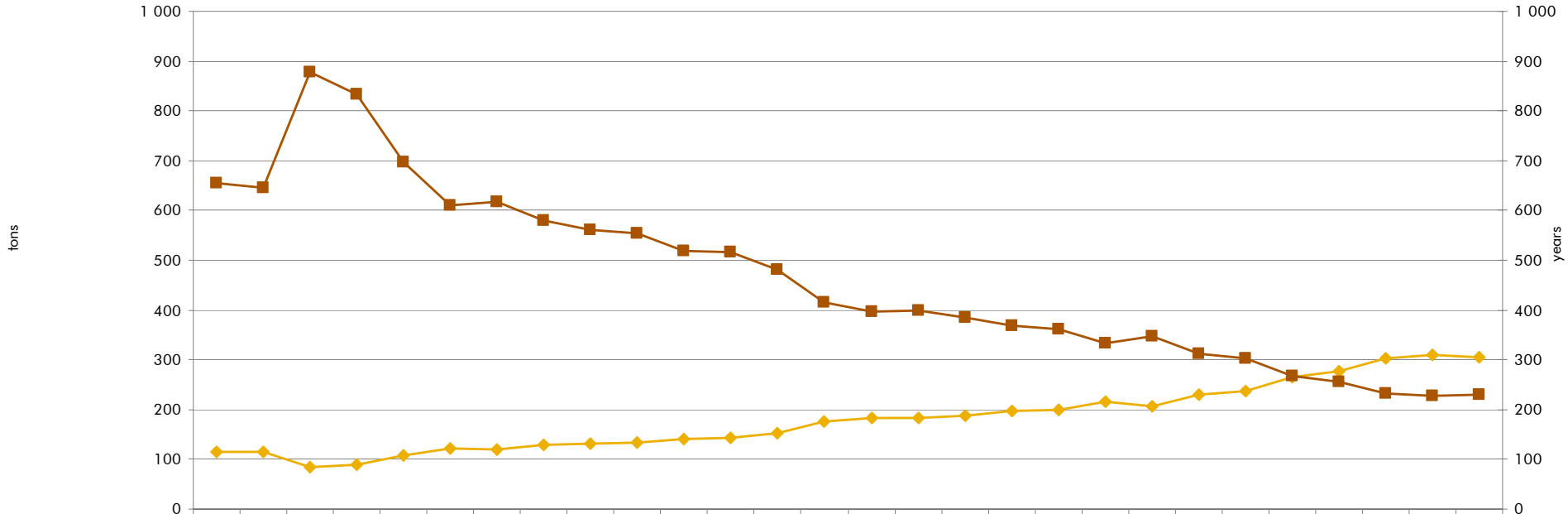
[10] Government Communication Information System, 2008/09. South African Yearbook 2008/09: Minerals, Energy and Geology.

Table 2: Platinum group metals: physical accounts for South Africa, 1980–2007

	Tons								
Year	Opening stock*	Production* (extraction)	Discoveries	Other volume changes	Closing stock* (sub-soil assets)	Volume sold	Net changes in inventories	Closing stock* (including inventories)	Years to depletion*
1980	75 061	114	0	0	74 947	112	2	74 949	656
1981	74 947	116	0	0	74 831	104	12	74 843	646
1982	74 831	85	0	0	74 746	98	-13	74 733	877
1983	74 746	90	0	0	74 656	104	-14	74 642	834
1984	74 656	107	0	0	74 549	113	-6	74 544	697
1985	74 549	122	0	0	74 428	118	4	74 431	611
1986	74 428	121	0	0	74 307	120	0	74 307	616
1987	74 307	128	0	0	74 179	130	-2	74 177	580
1988	74 179	132	0	0	74 047	131	1	74 048	562
1989	74 047	134	0	0	73 914	137	-4	73 910	553
1990	73 914	142	0	0	73 772	136	6	73 778	520
1991	73 772	143	0	0	73 629	141	2	73 631	515
1992	73 629	153	0	0	73 476	137	16	73 492	481
1993	73 476	176	0	0	73 300	154	22	73 322	416
1994	73 300	184	0	0	73 116	162	22	73 138	398
1995	73 116	183	0	0	72 933	175	8	72 941	398
1996	72 933	189	0	0	72 744	184	5	72 749	386
1997	72 744	197	0	0	72 548	187	9	72 557	369
1998	72 548	200	0	0	72 348	194	6	72 354	362
1999	72 348	216	0	0	72 131	199	18	72 149	333
2000	72 131	207	0	0	71 924	199	8	71 932	348
2001	71 924	230	0	0	71 695	193	36	71 731	312
2002	71 695	237	0	0	71 458	208	29	71 487	302
2003	71 458	265	0	0	71 193	241	24	71 217	268
2004	71 193	276	0	0	70 916	260	17	70 933	257
2005	70 916	303	0	0	70 613	259	44	70 657	233
2006	70 613	309	0	0	70 304	266	43	70 347	227
2007	70 304	304	0	0	70 000	258	46	70 046	230

Notes: Discoveries = 0 due to confidentiality in mining industry; see Annexure 1, methodological notes, for the definition of the variables.
*Where figures have been rounded, discrepancies may occur with totals.
Source: Department of Minerals and Energy (SAMI 2007/2008, Statistical Tables 1985–2007). Calculations: Statistics South Africa.

Figure 6: Platinum group metals: production and years to depletion, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Production (extraction)	114	116	85	90	107	122	121	128	132	134	142	143	153	176	184	183	189	197	200	216	207	230	237	265	276	303	309	304
Years to depletion	656	646	877	834	697	611	616	580	562	553	520	515	481	416	398	398	386	369	362	333	348	312	302	268	257	233	227	230

Source: Department of Minerals and Energy (SAMI 2007/2008, Statistical Tables 1985–2007). Calculations: Statistics South Africa.

3.3 Coal

South Africa has approximately 27 981 million tons of proven coal reserves, making it the eight-largest holder of proven coal reserves in the world and ranked number five in coal production[11].

Coal production (extraction) in South Africa has experienced an increase over the observation period of 1980 to 2007 (refer to Table 3). In 1980 production (extraction) was 115 million tons and in 2007 production was 248 million tons, which represents an increase of 116%. The volume sold showed an increase of 121% from 113 million tons in 1980 to 250 million tons in 2007. Figure 7 illustrates that an increase in production (extraction) has caused the years to depletion to decrease by 61%. In 1980 there were 290 years to depletion and in 2007 there were only 113 years to depletion.

The increase in production (extraction) and volume sold that is observed in the physical accounts for coal (refer to Table 3) is due to the increase in demand for coal as a source of producing electricity. According to the Chamber of Mines of South Africa 110 million tons of coal was mined and supplied to the Electricity Supply Commission of South Africa (Eskom) for electricity generation in 2007, which accounted for about 93% of the electricity produced in the country. In the South African coal market for 2007 the electricity sector consumed 61% coal sold locally while the other sectors that consumed coal were the synthetic fuels sector at 25%, the industrial sector (including mining) at 4%, the metallurgical industry used 3% and merchants bought 6% of domestic coal (DMR, 2008).

Electricity is the driver for the local coal market, while the coal market is driven by exports in monetary terms. According to DMR during 2007, 248 million tons of saleable coal was produced of which 27% was exported at a value of R24 448 million and an average price of R361/ton. The 73% of production sold inland (183 million tons) was worth R19 719 million.

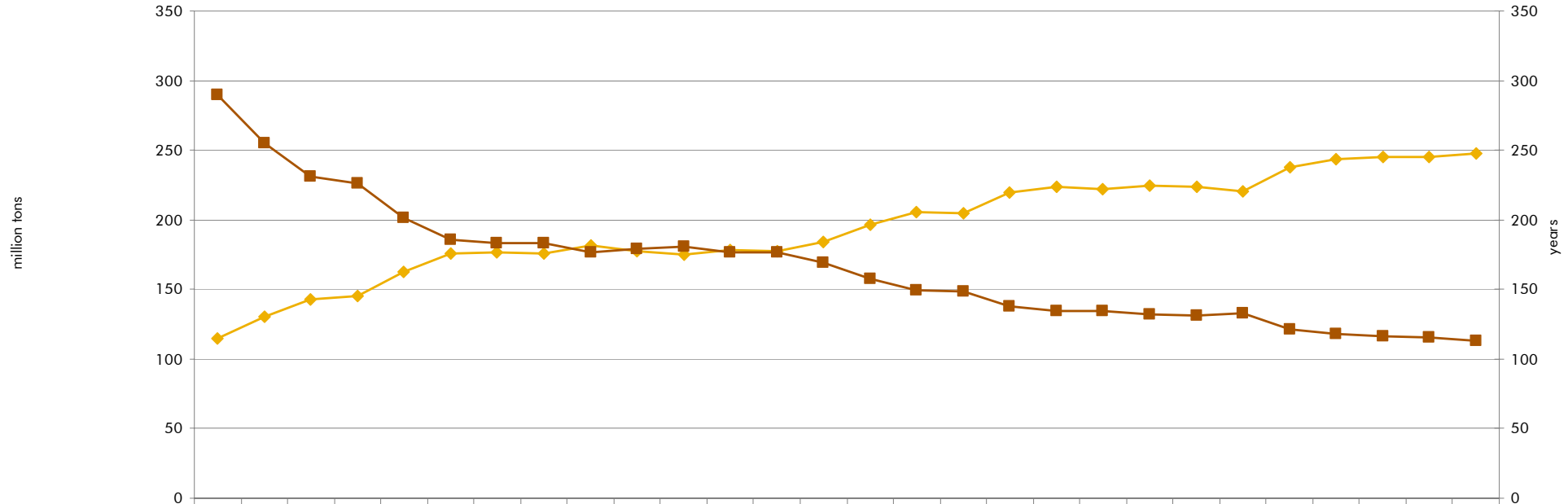
[11] Government Communication Information System, 2008/09. South African Yearbook 2008/09: Minerals, Energy and Geology.

Table 3: Coal: physical accounts for South Africa, 1980–2007

	Million tons								
Year	Opening stock*	Production* (extraction)	Discoveries	Other volume changes	Closing stock* (sub-soil assets)	Volume sold	Net changes in inventories	Closing stock* (including inventories)	Years to depletion*
1980	33 440	115	0	0	33 325	113	2	33 327	290
1981	33 325	130	0	0	33 195	130	0	33 195	255
1982	33 195	143	0	0	33 052	140	3	33 055	231
1983	33 052	146	0	0	32 906	145	1	32 907	226
1984	32 906	163	0	0	32 744	161	2	32 745	201
1985	32 744	176	0	0	32 568	172	4	32 572	185
1986	32 568	177	0	0	32 391	174	3	32 394	183
1987	32 391	176	0	0	32 215	173	4	32 219	183
1988	32 215	182	0	0	32 033	184	-2	32 031	176
1989	32 033	178	0	0	31 856	180	-2	31 853	179
1990	31 856	175	0	0	31 681	185	-10	31 670	181
1991	31 681	178	0	0	31 502	182	-3	31 499	177
1992	31 502	177	0	0	31 325	179	-2	31 323	177
1993	31 325	184	0	0	31 141	184	0	31 141	169
1994	31 141	196	0	0	30 944	194	3	30 947	158
1995	30 944	206	0	0	30 739	206	0	30 739	149
1996	30 739	205	0	0	30 534	206	-1	30 533	149
1997	30 534	219	0	0	30 314	217	2	30 316	138
1998	30 314	224	0	0	30 091	224	0	30 091	134
1999	30 091	222	0	0	29 868	222	1	29 869	134
2000	29 868	225	0	0	29 643	225	-1	29 643	132
2001	29 643	223	0	0	29 420	221	2	29 422	132
2002	29 420	220	0	0	29 200	227	-7	29 193	133
2003	29 200	238	0	0	28 962	240	-3	28 959	122
2004	28 962	243	0	0	28 718	247	-3	28 715	118
2005	28 718	245	0	0	28 473	245	0	28 474	116
2006	28 473	245	0	0	28 229	246	-1	28 228	115
2007	28 229	248	0	0	27 981	250	-3	27 978	113

Notes: Discoveries = 0 due to confidentiality in mining industry; see Annexure 1, methodological notes, for the definition of the variables.
*Where figures have been rounded, discrepancies may occur with totals.
Source: Department of Minerals and Energy (SAMI 2007/2008, Statistical Tables 1985–2007). Calculations: Statistics South Africa.

Figure 7: Coal: production and years to depletion, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Production (extraction)	115	130	143	146	163	176	177	176	182	178	175	178	177	184	196	206	205	219	224	222	225	223	220	238	243	245	245	248
Years to depletion	290	255	231	226	201	185	183	183	176	179	181	177	177	169	158	149	149	138	134	134	132	132	133	122	118	116	115	113

Source: Department of Minerals and Energy (SAMI 2007/2008, Statistical Tables 1985–2007). Calculations: Statistics South Africa.

4. Resource rent accounts for the South African mining industry

This section discusses resource rent calculations for South Africa's gold, PGM and coal industries (Tables 4 to 6). The resource rent tables show output; intermediate consumption; compensation of employees; unit rent; resource rent; and other calculations for the period 1980 to 2007. The results of these calculations will be used to compile the monetary accounts presented in section 5 of this document. Research was conducted to calculate a new Social Discount Rate (SDR), where previously only 3% and 5% were used in the resource rent calculations the new SDR added is just below 12%. Detailed discussions of the methods used are presented in Annexure 1, Section 2.1. The SDR that is used in the resource rent calculation in this discussion document are 3%, 5% and just below 12%.

In the previous mineral accounts discussion document (*Mineral Accounts for South Africa: 1980–2006* D0405.2) there were negative values for the resource rents that were recorded and at the time of publication these negative values could not be explained. In this document an attempt is made to explain the negative values through an academic exercise where an analysis of both the resource rent calculation and the individual components are done. This exercise is also extended to include the analysis of the mining industry in South Africa specific to each mineral, as well as to the relevant year in order to explain the negative resource rent values. The results of the exercise are discussed below. Negative resource rent values may be an indication that during that specific period it was not economically viable for mines to sustain their current production rates.

4.1 Gold

The resource rent and other calculations for gold are presented in Table 4 for the years 1980 to 2007 (at current prices). Gold output (sales) increased from R10 395 million in 1980 to R38 036 million in 2007. Figure 8 illustrates intermediate consumption increasing steadily from R1 454 million in 1980 to R8 232 million in 1992. From 1993 intermediate consumption began to increase at a faster pace from R9 314 million to R16 116 million in 2007. This may be due to the improved data availability from 1993 for intermediate consumption. Figure 8 shows how gold output (sales), intermediate consumption and consumption of fixed capital follow a similar trend.

Resource rent at 3%, 5% and just below 12% have all experienced a steady increase for the years 1980 to 2007. The negative resource rents that were mentioned earlier are present at the 3%, 5% and just below 12% SDR from 1993 to 2001 and again in 2005. Negative resource rent may be an indication that mining of gold have not been economically viable. One indicator may be the price of gold during the negative resource rent periods. As the price of gold decreases it may become non-viable to mine the gold. According to Gold Research Statistics[12] the annual average gold price for the year 1993 was US$360 per ounce with the gold price dropping to a low of US$273 per ounce in 2001 and then recovering to US$695 per ounce for 2007.

[12] Gold Research Statistics: http://www.research.gold.org

Table 4: Gold: resource rent and other calculations for South Africa, 1980–2007

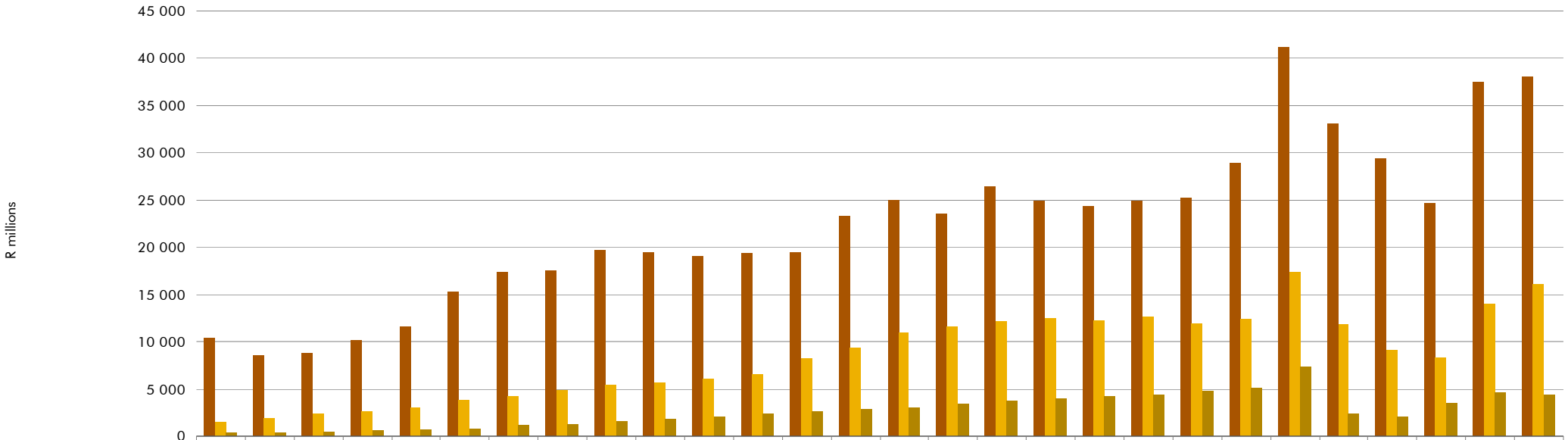
	Rand Millions													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Output (sales)	10 395	8 554	8 778	10 177	11 574	15 291	17 283	17 495	19 701	19 439	18 994	19 296	19 513	23 239
Intermediate consumption	1 454	1 860	2 379	2 639	3 028	3 822	4 219	4 814	5 372	5 651	6 069	6 579	8 232	9 314
Compensation of employees (total)	1 448	1 793	2 098	2 438	2 844	3 311	3 949	4 852	5 521	6 100	6 720	6 849	6 940	7 217
Compensation of employees (male)	1 430	1 769	2 068	2 402	2 801	3 256	3 880	4 763	5 417	5 982	6 585	6 701	6 795	7 068
Compensation of employees (female)	18	24	30	36	43	56	69	89	103	117	135	148	145	149
Consumption of fixed capital	306	385	478	575	658	817	1 074	1 262	1 527	1 776	2 069	2 331	2 567	2 808
Opportunity cost of capital (SDR 3%)	173	223	279	339	394	495	651	752	902	1 053	1 201	1 318	1 411	1 499
Opportunity cost of capital (SDR 5%)	289	372	464	565	657	826	1 085	1 254	1 504	1 756	2 002	2 196	2 352	2 498
Opportunity cost of capital (SDR 11,7%)	676	870	1 086	1 322	1 537	1 932	2 538	2 935	3 520	4 108	4 684	5 139	5 503	5 845
Rent (SDR 3%)	7 013	4 293	3 545	4 187	4 650	6 845	7 391	5 813	6 379	4 859	2 935	2 219	362	2 401
Rent (SDR 5%)	6 898	4 144	3 359	3 961	4 388	6 515	6 957	5 312	5 777	4 157	2 135	1 341	-578	1 402
Rent (SDR 11,7%)	6 510	3 646	2 737	3 204	3 508	5 408	5 503	3 631	3 761	1 805	-548	-1 602	-3 729	-1 945
Unit rent (R/kg) (SDR 3%)	10 389	6 527	5 335	6 160	6 820	10 171	11 547	9 619	10 289	7 997	4 851	3 693	591	3 878
Unit rent (R/kg) (SDR 5%)	10 217	6 301	5 055	5 827	6 435	9 681	10 869	8 789	9 319	6 841	3 528	2 231	-943	2 264
Unit rent (R/kg) (SDR 11,7%)	9 644	5 544	4 119	4 714	5 144	8 036	8 598	6 009	6 068	2 970	-905	-2 665	-6 083	-3 140
Unit rent (R/kg) 5-year moving average (SDR 3%)	10 389	8 458	7 417	7 103	7 046	7 003	8 007	8 863	9 689	9 925	8 861	7 290	5 484	4 202
Unit rent (R/kg) 5-year moving average (SDR 5%)	10 217	8 259	7 191	6 850	6 767	6 660	7 573	8 320	9 019	9 100	7 869	6 142	4 195	2 784
Unit rent (R/kg) 5-year moving average (SDR 11,7%)	9 644	7 594	6 436	6 005	5 833	5 511	6 122	6 500	6 771	6 336	4 548	2 295	-123	-1 965

Table 4: Gold: resource rent and other calculations for South Africa, 1980–2007 (concluded)

	Rand Millions													
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output (sales)	24 953	23 465	26 468	24 905	24 295	24 915	25 190	28 904	41 222	33 053	29 330	24 601	37 443	38 036
Intermediate consumption	10 870	11 579	12 102	12 508	12 226	12 558	11 876	12 358	17 353	11 765	9 133	8 326	13 966	16 116
Compensation of employees (total)	7 612	8 292	8 807	9 613	9 372	9 100	9 846	10 904	11 324	12 496	12 610	12 153	12 865	14 709
Compensation of employees (male)	7 462	8 107	8 602	9 390	9 164	8 902	9 623	10 674	11 081	12 219	12 320	11 787	12 435	14 153
Compensation of employees (female)	150	185	205	223	208	198	224	230	243	277	289	367	430	556
Consumption of fixed capital	3 090	3 382	3 661	3 948	4 125	4 370	4 734	5 113	7 292	2 309	2 049	3 442	4 658	4 391
Opportunity cost of capital (SDR 3%)	1 595	1 693	1 779	1 862	1 875	1 917	2 002	2 087	2 976	1 019	904	1 232	2 078	1 726
Opportunity cost of capital (SDR 5%)	2 659	2 822	2 964	3 103	3 125	3 195	3 337	3 478	4 960	1 698	1 507	2 053	3 464	2 877
Opportunity cost of capital (SDR 11,7%)	6 221	6 604	6 937	7 261	7 313	7 477	7 808	8 959	12 777	3 973	3 526	4 805	8 106	6 731
Rent (SDR 3%)	1 786	-1 481	119	-3 026	-3 304	-3 030	-3 268	-1 557	2 277	5 464	4 635	-552	3 876	1 093
Rent (SDR 5%)	723	-2 610	-1 067	-4 267	-4 554	-4 308	-4 603	-2 948	293	4 785	4 032	-1 374	2 490	-57
Rent (SDR 11,7%)	-2 840	-6 391	-5 039	-8 425	-8 742	-8 590	-9 074	-8 430	-7 524	2 509	2 013	-4 125	-2 152	-3 912
Unit rent (R/kg) (SDR 3%)	3 079	-2 827	239	-6 168	-7 103	-6 716	-7 586	-3 942	5 714	14 639	13 744	-1 874	14 243	4 328
Unit rent (R/kg) (SDR 5%)	1 246	-4 982	-2 141	-8 697	-9 791	-9 549	-10 684	-7 464	736	12 819	11 956	-4 662	9 151	-227
Unit rent (R/kg) (SDR 11,7%)	-4 895	-12 201	-10 113	-17 172	-18 795	-19 040	-21 063	-21 340	-18 879	6 723	5 969	-13 999	-7 909	-15 486
Unit rent (R/kg) 5-year moving average (SDR 3%)	3 218	1 683	992	-360	-2 556	-4 515	-5 467	-6 303	-3 927	422	4 514	5 656	9 293	9 016
Unit rent (R/kg) 5-year moving average (SDR 5%)	1 665	-37	-911	-2 462	-4 873	-7 032	-8 172	-9 237	-7 350	-2 828	1 473	2 677	6 000	5 808
Unit rent (R/kg) 5-year moving average (SDR 11,7%)	-3 538	-5 797	-7 287	-9 504	-12 635	-15 464	-17 236	-19 482	-19 823	-14 720	-9 718	-8 305	-5 619	-4 940

Notes: Where figures have been rounded, discrepancies may occur with totals.
Source: Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).
Calculations: Statistics South Africa.

Figure 8: Gold: output, intermediate consumption and consumption of fixed capital, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output (Sales)	10 395	8 554	8 778	10 177	11 574	15 291	17 283	17 495	19 701	19 439	18 994	19 296	19 513	23 239	24 953	23 465	26 468	24 905	24 295	24 915	25 190	28 904	41 222	33 053	29 330	24 601	37 443	38 036
Intermediate consumption	1 454	1 860	2 379	2 639	3 028	3 822	4 219	4 814	5 372	5 651	6 069	6 579	8 232	9 314	10 870	11 579	12 102	12 508	12 226	12 558	11 876	12 358	17 353	11 765	9 133	8 326	13 966	16 116
Consumption of fixed capital	306	385	478	575	658	817	1 074	1 262	1 527	1 776	2 069	2 331	2 567	2 808	3 090	3 382	3 661	3 948	4 125	4 370	4 734	5 113	7 292	2 309	2 049	3 442	4 658	4 391

Source: Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).
Calculations: Statistics South Africa.

4.2 Platinum group metals

The resource rent and other calculations for PGM are presented in Table 5 for the years 1980 to 2007 (at current prices). PGM output (sales) increased from R851 million in 1980 to R78 360 million in 2007. Output (sales) steadily increased from 1980 to 1997 (at an average of R2 000 million) and from 1998 to 2007 (at an average of R13 000 million). Intermediate consumption increased from R128 million in 1980 to R5 237 million in 1997. From 1997 intermediate consumption began to increase at a faster pace on an annual basis (refer to Figure 9). This may be due to the improved data availability from 1993 for intermediate consumption. Figure 9 shows how PGM output (sales), intermediate consumption and consumption of fixed capital follow a similar trend.

Resource rent at 3%, 5% and just below 12% have all experienced a steady increase for the years 1980 to 2007. The negative resource rents are present at 3%, 5% and just below 12% from 1993 to 2000 and again in 2002, 2003 and 2004 for a SDR of just below 12%. As in the case of gold, one reason for the negative resource rents may be the price of PGM during the negative resource rent periods. As the price of PGM decreases, it may become non-viable to mine the PGM. According to Johnson Mathey[13] the monthly average platinum price for December 1993 was US$383 per ounce. The platinum price held steady between US$300 per ounce and US$400 per ounce until 2000. Platinum then peaked at US$625 per ounce in January 2001 and then continued to increase to US$1 494 per ounce for December 2007.

[13] Johnson Mathey: http://www.platinum.matthey.com

Table 5: Platinum group metals: resource rent and other calculations for South Africa, 1980–2007

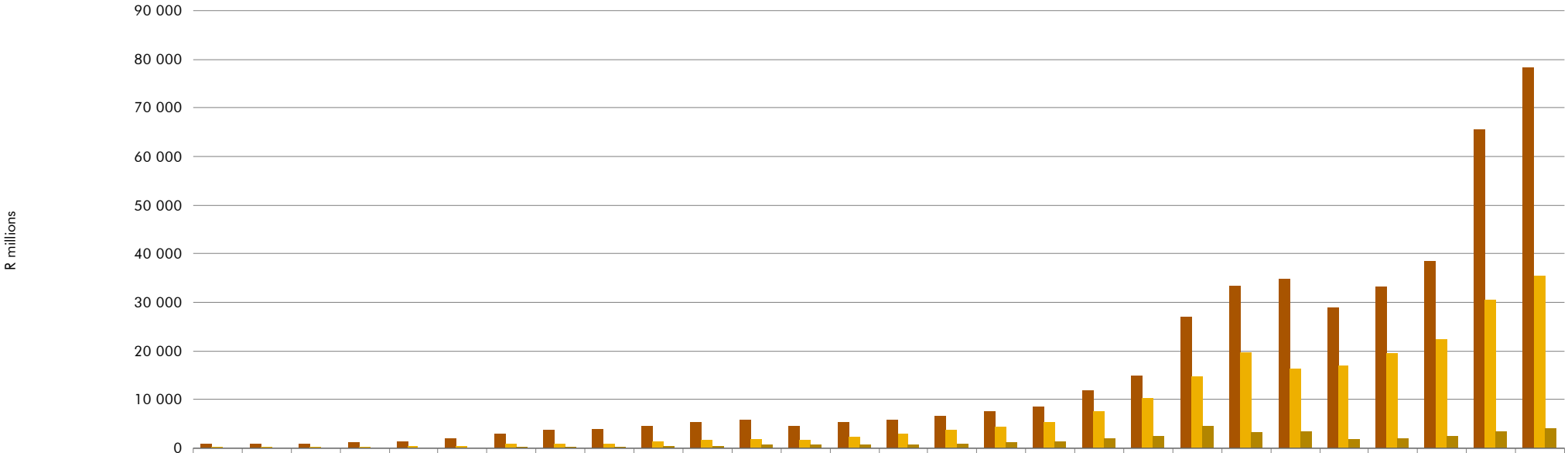
	Rand Millions													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Output (sales)	851	937	852	1 118	1 432	1 998	2 964	3 581	3 813	4 611	5 164	5 692	4 678	5 189
Intermediate consumption	128	206	230	291	372	500	830	967	1 030	1 337	1 652	1 935	1 637	2 243
Compensation of employees (total)	224	278	235	254	341	450	570	768	933	1 136	1 505	1 658	1 901	2 111
Compensation of employees (male)	221	273	231	250	337	444	564	758	921	1 119	1 472	1 631	1 869	2 079
Compensation of employees (female)	3	5	4	4	4	6	7	9	12	16	32	27	33	33
Consumption of fixed capital	26	47	43	67	86	100	178	251	305	415	568	683	608	623
Opportunity cost of capital (SDR 3%)	17	28	26	34	43	60	119	143	191	231	310	398	327	311
Opportunity cost of capital (SDR 5%)	26	37	43	67	86	100	178	251	305	415	568	626	561	571
Opportunity cost of capital (SDR 11,7%)	73	106	114	157	188	239	368	520	550	696	917	1 091	990	1 047
Rent (SDR 3%)	456	378	319	472	590	889	1 268	1 452	1 355	1 493	1 130	1 018	204	-100
Rent (SDR 5%)	448	369	302	439	547	849	1 208	1 345	1 240	1 309	872	790	-30	-359
Rent (SDR 11,7%)	401	300	231	349	445	710	1 018	1 075	995	1 028	523	325	-459	-836
Unit rent (R/kg) (SDR 3%)	3 993	3 262	3 742	5 278	5 515	7 300	10 515	11 346	10 286	11 169	7 961	7 123	1 333	-567
Unit rent (R/kg) (SDR 5%)	3 919	3 181	3 542	4 903	5 114	6 972	10 024	10 507	9 417	9 789	6 141	5 529	-197	-2 040
Unit rent (R/kg) (SDR 11,7%)	3 507	2 586	2 707	3 895	4 157	5 833	8 443	8 401	7 555	7 690	3 685	2 278	-2 999	-4 744
Unit rent (R/kg) 5-year moving average (SDR 3%)	3 993	3 628	3 666	4 069	4 358	5 019	6 470	7 991	8 993	10 123	10 255	9 577	7 574	5 404
Unit rent (R/kg) 5-year moving average (SDR 5%)	3 919	3 550	3 547	3 886	4 132	4 742	6 111	7 504	8 407	9 342	9 176	8 277	6 136	3 845
Unit rent (R/kg) 5-year moving average (SDR 11,7%)	3 507	3 046	2 933	3 173	3 370	3 835	5 007	6 146	6 878	7 584	7 155	5 922	3 642	1 182

Table 5: Platinum group metals: resource rent and other calculations for South Africa, 1980–2007 (concluded)

	Rand Millions													
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output (sales)	5 810	6 573	7 486	8 510	11 930	14 887	27 095	33 371	34 829	28 824	33 313	38 451	65 444	78 360
Intermediate consumption	2 935	3 631	4 246	5 237	7 446	10 237	14 708	19 748	16 205	17 014	19 487	22 540	30 382	35 580
Compensation of employees (total)	2 241	2 522	2 725	2 979	3 444	3 740	4 373	4 915	5 937	7 243	9 064	11 358	12 585	18 341
Compensation of employees (male)	2 199	2 471	2 664	2 920	3 364	3 653	4 278	4 806	5 783	7 022	8 743	10 925	11 953	17 376
Compensation of employees (female)	43	51	61	59	80	88	96	109	154	221	321	432	633	965
Consumption of fixed capital	697	920	1 048	1 362	2 028	2 531	4 606	3 295	3 439	1 782	2 060	2 428	3 357	4 118
Opportunity cost of capital (SDR 3%)	349	460	524	596	954	1 191	2 168	1 212	1 265	839	970	1 090	1 226	1 470
Opportunity cost of capital (SDR 5%)	639	789	823	1 021	1 551	1 935	3 522	2 060	2 150	1 398	1 616	1 816	2 043	2 450
Opportunity cost of capital (SDR 11,7%)	1 132	1 216	1 255	1 394	1 925	2 385	3 624	4 463	4 658	3 272	3 782	4 249	4 781	5 732
Rent (SDR 3%)	-412	-961	-1 057	-1 664	-1 943	-2 812	1 240	4 201	7 983	1 946	1 733	1 035	17 894	18 851
Rent (SDR 5%)	-703	-1 290	-1 356	-2 089	-2 540	-3 556	-115	3 353	7 098	1 386	1 086	309	17 077	17 871
Rent (SDR 11,7%)	-1 195	-1 717	-1 788	-2 463	-2 914	-4 006	-216	950	4 590	-488	-1 079	-2 124	14 339	14 589
Unit rent (R/kg) (SDR 3%)	-2 241	-5 250	-5 601	-8 463	-9 718	-12 989	5 998	18 301	33 735	7 331	6 270	3 417	57 844	62 004
Unit rent (R/kg) (SDR 5%)	-3 820	-7 045	-7 188	-10 628	-12 701	-16 428	-554	14 606	29 995	5 223	3 931	1 020	55 202	58 781
Unit rent (R/kg) (SDR 11,7%)	-6 498	-9 377	-9 476	-12 526	-14 571	-18 505	-1 044	4 138	19 397	-1 837	-3 905	-7 012	46 352	47 984
Unit rent (R/kg) 5-year moving average (SDR 3%)	2 722	80	-2 465	-4 424	-6 255	-8 404	-6 155	-1 374	7 065	10 475	14 327	13 811	21 719	27 373
Unit rent (R/kg) 5-year moving average (SDR 5%)	1 123	-1 514	-4 058	-6 144	-8 276	-10 798	-9 500	-5 141	2 984	6 569	10 640	10 955	19 074	24 831
Unit rent (R/kg) 5-year moving average (SDR 11,7%)	-1 656	-4 268	-6 619	-8 524	-10 490	-12 891	-11 225	-8 502	-2 117	430	3 350	2 156	10 599	16 316

Notes: Where figures have been rounded, discrepancies may occur with totals.
Source: Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS (2005 to 2007).
Calculations: Statistics South Africa.

Figure 9: Platinum group metals: output, intermediate consumption and consumption of fixed capital, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output (Sales)	851	937	852	1 118	1 432	1 998	2 964	3 581	3 813	4 611	5 164	5 692	4 678	5 189	5 810	6 573	7 486	8 510	11 930	14 887	27 095	33 371	34 829	28 824	33 313	38 451	65 444	78 360
Intermediate consumption	128	206	230	291	372	500	830	967	1 030	1 337	1 652	1 935	1 637	2 243	2 935	3 631	4 246	5 237	7 446	10 237	14 708	19 748	16 205	17 014	19 487	22 540	30 382	35 580
Consumption of fixed capital	26	47	43	67	86	100	178	251	305	415	568	683	608	623	697	920	1 048	1 362	2 028	2 531	4 606	3 295	3 439	1 782	2 060	2 428	3 357	4 118

Source: Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).
Calculations: Statistics South Africa.

4.3 Coal

The resource rent and other calculations for coal are presented in Table 6 for the years 1980 to 2007 (current prices). Coal output (sales) experienced a large increase from R1 497 million in 1980 to R44 166 million in 2007. In Figure 10, intermediate consumption increased steadily from R507 million in 1980 to R3 816 million in 1992. From 1993, intermediate consumption began to increase at a faster pace on an annual basis. This may be due to the improved data availability from 1993 for intermediate consumption. As with gold and PGM, Figure 10 shows how coal output (sales), intermediate consumption and consumption of fixed capital follow a similar trend.

Resource rent at 3%, 5% and just below 12% have all experienced a steady increase for the years 1980 to 2007. Unlike gold and PGM, coal only experienced negative resource rents at just below 12% for 1999, 2000, 2003 and 2004. Negative resource rent, may indicate that mining of coal may have not been economically viable. One indicator may be the price of coal during the negative resource rent periods. As the price of coal decreases, it may become non-viable to mine the coal. According to I-Net Bridge,[14] the monthly average coal price for the year 1999 was at its lowest in September at US$28 per ton. In 2000, the coal price improved to US$38 per ton and then recovered further to US$102 per ton for September 2007.

[14] I-Net-Bridge: http://www.inet.co.za

Table 6: Coal: resource rent and other calculations for South Africa, 1980–2007

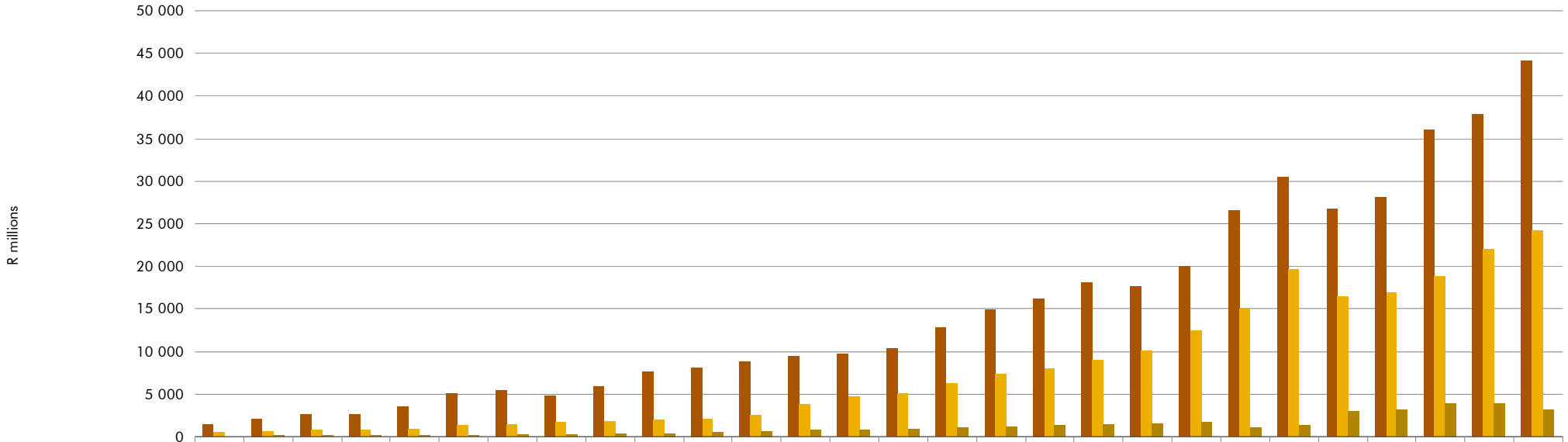
	Rand Millions													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Output (sales)	1 497	2 146	2 653	2 651	3 474	5 102	5 433	4 846	5 952	7 574	8 173	8 785	9 424	9 714
Intermediate consumption	507	609	732	794	886	1 261	1 449	1 730	1 885	1 963	2 080	2 434	3 816	4 684
Compensation of employees (total)	567	738	792	803	903	1 064	1 246	1 383	1 545	1 870	2 130	2 441	2 082	1 884
Compensation of employees (male)	554	720	769	777	872	1 028	1 203	1 332	1 487	1 802	2 046	2 344	2 010	1 821
Compensation of employees (female)	13	18	23	26	31	37	43	51	58	68	84	97	71	62
Consumption of fixed capital	55	73	96	121	143	184	243	286	356	430	534	645	728	814
Opportunity cost of capital (SDR 3%)	38	51	68	83	98	124	161	186	228	270	334	401	442	481
Opportunity cost of capital (SDR 5%)	63	85	113	139	164	207	269	310	380	450	557	668	736	802
Opportunity cost of capital (SDR 11,7%)	148	198	264	326	383	485	629	724	888	1 052	1 303	1 562	1 723	1 876
Rent (SDR 3%)	331	676	965	850	1 444	2 468	2 333	1 261	1 938	3 041	3 095	2 865	2 356	1 851
Rent (SDR 5%)	305	642	920	795	1 378	2 385	2 226	1 137	1 786	2 861	2 872	2 598	2 061	1 530
Rent (SDR 11,7%)	220	528	769	608	1 159	2 107	1 866	722	1 278	2 259	2 126	1 704	1 075	456
Unit rent (R/kg) (SDR 3%)	2 876	5 185	6 745	5 840	8 867	14 045	13 198	7 157	10 670	17 107	17 689	16 055	13 283	10 063
Unit rent (R/kg) (SDR 5%)	2 655	4 925	6 430	5 458	8 465	13 573	12 590	6 454	9 834	16 095	16 416	14 559	11 622	8 319
Unit rent (R/kg) (SDR 11,7%)	1 917	4 054	5 374	4 177	7 119	11 992	10 554	4 100	7 033	12 705	12 152	9 546	6 059	2 480
Unit rent (R/kg) 5-year moving average (SDR 3%)	2 876	4 030	4 935	5 161	5 903	8 136	9 739	9 821	10 787	12 435	13 164	13 736	14 961	14 839
Unit rent (R/kg) 5-year moving average (SDR 5%)	2 655	3 790	4 670	4 867	5 587	7 770	9 303	9 308	10 183	11 709	12 278	12 672	13 705	13 402
Unit rent (R/kg) 5-year moving average (SDR 11,7%)	1 917	2 985	3 782	3 881	4 528	6 543	7 843	7 588	8 160	9 277	9 309	9 107	9 499	8 588

Table 6: Coal: resource rent and other calculations for South Africa, 1980–2007 (concluded)

	Rand Millions													
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output (sales)	10 353	12 818	14 891	16 287	18 024	17 681	20 039	26 596	30 468	26 734	28 139	36 033	37 867	44 166
Intermediate consumption	5 106	6 221	7 287	7 997	9 085	10 081	12 410	15 026	19 588	16 539	16 830	18 869	21 986	24 182
Compensation of employees (total)	2 021	2 371	2 782	3 204	3 523	3 831	4 287	4 451	4 468	5 481	5 863	6 482	7 270	8 692
Compensation of employees (male)	1 949	2 288	2 687	3 095	3 399	3 698	4 127	4 293	4 289	5 252	5 582	6 156	6 855	8 107
Compensation of employees (female)	72	83	95	109	124	133	161	158	180	229	281	326	415	585
Consumption of fixed capital	911	1 019	1 145	1 269	1 377	1 508	1 708	1 090	1 249	2 996	3 154	3 879	3 968	3 162
Opportunity cost of capital (SDR 3%)	526	574	633	686	729	780	873	786	900	644	678	758	726	808
Opportunity cost of capital (SDR 5%)	876	956	1 056	1 144	1 215	1 301	1 455	1 309	1 500	1 074	1 130	1 263	1 211	1 346
Opportunity cost of capital (SDR 11,7%)	2 051	2 238	2 470	2 676	2 842	3 043	3 404	4 518	5 176	2 513	2 645	2 956	2 833	3 150
Rent (SDR 3%)	1 788	2 633	3 045	3 131	3 311	1 481	760	5 242	4 262	1 074	1 614	6 045	3 916	7 322
Rent (SDR 5%)	1 438	2 251	2 622	2 674	2 825	961	178	4 719	3 663	644	1 162	5 540	3 432	6 784
Rent (SDR 11,7%)	264	969	1 208	1 141	1 197	-782	-1 771	1 510	-14	-794	-353	3 847	1 810	4 980
Unit rent (R/kg) (SDR 3%)	9 103	12 805	14 852	14 282	14 793	6 663	3 380	23 457	19 350	4 515	6 631	24 676	15 997	29 566
Unit rent (R/kg) (SDR 5%)	7 319	10 945	12 792	12 195	12 622	4 323	792	21 117	16 630	2 709	4 773	22 614	14 018	27 391
Unit rent (R/kg) (SDR 11,7%)	1 341	4 714	5 892	5 206	5 349	-3 518	-7 876	6 756	-62	-3 340	-1 449	15 704	7 392	20 107
Unit rent (R/kg) 5-year moving average (SDR 3%)	13 239	12 262	12 021	12 221	13 167	12 679	10 794	12 515	13 529	11 473	11 466	15 726	14 234	16 277
Unit rent (R/kg) 5-year moving average (SDR 5%)	11 647	10 553	10 200	10 314	11 175	10 576	8 545	10 210	11 097	9 114	9 204	13 568	12 149	14 301
Unit rent (R/kg) 5-year moving average (SDR 11,7%)	6 316	4 828	4 097	3 927	4 501	3 529	1 011	1 184	130	-1 608	-1 194	3 522	3 649	7 683

Notes: Where figures have been rounded, discrepancies may occur with totals.
Source: Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).
Calculations: Statistics South Africa.

Figure 10: Coal: output, intermediate consumption and consumption of fixed capital, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Output (Sales)	1 497	2 146	2 653	2 651	3 474	5 102	5 433	4 846	5 952	7 574	8 173	8 785	9 424	9 714	10 353	12 818	14 891	16 287	18 024	17 681	20 039	26 596	30 468	26 734	28 139	36 033	37 867	44 166
Intermediate consumption	507	609	732	794	886	1 261	1 449	1 730	1 885	1 963	2 080	2 434	3 816	4 684	5 106	6 221	7 287	7 997	9 085	10 081	12 410	15 026	19 588	16 539	16 830	18 869	21 986	24 182
Consumption of fixed capital	55	73	96	121	143	184	243	286	356	430	534	645	728	814	911	1 019	1 145	1 269	1 377	1 508	1 708	1 090	1 249	2 996	3 154	3 879	3 968	3 162

Source: Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).
Calculations: Statistics South Africa.

5. Monetary accounts for the South African mining industry

This section describes the monetary accounts for South Africa's gold, PGM and coal mining industries. As mentioned before, the results from the resource rent calculations in section 4 were used in the compilation of the monetary accounts. Thus the negative resource rent values are carried through to the monetary accounts. The in-depth discussion into the negative resource rents values presented in section 4 are also of vital importance for the monetary accounts, it looks at how the fluctuating mineral prices will have an effect on the value of mineral assets represented in the monetary accounts. In other words, if there are negative resource rents, this may present negative values for the mineral asset.

Monetary accounts are presented both in current resource rent (the rent calculated for each year) and using a 5-year moving average. The 5-year moving average is used to reflect the fact that mineral prices can have large fluctuations within one year thus the current value of mineral assets is not always best represented by the unit rent in any single year (CEEPA, 2009).

5.1 Gold

Tables 7 and 8 below present the monetary accounts for gold in South Africa. The tables show opening stock, depletion, revaluation and the closing stock in rand values. The values are represented by 3%, 5% and just below 12% SDR values. Table 7 is calculated in annual unit rent figures and Table 8 is calculated with unit rents in 5-year moving averages.

The mineral asset value for closing stock at 3%, 5% and just below 12% demonstrated a fluctuating trend that eventually began to decline through the period 1980 to 2001 (refer to Figures 11 and 12). Figure 11 shows that the asset value for closing stock is negative for the period 1995 to 2001. The closing stock began to recover in 2006 but dropped again in 2007. This observed trend may be due to the fluctuations in the gold price as discussed in section 4.1 above.

Table 7: Gold: monetary accounts for South Africa, annual 1980–2007

Year	Rand Millions											
	Opening stock			Depletion			Revaluation			Closing stock		
	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%
1980	0	0	0	7 013	6 898	6 510	0	0	0	207 629	134 244	55 629
1981	207 629	134 244	55 629	4 293	4 144	3 646	-84 379	-57 629	-28 120	127 543	80 759	31 156
1982	127 543	80 759	31 156	3 545	3 359	2 737	-26 467	-18 819	-10 508	104 621	65 299	23 385
1983	104 621	65 299	23 385	4 187	3 961	3 204	13 464	7 434	784	122 272	76 694	27 373
1984	122 272	76 694	27 373	4 650	4 388	3 508	8 182	3 707	-914	135 104	84 789	29 967
1985	135 104	84 789	29 967	6 845	6 515	5 408	56 843	34 568	10 826	198 792	125 872	46 201
1986	198 792	125 872	46 201	7 391	6 957	5 503	10 775	2 140	-4 687	216 958	134 969	47 018
1987	216 958	134 969	47 018	5 813	5 312	3 631	-49 995	-36 758	-19 620	172 776	103 523	31 028
1988	172 776	103 523	31 028	6 379	5 777	3 761	8 363	2 842	-2 652	187 518	112 141	32 137
1989	187 518	112 141	32 137	4 859	4 157	1 805	-49 261	-35 544	-18 522	143 117	80 754	15 420
1990	143 117	80 754	15 420	2 935	2 135	-548	-59 839	-41 465	-19 551	86 213	41 423	-4 678
1991	86 213	41 423	-4 678	2 219	1 341	-1 602	-23 382	-16 764	-7 406	65 050	26 000	-13 686
1992	65 050	26 000	-13 686	362	-578	-3 729	-54 901	-36 592	-14 444	10 511	-11 170	-31 860
1993	10 511	-11 170	-31 860	2 401	1 402	-1 945	56 230	36 770	17 192	69 143	27 002	-16 612
1994	69 143	27 002	-16 612	1 786	723	-2 840	-18 692	-13 722	-4 810	52 237	14 003	-24 262
1995	52 237	14 003	-24 262	-1 481	-2 610	-6 391	-95 142	-62 405	-23 962	-44 386	-51 011	-54 616
1996	-44 386	-51 011	-54 616	119	-1 067	-5 039	47 870	31 163	16 593	3 604	-20 915	-43 062
1997	3 604	-20 915	-43 062	-3 026	-4 267	-8 425	-92 204	-58 512	-20 516	-91 626	-83 695	-72 003
1998	-91 626	-83 695	-72 003	-3 304	-4 554	-8 742	-6 078	-1 338	6 034	-101 008	-89 587	-74 710
1999	-101 008	-89 587	-74 710	-3 030	-4 308	-8 590	11 005	9 031	9 885	-93 033	-84 864	-73 416
2000	-93 033	-84 864	-73 416	-3 268	-4 603	-9 074	-4 779	-1 389	4 938	-101 080	-90 856	-77 552
2001	-101 080	-90 856	-77 552	-1 557	-2 948	-8 430	53 766	35 383	13 936	-48 872	-58 422	-72 046
2002	-48 872	-58 422	-72 046	2 277	293	-7 524	12 825	63 939	38 017	-33 769	5 811	-41 552
2003	-33 769	5 811	-41 552	5 464	4 785	2 509	200 830	84 354	60 490	172 525	94 949	21 447
2004	172 525	94 949	21 447	4 635	4 032	2 013	-28 799	-18 734	-6 256	148 360	80 247	17 204
2005	148 360	80 247	17 204	-552	-1 374	-4 125	-165 747	-106 281	-48 336	-17 939	-27 408	-35 257
2006	-17 939	-27 408	-35 257	3 876	2 490	-2 152	140 730	74 641	19 016	126 667	49 723	-18 393
2007	126 667	49 723	-18 393	1 093	-57	-3 912	-91 854	-50 809	-11 129	35 906	-1 144	-33 434

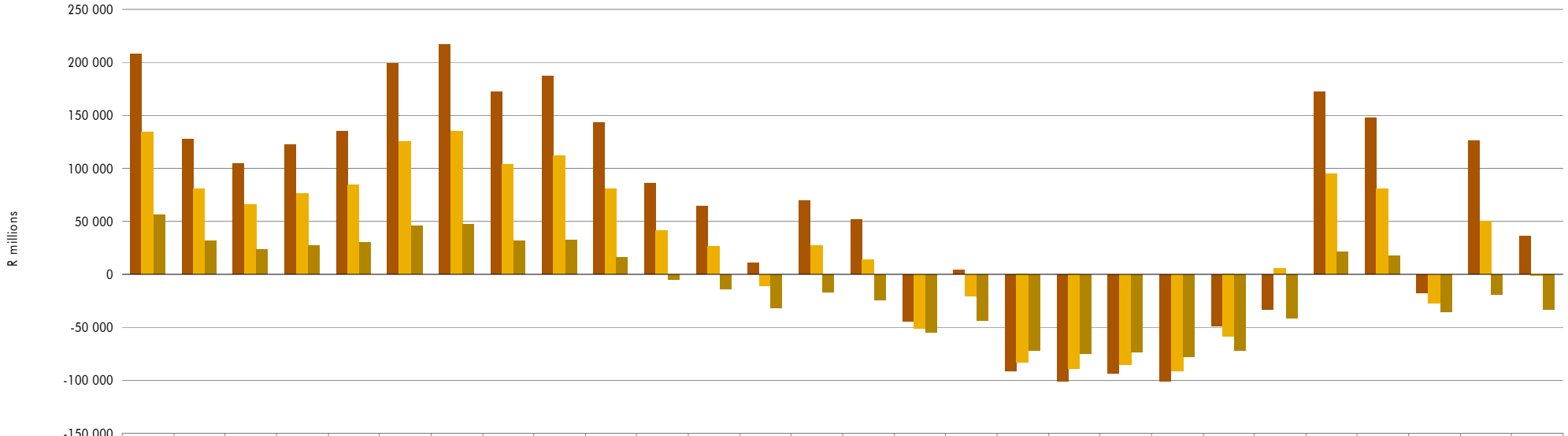
Notes: 0 = Data not available; where figures have been rounded, discrepancies may occur with totals.
Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

Table 8: Gold: monetary accounts for South Africa, 5-year moving average 1980–2007

Year	Rand Millions											
	Opening stock			Depletion			Revaluation			Closing stock		
	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%
1980	0	0	0	7 013	6 898	6 510	0	0	0	207 629	134 244	55 629
1981	207 629	134 244	55 629	5 563	5 432	4 994	-47 925	-33 822	-17 947	165 267	105 855	42 676
1982	165 267	105 855	42 676	4 928	4 778	4 276	-24 745	-17 746	-10 418	145 450	92 887	36 534
1983	145 450	92 887	36 534	4 828	4 656	4 082	-9 286	-7 383	-5 744	140 992	90 160	34 872
1984	140 992	90 160	34 872	4 805	4 615	3 977	-6 208	-5 602	-4 870	139 588	89 172	33 980
1985	139 588	89 172	33 980	4 712	4 482	3 709	-7 440	-7 060	-6 003	136 860	86 594	31 685
1986	136 860	86 594	31 685	5 124	4 847	3 918	8 450	2 602	-2 124	150 434	94 043	33 479
1987	150 434	94 043	33 479	5 357	5 028	3 928	3 408	-1 074	-3 840	159 199	97 997	33 567
1988	159 199	97 997	33 567	6 007	5 591	4 197	11 377	4 938	-1 902	176 583	108 526	35 863
1989	176 583	108 526	35 863	6 031	5 530	3 850	-4 995	-6 642	-6 816	177 619	107 414	32 897
1990	177 619	107 414	32 897	5 362	4 762	2 752	-25 506	-19 774	-12 137	157 475	92 401	23 512
1991	157 475	92 401	23 512	4 381	3 691	1 379	-33 437	-24 519	-13 106	128 419	71 574	11 786
1992	128 419	71 574	11 786	3 362	2 572	-76	-34 234	-24 473	-12 355	97 547	49 672	-645
1993	97 547	49 672	-645	2 602	1 724	-1 217	-25 225	-18 194	-8 532	74 924	33 202	-10 394
1994	74 924	33 202	-10 394	1 867	966	-2 053	-22 188	-15 452	-5 089	54 604	18 717	-17 536
1995	54 604	18 717	-17 536	881	-19	-3 037	-29 069	-19 075	-5 375	26 416	-378	-25 948
1996	26 416	-378	-25 948	494	-454	-3 631	-11 958	-8 071	-1 447	14 952	-8 903	-31 026
1997	14 952	-8 903	-31 026	-177	-1 208	-4 663	-20 122	-13 582	-4 162	-5 346	-23 692	-39 852
1998	-5 346	-23 692	-39 852	-1 189	-2 267	-5 877	-29 812	-18 630	-4 497	-36 347	-44 589	-50 225
1999	-36 347	-44 589	-50 225	-2 037	-3 173	-6 977	-24 157	-14 732	-2 427	-62 541	-62 494	-59 630
2000	-62 541	-62 494	-59 630	-2 355	-3 521	-7 426	-7 946	-3 483	3 591	-72 843	-69 498	-63 465
2001	-72 843	-69 498	-63 465	-2 490	-3 649	-7 696	-2 802	846	5 387	-78 135	-72 301	-65 773
2002	-78 135	-72 301	-65 773	-1 565	-2 929	-7 900	30 763	17 238	53 931	-48 937	-57 993	-19 742
2003	-48 937	-57 993	-19 742	157	-1 056	-5 494	53 751	38 100	-21 720	4 971	-20 948	-46 956
2004	4 971	-20 948	-46 956	1 522	497	-3 277	42 232	30 337	22 224	48 725	9 885	-28 009
2005	48 725	9 885	-28 009	1 667	789	-2 447	3 740	5 067	9 539	54 131	15 741	-20 917
2006	54 131	15 741	-20 917	2 529	1 633	-1 529	25 986	15 230	9 378	82 646	32 604	-13 068
2007	82 646	32 604	-13 068	2 277	1 467	-1 248	-10 134	-4 759	3 650	74 789	29 312	-10 666

Notes: 0 = Data not available; where figures have been rounded, discrepancies may occur with totals.
Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

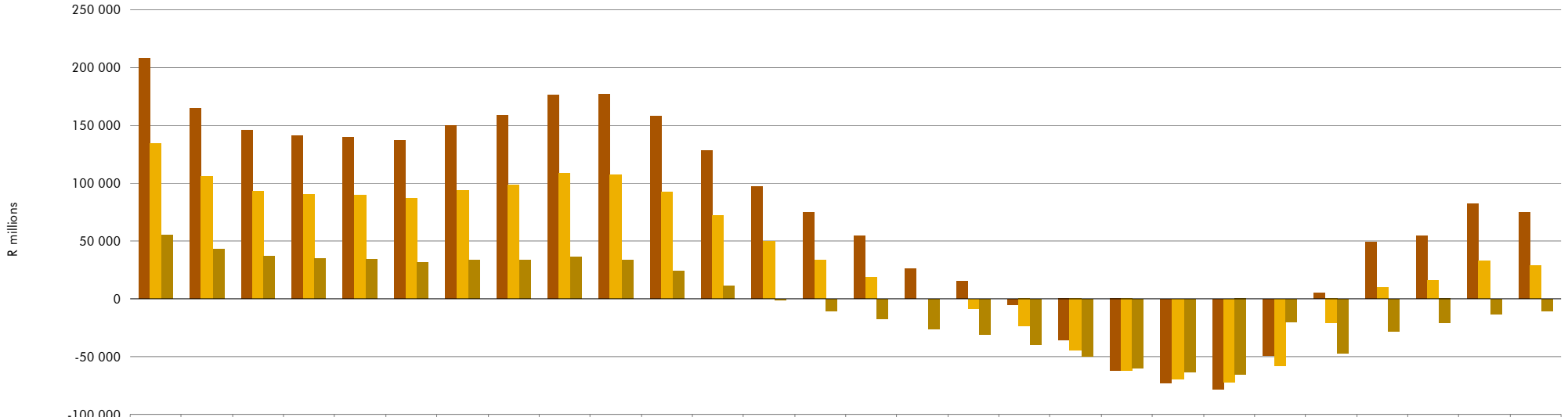
Figure 11: Gold: value of annual closing stock, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Closing Stock 3%	207 629	127 543	104 621	122 272	135 104	198 792	216 958	172 776	187 518	143 117	86 213	65 050	10 511	69 143	52 237	-44 386	3 604	-91 626	-101 008	-93 033	-101 080	-48 872	-33 769	172 525	148 360	-17 939	126 667	35 906
Closing Stock 5%	134 244	80 759	65 299	76 694	84 789	125 872	134 969	103 523	112 141	80 754	41 423	26 000	-11 170	27 002	14 003	-51 011	-20 915	-83 695	-89 587	-84 864	-90 856	-58 422	5 811	94 949	80 247	-27 408	49 723	-1 144
Closing Stock 11,7%	55 629	31 156	23 385	27 373	29 967	46 201	47 018	31 028	32 137	15 420	-4 678	-13 686	-31 860	-16 612	-24 262	-54 616	-43 062	-72 003	-74 710	-73 416	-77 552	-72 046	-41 552	21 447	17 204	-35 257	-18 393	-33 434

Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

Figure 12: Gold: value of 5-year moving average closing stock, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Closing Stock 3%	207 629	165 267	145 450	140 992	139 588	136 860	150 434	159 199	176 583	177 619	157 475	128 419	97 547	74 924	54 604	26 416	14 952	-5 346	-36 347	-62 541	-72 843	-78 135	-48 937	4 971	48 725	54 131	82 646	74 789
Closing Stock 5%	134 244	105 855	92 887	90 160	89 172	86 594	94 043	97 997	108 526	107 414	92 401	71 574	49 672	33 202	18 717	-378	-8 903	-23 692	-44 589	-62 494	-69 498	-72 301	-57 993	-20 948	9 885	15 741	32 604	29 312
Closing Stock 11,7%	55 629	42 676	36 534	34 872	33 980	31 685	33 479	33 567	35 863	32 897	23 512	11 786	-645	-10 394	-17 536	-25 948	-31 026	-39 852	-50 225	-59 630	-63 465	-65 773	-19 742	-46 956	-28 009	-20 917	-13 068	-10 666

Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

5.2 Platinum group metals

Tables 9 and 10 below present the monetary accounts for PGM in South Africa. The tables show opening stock, depletion, revaluation and the closing stock in rand values. The values are represented by 3%, 5% and just below 12% SDR values. Table 9 is calculated in annual unit rent figures, whereas Table 10 is calculated with unit rents in 5-year moving averages.

The closing stock for PGM for the 3%, 5% and 12% SDR values all showed an increasing trend from 1980. For the annual asset values for closing stock for the period 1990 to 2000, the closing stock started on a declining trend where negative values are represented for the years 1993 to 2000. However, from 2001, the closing stock for PGM showed a recovery trend up to 2007 (refer to Figure 13). This trend could be attributed to the price of PGM as discussed in section 4.2.

Table 9: Platinum group metals: monetary accounts for South Africa, annual 1980–2007

Year	Rand Millions											
	Opening stock			Depletion			Revaluation			Closing stock		
	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%
1980	0	0	0	456	448	401	0	0	0	15 215	8 959	3 426
1981	15 215	8 959	3 426	378	369	300	-2 992	-1 954	-1 164	12 601	7 373	2 561
1982	12 601	7 373	2 561	319	302	231	-2 292	-1 639	-821	10 628	6 036	1 971
1983	10 628	6 036	1 971	472	439	349	4 646	2 302	660	15 746	8 777	2 979
1984	15 746	8 777	2 979	590	547	445	3 335	1 619	377	19 671	10 943	3 801
1985	19 671	10 943	3 801	889	849	710	9 062	5 181	1 557	29 621	16 973	6 068
1986	29 621	16 973	6 068	1 268	1 208	1 018	11 363	5 984	1 612	42 251	24 165	8 699
1987	42 251	24 165	8 699	1 452	1 345	1 075	4 700	1 384	-584	48 403	26 893	9 190
1988	48 403	26 893	9 190	1 355	1 240	995	-4 596	-3 325	-1 679	45 162	24 809	8 506
1989	45 162	24 809	8 506	1 493	1 309	1 028	3 114	55	-748	49 769	26 172	8 786
1990	49 769	26 172	8 786	1 130	872	523	-13 240	-9 613	-4 840	37 658	17 431	4 469
1991	37 658	17 431	4 469	1 018	790	325	-4 755	-2 422	-2 013	33 920	15 799	2 782
1992	33 920	15 799	2 782	204	-30	-459	-27 332	-16 371	-6 242	6 792	-602	-3 919
1993	6 792	-602	-3 919	-100	-359	-836	-10 023	-6 225	-2 389	-3 330	-7 187	-7 143
1994	-3 330	-7 187	-7 143	-412	-703	-1 195	-9 995	-6 163	-1 877	-13 737	-14 052	-10 215
1995	-13 737	-14 052	-10 215	-961	-1 290	-1 717	-17 341	-10 455	-2 742	-32 040	-25 797	-14 674
1996	-32 040	-25 797	-14 674	-1 057	-1 356	-1 788	-2 122	32	1 183	-35 218	-27 120	-15 279
1997	-35 218	-27 120	-15 279	-1 664	-2 089	-2 463	-18 582	-12 579	3 520	-55 464	-41 789	-14 222
1998	-55 464	-41 789	-14 222	-1 943	-2 540	-2 914	-7 363	-6 464	-7 767	-64 770	-50 793	-24 902
1999	-64 770	-50 793	-24 902	-2 812	-3 556	-4 006	-26 142	-16 776	-5 330	-93 724	-71 125	-34 238
2000	-93 724	-71 125	-34 238	1 240	-115	-216	133 822	68 949	32 610	41 338	-2 291	-1 844
2001	41 338	-2 291	-1 844	4 201	3 353	950	94 475	65 995	9 013	140 014	67 057	8 119
2002	140 014	67 057	8 119	7 983	7 098	4 590	118 068	67 805	26 522	266 065	141 959	39 231
2003	266 065	141 959	39 231	1 946	1 386	-488	-203 180	-115 620	-42 911	64 831	27 725	-4 167
2004	64 831	27 725	-4 167	1 733	1 086	-1 079	-8 828	-7 083	-3 978	57 736	21 729	-9 224
2005	57 736	21 729	-9 224	1 035	309	-2 124	-24 296	-15 860	-6 808	34 475	6 179	-18 157
2006	34 475	6 179	-18 157	17 894	17 077	14 339	543 377	318 274	126 372	595 746	341 529	122 554
2007	595 746	341 529	122 554	18 851	17 871	14 589	13 075	-1 982	-12 453	627 673	357 419	124 689

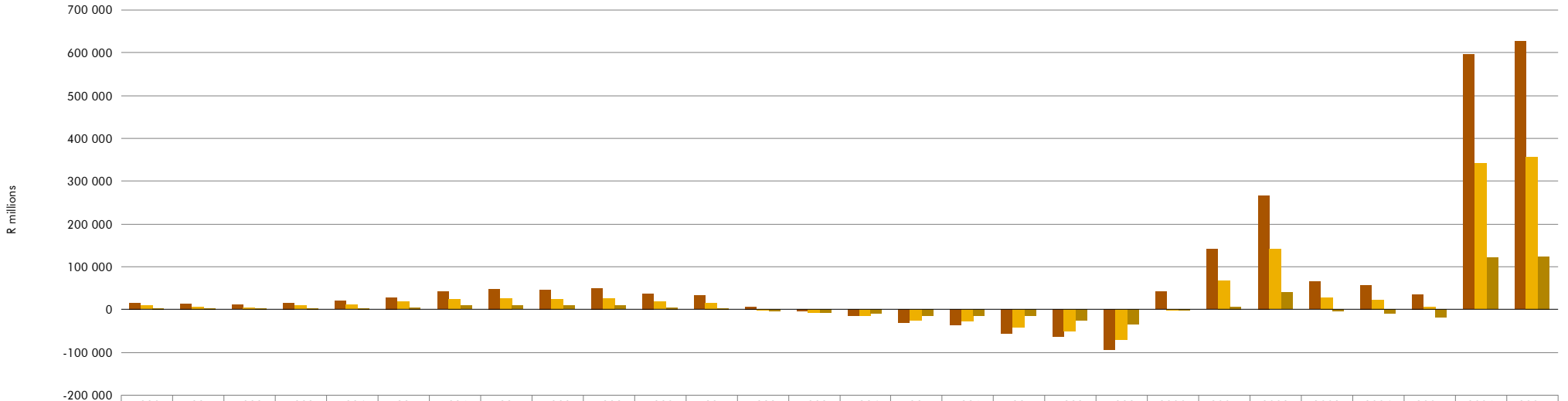
Notes: 0 = Data not available; where figures have been rounded, discrepancies may occur with totals.
Calculations: Statistics South Africa. Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

Table 10: Platinum group metals: monetary accounts for South Africa, 5-year moving average 1980–2007

Year	Rand Millions											
	Opening stock			Depletion			Revaluation			Closing stock		
	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%
1980	0	0	0	456	448	401	0	0	0	15 215	8 959	3 426
1981	15 215	8 959	3 426	420	411	353	-1 621	-1 141	-761	14 015	8 229	3 018
1982	14 015	8 229	3 018	312	302	250	-3 916	-2 486	-1 132	10 411	6 045	2 136
1983	10 411	6 045	2 136	364	348	284	1 364	564	8	12 139	6 957	2 428
1984	12 139	6 957	2 428	466	442	361	2 939	1 443	294	15 544	8 842	3 082
1985	15 544	8 842	3 082	611	577	467	4 212	2 126	441	20 367	11 546	3 990
1986	20 367	11 546	3 990	780	737	604	4 851	2 450	565	25 998	14 732	5 158
1987	25 998	14 732	5 158	1 023	960	787	7 069	3 514	778	34 089	19 207	6 722
1988	34 089	19 207	6 722	1 185	1 107	906	4 210	1 833	115	39 484	22 147	7 743
1989	39 484	22 147	7 743	1 353	1 249	1 014	4 273	1 581	-91	45 110	24 977	8 666
1990	45 110	24 977	8 666	1 455	1 302	1 015	1 946	-236	-1 003	48 512	26 043	8 678
1991	48 512	26 043	8 678	1 368	1 182	846	-4 275	-3 577	-2 294	45 605	23 648	7 231
1992	45 605	23 648	7 231	1 158	938	557	-8 163	-5 824	-3 029	38 601	18 762	4 759
1993	38 601	18 762	4 759	952	677	208	-7 822	-5 894	-3 188	31 731	13 546	1 780
1994	31 731	13 546	1 780	501	207	-305	-15 545	-9 622	-4 078	16 687	4 130	-2 603
1995	16 687	4 130	-2 603	15	-277	-781	-16 215	-9 398	-3 295	486	-5 546	-6 679
1996	486	-5 546	-6 679	-465	-765	-1 249	-15 522	-8 998	-2 744	-15 500	-15 310	-10 671
1997	-15 500	-15 310	-10 671	-870	-1 208	-1 676	-12 625	-7 642	-1 977	-28 995	-24 159	-14 324
1998	-28 995	-24 159	-14 324	-1 251	-1 655	-2 097	-11 441	-7 284	-1 505	-41 686	-33 098	-17 927
1999	-41 686	-33 098	-17 927	-1 819	-2 338	-2 791	-17 136	-11 315	-3 134	-60 641	-46 750	-23 852
2000	-60 641	-46 750	-23 852	-1 273	-1 964	-2 321	19 495	9 429	6 336	-42 419	-39 285	-19 837
2001	-42 419	-39 285	-19 837	-315	-1 180	-1 951	32 219	16 864	5 109	-10 515	-23 601	-16 679
2002	-10 515	-23 601	-16 679	1 672	706	-501	64 567	37 016	12 899	55 723	14 121	-4 282
2003	55 723	14 121	-4 282	2 780	1 743	114	34 133	19 002	5 143	92 636	34 866	975
2004	92 636	34 866	975	3 960	2 941	926	35 334	21 012	6 013	131 930	58 819	7 914
2005	131 930	58 819	7 914	4 184	3 319	653	3 221	4 244	-2 983	139 335	66 382	5 584
2006	139 335	66 382	5 584	6 719	5 901	3 279	77 636	45 727	19 161	223 690	118 009	28 024
2007	223 690	118 009	28 024	8 322	7 550	4 961	45 090	25 429	9 415	277 102	150 988	42 399

Notes: 0 = Data not available; where figures have been rounded, discrepancies may occur with totals.
Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

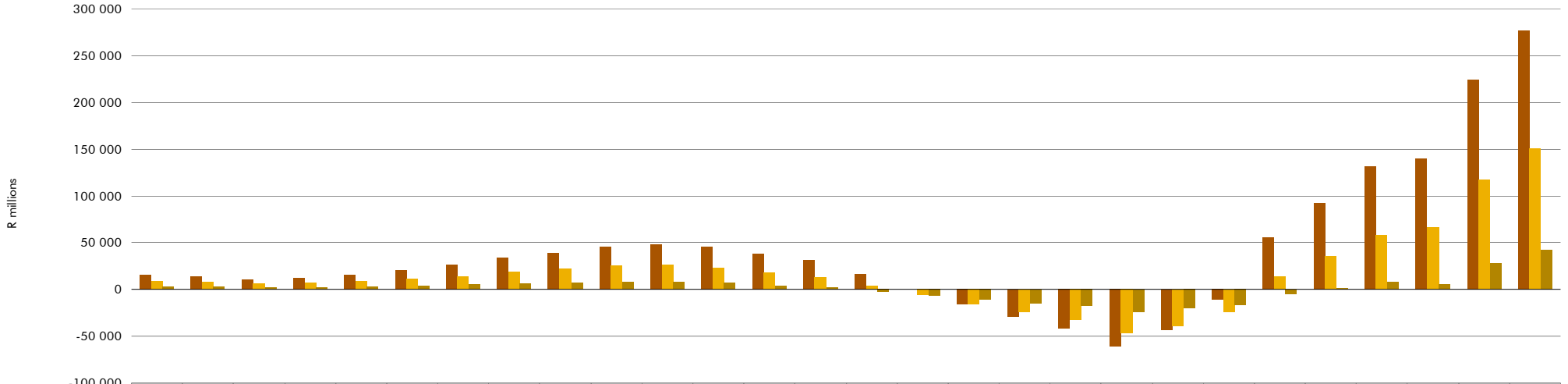
Figure 13: Platinum group metals: value of annual closing stock 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Closing Stock 3%	15 215	12 601	10 628	15 746	19 671	29 621	42 251	48 403	45 162	49 769	37 658	33 920	6 792	-3 330	-13 737	-32 040	-35 218	-55 464	-64 770	-93 724	41 338	140 014	266 065	64 831	57 736	34 475	595 746	627 673
Closing Stock 5%	8 959	7 373	6 036	8 777	10 943	16 973	24 165	26 893	24 809	26 172	17 431	15 799	-602	-7 187	-14 052	-25 797	-27 120	-41 789	-50 793	-71 125	-2 291	67 057	141 959	27 725	21 729	6 179	341 529	357 419
Closing Stock 11,7%	3 426	2 561	1 971	2 979	3 801	6 068	8 699	9 190	8 506	8 786	4 469	2 782	-3 919	-7 143	-10 215	-14 674	-15 279	-14 222	-24 902	-34 238	-1 844	8 119	39 231	-4 167	-9 224	-18 157	122 554	124 689

Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

Figure 14: Platinum group metals: value of 5-year moving average closing stock, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Closing Stock 3%	15 215	14 015	10 411	12 139	15 544	20 367	25 998	34 089	39 484	45 110	48 512	45 605	38 601	31 731	16 687	486	-15 500	-28 995	-41 686	-60 641	-42 419	-10 515	55 723	92 636	131 930	139 335	223 690	277 102
Closing Stock 5%	8 959	8 229	6 045	6 957	8 842	11 546	14 732	19 207	22 147	24 977	26 043	23 648	18 762	13 546	4 130	-5 546	-15 310	-24 159	-33 098	-46 750	-39 285	-23 601	14 121	34 866	58 819	66 382	118 009	150 988
Closing Stock 11,7%	3 426	3 018	2 136	2 428	3 082	3 990	5 158	6 722	7 743	8 666	8 678	7 231	4 759	1 780	-2 603	-6 679	-10 671	-14 324	-17 927	-23 852	-19 837	-16 679	-4 282	975	7 914	5 584	28 024	42 399

Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

5.3 Coal

Tables 11 and 12 below present the monetary accounts for coal in South Africa. The tables show opening stock, depletion, revaluation and the closing stock in rand values. The values are represented by 3%, 5% and just below 12% SDR values. Table 11 is calculated in annual unit rent figures, whereas Table 12 is calculated with unit rents in 5-year moving averages.

The closing stock for coal for the period 1980 to 2007 has shown a positive trend for both annual and 5-year moving averages (refer to Figures 15 and 16) with only negative values in 1999, 2000 and 2004 at the discount rate of just below 12% for annual values (refer to Figure 15) and at 5-year moving average there are only negative values for 2003 and 2004 at just below 12% (refer to Figure 16).

Table 11: Coal: monetary accounts for South Africa, annual 1980–2007

Year	Rand Millions											
	Opening stock			Depletion			Revaluation			Closing stock		
	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%
1980	0	0	0	331	305	220	0	0	0	11 022	6 107	1 884
1981	11 022	6 107	1 884	676	642	528	10 809	6 085	2 102	22 506	12 833	4 514
1982	22 506	12 833	4 514	965	920	769	8 647	4 637	1 286	32 118	18 390	6 569
1983	32 118	18 390	6 569	850	795	608	-4 660	-3 292	-1 978	28 308	15 893	5 199
1984	28 308	15 893	5 199	1 444	1 378	1 159	18 241	10 290	3 548	47 992	27 561	9 906
1985	47 992	27 561	9 906	2 468	2 385	2 107	31 462	17 749	5 997	81 923	47 695	18 010
1986	81 923	47 695	18 010	2 333	2 226	1 866	-6 826	-5 410	-3 928	77 430	44 511	15 948
1987	77 430	44 511	15 948	1 261	1 137	722	-36 856	-22 913	-10 498	41 835	22 735	6 172
1988	41 835	22 735	6 172	1 938	1 786	1 278	20 484	11 200	3 470	64 257	35 722	10 920
1989	64 257	35 722	10 920	3 041	2 861	2 259	33 564	18 632	6 125	100 862	57 215	19 304
1990	100 862	57 215	19 304	3 095	2 872	2 126	-1 276	-2 648	-3 257	102 682	57 439	18 173
1991	102 682	57 439	18 173	2 865	2 598	1 704	-10 554	-8 082	-5 316	94 993	51 956	14 561
1992	94 993	51 956	14 561	2 356	2 061	1 075	-19 242	-12 797	-6 450	78 107	41 220	9 185
1993	78 107	41 220	9 185	1 851	1 530	456	-18 668	-12 149	-5 742	61 290	30 601	3 899
1994	61 290	30 601	3 899	1 788	1 438	264	-4 035	-3 297	-1 911	59 044	28 743	2 252
1995	59 044	28 743	2 252	2 633	2 251	969	25 039	13 991	5 064	86 717	44 985	8 286
1996	86 717	44 985	8 286	3 045	2 622	1 208	10 484	4 804	830	100 245	52 411	10 324
1997	100 245	52 411	10 324	3 131	2 674	1 141	-747	-1 668	-1 709	102 629	53 417	9 756
1998	102 629	53 417	9 756	3 311	2 825	1 197	2 338	172	-722	108 278	56 414	10 232
1999	108 278	56 414	10 232	1 481	961	-782	-61 323	-38 187	-16 133	48 436	19 188	-6 683
2000	48 436	19 188	-6 683	760	178	-1 771	-24 375	-15 809	-6 686	24 822	3 557	-15 140
2001	24 822	3 557	-15 140	5 242	4 719	1 510	141 115	85 959	26 536	171 179	94 236	12 906
2002	171 179	94 236	12 906	4 262	3 663	-14	-82 555	-24 752	-4 017	92 886	73 147	8 875
2003	92 886	73 147	8 875	1 074	644	-794	-59 143	-60 938	-14 871	34 817	12 854	-6 790
2004	34 817	12 854	-6 790	1 614	1 162	-353	15 716	9 145	4 128	52 147	23 160	-3 015
2005	52 147	23 160	-3 015	6 045	5 540	3 847	136 831	81 720	32 050	195 023	110 420	32 883
2006	195 023	110 420	32 883	3 916	3 432	1 810	-72 712	-45 457	-19 225	126 228	68 396	15 467
2007	126 228	68 396	15 467	7 322	6 784	4 980	101 878	59 951	22 116	235 428	135 131	42 563

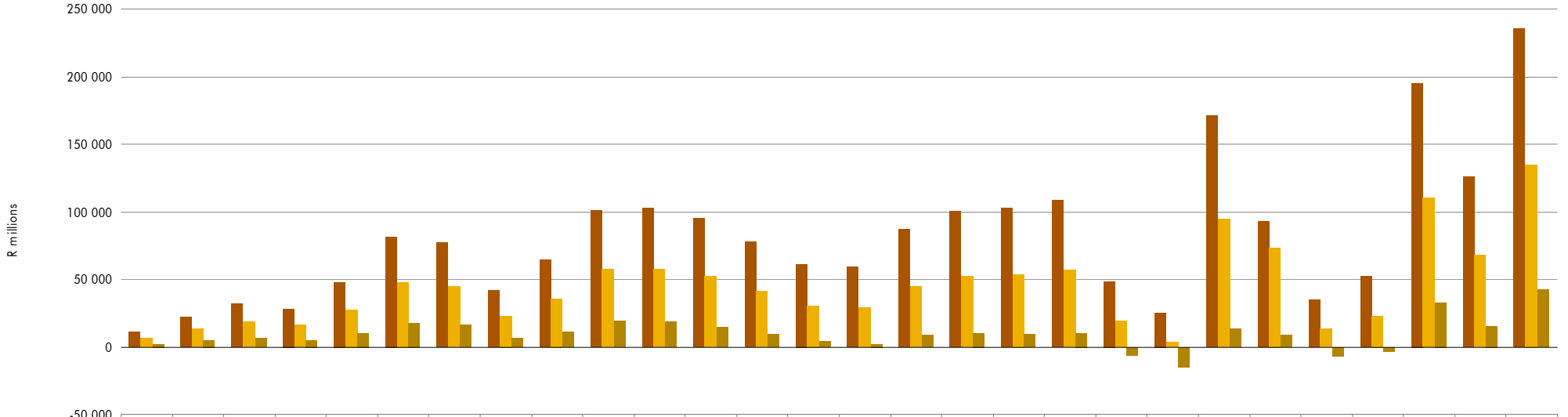
Notes: 0 = Data not available; where figures have been rounded, discrepancies may occur with totals.
Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

Table 12: Coal: monetary accounts for South Africa, 5-year moving average 1980–2007

Year	Rand Millions											
	Opening stock			Depletion			Revaluation			Closing stock		
	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%	3%	5%	11,7%
1980	0	0	0	331	305	220	0	0	0	11 022	6 107	1 884
1981	11 022	6 107	1 884	525	494	389	5 948	3 276	1 052	17 495	9 877	3 325
1982	17 495	9 877	3 325	706	668	541	5 298	2 812	757	23 499	13 356	4 622
1983	23 499	13 356	4 622	752	709	565	768	108	-358	25 019	14 172	4 829
1984	25 019	14 172	4 829	961	909	737	5 968	3 107	735	31 947	18 189	6 301
1985	31 947	18 189	6 301	1 430	1 365	1 150	14 081	7 749	2 376	47 458	27 304	9 827
1986	47 458	27 304	9 827	1 722	1 645	1 387	7 960	3 943	638	57 139	32 891	11 852
1987	57 139	32 891	11 852	1 730	1 640	1 337	-1 458	-1 742	-1 763	57 411	32 789	11 425
1988	57 411	32 789	11 425	1 960	1 850	1 482	5 594	2 352	-239	64 964	36 991	12 669
1989	64 964	36 991	12 669	2 211	2 081	1 649	6 142	2 551	-223	73 317	41 623	14 095
1990	73 317	41 623	14 095	2 303	2 148	1 629	795	-812	-1 802	76 415	42 960	13 921
1991	76 415	42 960	13 921	2 451	2 261	1 625	2 402	-1	-1 655	81 268	45 221	13 892
1992	81 268	45 221	13 892	2 654	2 431	1 685	4 054	958	-1 176	87 975	48 609	14 401
1993	87 975	48 609	14 401	2 730	2 466	1 580	-320	-1 777	-2 477	90 386	49 298	13 504
1994	90 386	49 298	13 504	2 601	2 288	1 241	-7 118	-5 845	-4 140	85 868	45 741	10 605
1995	85 868	45 741	10 605	2 521	2 170	993	-5 353	-4 539	-3 112	83 037	43 372	8 486
1996	83 037	43 372	8 486	2 464	2 091	840	-4 364	-3 675	-2 147	81 137	41 788	7 179
1997	81 137	41 788	7 179	2 680	2 262	861	4 004	1 128	-681	87 821	45 178	7 359
1998	87 821	45 178	7 359	2 947	2 501	1 007	5 606	2 265	242	96 374	49 944	8 608
1999	96 374	49 944	8 608	2 818	2 351	784	-7 022	-5 349	-2 689	92 170	46 946	6 704
2000	92 170	46 946	6 704	2 428	1 922	227	-15 321	-10 493	-4 988	79 276	38 374	1 943
2001	79 276	38 374	1 943	2 797	2 282	265	9 256	4 906	53	91 329	45 563	2 261
2002	91 329	45 563	2 261	2 980	2 444	29	3 048	803	6 800	97 357	48 809	9 090
2003	97 357	48 809	9 090	2 729	2 168	-382	-11 606	-7 732	-11 976	88 480	43 245	-3 269
2004	88 480	43 245	-3 269	2 791	2 240	-291	-1 094	-826	1 076	90 176	44 659	-2 484
2005	90 176	44 659	-2 484	3 853	3 324	863	30 255	18 270	8 996	124 283	66 253	7 375
2006	124 283	66 253	7 375	3 485	2 974	893	-15 452	-9 954	-632	112 316	59 274	7 636
2007	112 316	59 274	7 636	4 031	3 542	1 903	13 262	7 736	6 724	129 610	70 552	16 263

Notes: 0 = Data not available; where figures have been rounded, discrepancies may occur with totals.
Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

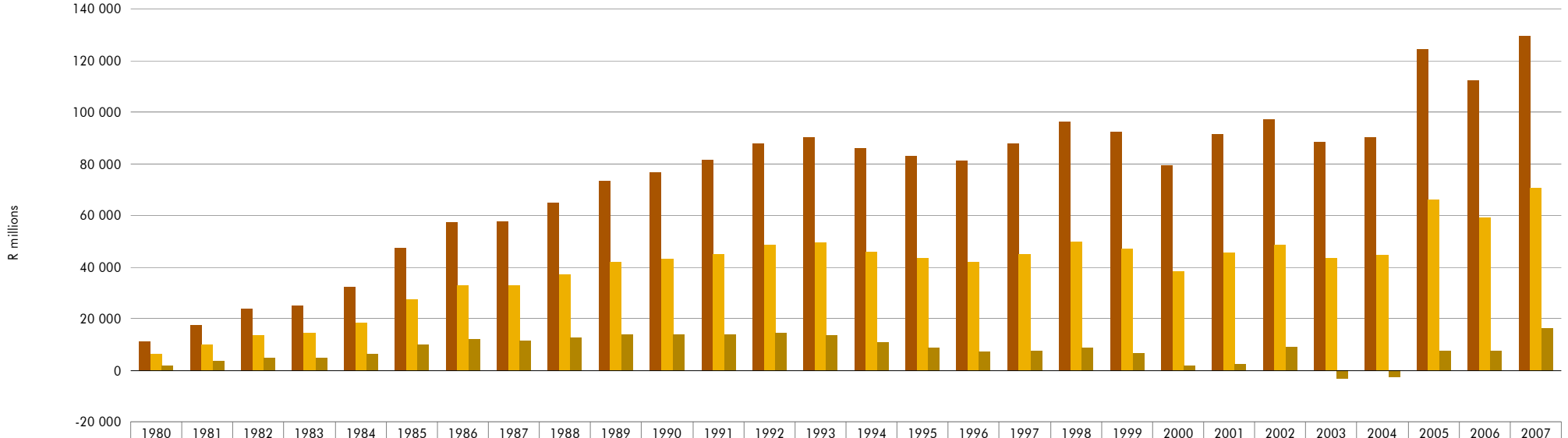
Figure 15: Coal: value of annual closing stock 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Closing Stock 3%	11 022	22 506	32 118	28 308	47 992	81 923	77 430	41 835	64 257	100 862	102 682	94 993	78 107	61 290	59 044	86 717	100 245	102 629	108 278	48 436	24 822	171 179	92 886	34 817	52 147	195 023	126 228	235 428
Closing Stock 5%	6 107	12 833	18 390	15 893	27 561	47 695	44 511	22 735	35 722	57 215	57 439	51 956	41 220	30 601	28 743	44 985	52 411	53 417	56 414	19 188	3 557	94 236	73 147	12 854	23 160	110 420	68 396	135 131
Closing Stock 11,7%	1 884	4 514	6 569	5 199	9 906	18 010	15 948	6 172	10 920	19 304	18 173	14 561	9 185	3 899	2 252	8 286	10 324	9 756	10 232	-6 683	-15 140	12 906	8 875	-6 790	-3 015	32 883	15 467	42 563

Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

Figure 16: Coal: value of 5-year moving average closing stock, 1980–2007



	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Closing Stock 3%	11 022	17 495	23 499	25 019	31 947	47 458	57 139	57 411	64 964	73 317	76 415	81 268	87 975	90 386	85 868	83 037	81 137	87 821	96 374	92 170	79 276	91 329	97 357	88 480	90 176	124 283	112 316	129 610
Closing Stock 5%	6 107	9 877	13 356	14 172	18 189	27 304	32 891	32 789	36 991	41 623	42 960	45 221	48 609	49 298	45 741	43 372	41 788	45 178	49 944	46 946	38 374	45 563	48 809	43 245	44 659	66 253	59 274	70 552
Closing Stock 11,7%	1 884	3 325	4 622	4 829	6 301	9 827	11 852	11 425	12 669	14 095	13 921	13 892	14 401	13 504	10 605	8 486	7 179	7 359	8 608	6 704	1 943	2 261	9 090	-3 269	-2 484	7 375	7 636	16 263

Calculations: Statistics South Africa with source data from Department of Minerals and Energy: Statistical Tables (1985 to 2007), Statistics South Africa, *Census of Mining 2004*, GDP publication (1993 to 2007) and AFS surveys (2005 to 2007).

6. Policy analysis

Section 6 briefly discusses the Mineral and Petroleum Resources Royalty Act (MPRDA), Act No. 28 of 2002) paying more attention to mineral resource royalties and the *Minerals and Petroleum Resources Royalty Bill (B59-2008)* which complement the MPRDA. The section closes with a discussion of El-Serafy's Use-Cost method as a policy analysis tool for mineral resource royalties. Results from the use of the El-Serafy's Use-Cost method are also presented.

6.1 Mineral resource royalties

Section 3(2) (b) of the MPRDA, (Act No. 28 of 2002), states: "As the custodian of the nation's mineral and petroleum resources, the State, acting through the Minister may: in consultation with the Minister of Finance, determine and levy, any fee or consideration payable in terms of any relevant Act of Parliament."

Resource royalties are not a tax; they instead represent compensation for the permanent loss of non-renewable commodities and the 'tax base' will be the value of the minerals mined and transferred – in other words this is an *ad valorem* gross sales charge.

The exploration for and extraction of mineral resources in South Africa have been subject to various pieces of legislation over the years. This legislation dealt with numerous issues, such as the ownership of mineral resources; the right to undertake exploration and mining operations; environmental and safety concerns relating to mining operations; and State mining lease payments (where applicable). The MPRDA brings South Africa's mining legislation in line with international norms. All mineral rights will vest with the State as custodian of minerals resources on behalf of South African citizens. The *Minerals and Petroleum Resources Royalty Bill (B59–2008),* which complements the MPRDA provides for the compensation to the State (as custodian) for the country's permanent loss of non-renewable resources. Whereas consideration for the extraction of mineral resources was previously payable to the State only in certain cases (i.e. where mining was conducted on State land), the exploitation of all minerals resources in South Africa will require consideration in the form of mineral royalties payable to the State[15].

Section 3(3) of the MPRDA also states that the Minister must ensure the sustainable development for South Africa's mineral and petroleum resources within a framework of national environmental policy, norms and standards while promoting economic and social development.

The question is how will the Minister ensure the sustainable development for South Africa's mineral and petroleum resources? This may be done through the proper usage of the resource rent or royalties (i.e. are the royalties that are to be collected being used for capital or current income investment?). (refer to section 6.2.) Knowledge on how government is investing the resource royalties being collected needs to be transparent. As per section 2 of the *Minerals and Petroleum Resources Royalty Bill (B59–2008),* all royalties received will be for the benefit of the National Revenue Fund. According to the South African Revenue Services (SARS), there is no specific use or area against which these payments will be utilised.

[15] South African Revenue Service (SARS): http://www.sars.gov.za

6.2 El-Serafy's Use-Cost method

The Use-Cost method is a measure of sustainable use of minerals. It divides resource rent into two components:

- Capital component: part of resource rent that needs to be reinvested to maintain a constant stream of income; and
- Income component: residual amount that can be consumed as current income.

The results of the El-Serafy's Use-Cost formula (refer to section 2.4 of Annexure 1) are presented in Tables 13, 14 and 15 for gold, PGM and coal respectively. The calculations are done using a 3%, 5% and just below 12% SDR/RRR[16].

The income component (X) for gold at a RRR of just below 12% decreased over the 27 years. In Table 13 the income component in 1980 was R6 509 million decreasing to -R3 912 million in 2007. The capital component also showed a decrease from approximately R2 million to R0 million. The capital depreciation factor in 1980 was 0% remaining unchanged to 2007.

The income component (X) for PGM at a RRR of just below 12% increased over the 27 years from 1980 to 2007. In Table 14 the income component in 1980 was R401 million increasing to R14 589 million in 2007. The capital component remained unchanged at R0 million. The capital depreciation factor also remained unchanged at 0% 2007.

The income component (X) for coal at a RRR of just below 12% increased over the 27 years from 1980 to 2007. In Table 15 the income component in 1980 was R220 million increasing to R4 980 million in 2007. The capital component also remained unchanged at R0 million. The capital depreciation factor remained unchanged at 0% for the 27–year period.

Government policy analysis can be informed by El-Serafy's Use-Cost method to help determine how much of resource rent should be consumed and how much should be re-invested to maintain a constant stream of income.

[16] SDR is the same as RRR as shown in El-Serafy's Use-Cost formula.

Table 13: Gold: income and capital component of resource rent 1980–2007

Income component (X)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	Rand Millions													
Rent consumed as income (RRR 11,7%)	6 509	3 645	2 736	3 203	3 506	5 406	5 501	3 630	3 760	1 804	-547	-1 601	-3 728	-1 944
Rent consumed as income (RRR 5%)	6 717	4 041	3 268	3 839	4 244	6 301	6 754	5 180	5 612	4 041	2 073	1 301	-559	1 352
Rent consumed as income (RRR 3%)	6 308	3 872	3 180	3 725	4 121	6 064	6 603	5 245	5 705	4 353	2 623	1 980	321	2 114
Capital component (R-X) Reinvestment														
Remaining rent invested (RRR 11,7%)	1,79	0,90	0,82	1,29	1,62	2,51	1,92	0,89	1,26	0,58	-0,19	-0,58	-1,78	-1,12
Remaining rent invested (RRR 5%)	181	104	91	122	143	214	202	132	165	116	62	40	-19	50
Remaining rent invested (RRR 3%)	706	421	364	461	529	781	788	569	673	507	312	239	42	288
	Percentage													
Capital depreciation factor (R-X)/R (%)														
Percentage of reinvestment (RRR 11,7%)	0,03	0,02	0,03	0,04	0,05	0,05	0,03	0,02	0,03	0,03	0,03	0,04	0,05	0,06
Percentage of reinvestment (RRR 5%)	2,62	2,50	2,72	3,08	3,27	3,28	2,91	2,49	2,86	2,79	2,89	2,96	3,31	3,59
Percentage of reinvestment (RRR 3%)	10,06	9,81	10,28	11,02	11,38	11,40	10,66	9,78	10,56	10,43	10,62	10,77	11,47	11,99

Income component (X)	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
	Rand Millions													
Rent consumed as income (RRR 11,7%)	-2 839	-6 390	-5 038	-8 424	-8 741	-8 590	-9 074	-8 429	-7 523	2 509	2 013	-4 125	-2 152	-3 912
Rent consumed as income (RRR 5%)	701	-2 552	-1 046	-4 186	-4 481	-4 244	-4 544	-2 921	291	4 748	4 012	-1 370	2 486	-57
Rent consumed as income (RRR 3%)	1 591	-1 345	109	-2 772	-3 051	-2 808	-3 048	-1 471	2 145	5 190	4 458	-539	3 801	1 077
Capital component (R-X) Reinvestment														
Remaining rent invested (RRR 11,7%)	-1,10	-1,19	-0,67	-1,10	-0,78	-0,64	-0,48	-0,21	-0,22	0,04	0,01	0,00	0,00	0,00
Remaining rent invested (RRR 5%)	22	-58	-20	-81	-73	-64	-59	-27	3	37	19	-3	4	0
Remaining rent invested (RRR 3%)	195	-136	10	-254	-253	-222	-220	-86	133	274	177	-14	74	16
	Percentage													
Capital depreciation factor (R-X)/R (%)														
Percentage of reinvestment (RRR 11,7%)	0,04	0,02	0,01	0,01	0,01	0,01	0,01	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 5%)	3,04	2,22	1,92	1,90	1,61	1,49	1,29	0,92	1,00	0,77	0,48	0,24	0,15	0,10
Percentage of reinvestment (RRR 3%)	10,93	9,16	8,45	8,39	7,65	7,32	6,73	5,53	5,82	5,01	3,81	2,50	1,91	1,46

Notes: Where figures have been rounded, discrepancies may occur with totals. Calculations: Statistics South Africa.

Table 14: Platinum group metals: income and capital component of resource rent 1980–2007

	Rand Millions													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Income component (X)														
Rent consumed as income (RRR 11,7%)	401	300	231	349	445	710	1 018	1 075	995	1 028	523	325	-459	-836
Rent consumed as income (RRR 5%)	448	369	302	439	547	849	1 208	1 345	1 240	1 309	872	790	-30	-359
Rent consumed as income (RRR 3%)	456	378	319	472	590	889	1 268	1 452	1 355	1 493	1 130	1 018	204	-100
Capital component (R-X) Reinvestment														
Remaining rent invested (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Remaining rent invested (RRR 5%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Remaining rent invested (RRR 3%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	Percentage													
Capital depreciation factor (R-X)/R (%)														
Percentage of reinvestment (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 5%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 3%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

	Rand Millions													
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Income component (X)														
Rent consumed as income (RRR 11,7%)	-1 195	-1 717	-1 788	-2 463	-2 914	-4 006	-216	950	4 590	-488	-1 079	-2 124	14 339	14 589
Rent consumed as income (RRR 5%)	-703	-1 290	-1 356	-2 089	-2 540	-3 556	-115	3 353	7 098	1 386	1 086	309	17 076	17 871
Rent consumed as income (RRR 3%)	-412	-961	-1 057	-1 664	-1 943	-2 812	1 240	4 200	7 982	1 945	1 732	1 034	17 872	18 830
Capital component (R-X) Reinvestment														
Remaining rent invested (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Remaining rent invested (RRR 5%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,26	0,24
Remaining rent invested (RRR 3%)	0,00	-0,01	-0,01	-0,03	-0,04	-0,15	0,04	0,41	1,06	0,70	0,88	1,05	21,61	20,86
	Percentage													
Capital depreciation factor (R-X)/R (%)														
Percentage of reinvestment (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 5%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 3%)	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,01	0,01	0,04	0,05	0,10	0,12	0,11

Notes: Where figures have been rounded, discrepancies may occur with totals. Calculations: Statistics South Africa.

Table 15: Coal: income and capital component of resource rent 1980–2007

	Rand Millions													
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Income component (X)														
Rent consumed as income (RRR 11,7%)	220	528	769	608	1 159	2 107	1 866	722	1 278	2 259	2 126	1 704	1 075	456
Rent consumed as income (RRR 5%)	305	642	919	795	1 378	2 385	2 226	1 137	1 786	2 861	2 872	2 598	2 061	1 530
Rent consumed as income (RRR 3%)	331	675	964	849	1 440	2 458	2 323	1 255	1 928	3 026	3 081	2 850	2 343	1 839
Capital component (R-X) Reinvestment														
Remaining rent invested (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Remaining rent invested (RRR 5%)	0,00	0,00	0,01	0,01	0,08	0,28	0,29	0,15	0,33	0,46	0,42	0,47	0,37	0,40
Remaining rent invested (RRR 3%)	0,06	0,36	1,04	1,07	3,77	10,26	10,33	5,64	10,50	15,15	14,60	15,45	12,67	12,34
	Percentage													
Capital depreciation factor (R-X)/R (%)														
Percentage of reinvestment (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 5%)	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,01	0,02	0,02	0,01	0,02	0,02	0,03
Percentage of reinvestment (RRR 3%)	0,02	0,05	0,11	0,13	0,26	0,42	0,44	0,45	0,54	0,50	0,47	0,54	0,54	0,67

	Rand Millions													
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Income component (X)														
Rent consumed as income (RRR 11,7%)	264	969	1 208	1 141	1 197	-782	-1 771	1 510	-14	-794	-353	3 847	1 810	4 980
Rent consumed as income (RRR 5%)	1 437	2 249	2 621	2 671	2 821	959	178	4 712	3 657	643	1 158	5 521	3 420	6 757
Rent consumed as income (RRR 3%)	1 771	2 602	3 008	3 080	3 249	1 454	745	5 138	4 179	1 045	1 566	5 857	3 791	7 072
Capital component (R-X) Reinvestment														
Remaining rent invested (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,02
Remaining rent invested (RRR 5%)	0,66	1,53	1,83	3,14	3,99	1,36	0,29	7,65	5,68	1,69	3,66	19,02	12,33	27,28
Remaining rent invested (RRR 3%)	16,84	31,36	36,83	51,73	61,05	27,38	15,14	104,93	83,05	28,59	47,86	188,65	125,50	250,72
	Percentage													
Capital depreciation factor (R-X)/R (%)														
Percentage of reinvestment (RRR 11,7%)	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Percentage of reinvestment (RRR 5%)	0,05	0,07	0,07	0,12	0,14	0,14	0,16	0,16	0,16	0,26	0,31	0,34	0,36	0,40
Percentage of reinvestment (RRR 3%)	0,94	1,19	1,21	1,65	1,84	1,85	1,99	2,00	1,95	2,66	2,97	3,12	3,20	3,42

Notes: Where figures have been rounded, discrepancies may occur with totals. Calculations: Statistics South Africa.

7. Conclusion

The mineral resources measured in these accounts are gold, PGM and coal as they are the major contributors to South Africa's mining industry as measured by the GDP.

The mineral accounts are crucial in that they enable the monitoring of the remaining proven reserves of mineral resources as well as the monetary value of these proven reserves and the resource rents that should be collected, either consumed or re-invested to ensure a sustainable future for the mineral industry.

The mineral accounts can therefore provide answers to the following questions:

- What is the level of production (extraction), proven reserves and the number of years to depletion?
- What is the monetary value of these proven reserves?
- What are the values of the resource rent produced form the extraction of the mineral resources?

These accounts will be updated periodically, based on data availability from the DMR. It is important to publish future energy accounts as official statistics and for the DMR and Stats SA to embark on the process of verification of input data.

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Glossary

Term	Description
Account	An account is a tool which records, for a given aspect of economic life, (a) the uses and resources or (b) the changes in assets and the changes in liabilities and/or (c) the stock of assets and liabilities existing at a certain time; the transactions accounts include a balancing item which is used to equate the two sides of the accounts (e.g. resources and uses) and which is a meaningful measure of economic performance in itself.
Compensation of employees	Compensation of employees is defined as the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the latter during the accounting period. Compensation of employees does not include any taxes payable by the employer on the wage and salary bill. Note that in this report, compensation of employees will not be equal with other figures published by Stats SA because such figures are adjusted to benchmarking levels done in 1999, whereas figures in this report are not adjusted.
Constant value	In economic terms, constant value refers to any price or value that is adjusted for the effect of inflation Synonym is *real prices*.
Consumption of capital	Consumption of fixed capital is a cost of production. It may be defined in general terms as the decline, during the course of the accounting period, in the current value of the stock of fixed assets owned and used by a producer as a result of physical deterioration, normal obsolescence or normal accidental damage. It excludes the value of fixed assets destroyed by acts of war or exceptional events such as major natural disasters, which occur very infrequently.
Current value	In economic terms, current value refers to any price or value expressed in money of the day. Synonym is *nominal prices*.
Depletion	The depletion of natural deposits covers the reduction in the value of deposits of subsoil assets as a result of the physical removal and using up of the asset. The changes recorded here are the negative counterparts of gross additions to the level of exploitable subsoil resources that result from reassessments of exploitability, because of changes in technology or relative prices.
Environmental Economic Accounts (EEA)	EEA brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy, and the impact of the economy on the environment.
Fixed assets	Fixed assets may have been purchased in the past at times when both relative prices and the general price level were very different from prices in the current period. In

Term	Description
	order to be consistent with the other entries, consumption of fixed capital must be valued with reference to the same overall set of current prices as that used to value output and intermediate consumption.
Fixed assets or inventories	Subsoil assets are different from the stocks of fixed assets and inventories, the major difference being that the process of production has created them. Although they are neither fixed assets nor inventories, they present characteristics of both. The 1993 SNA assumes that all receipts generated from the use of natural assets can be recorded as income, specifically as part operating surplus. The implicit assumption is that assets are not exhaustible and therefore no deductions from the receipts are necessary.
Intermediate consumption	Intermediate consumption consists of the value of the goods and services consumed as inputs by a process of production, excluding fixed assets whose consumption is recorded as consumption of fixed capital. The goods or services may be either transformed or used up by the production process. Some inputs re-emerge after having been transformed and incorporated into the outputs. Other inputs are completely consumed or used up. Intermediate consumption includes the rentals paid on the use of fixed assets.
Mineral exploration	Mineral exploration consists of the value of expenditures on exploration for petroleum and natural gas and for non-petroleum deposits; it includes pre-license costs, license and acquisition costs, appraisal costs and the costs of actual test drilling and boring, as well as the costs of aerial and other surveys, transportation costs, etc. incurred to make it possible to carry out the tests.
Monetary accounts	Provide a basket of measures that describe the economic and welfare impacts of water supply and use.
National accounts	National accounts are a coherent, consistent and integrated set of macro-economic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. National accounts provide a comprehensive accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision-taking and policy-making.
Natural Resource Accounting	Natural Resource Accounting is an accounting system that deals with stocks and stock changes of natural assets, comprising biota (produced or wild), subsoil assets (proved reserves), water and land with their aquatic and terrestrial ecosystems. It is frequently used in the sense of physical accounting as distinguished from monetary (environmental) accounting.

Term	Description
Natural resources	Natural assets (raw materials) occurring in nature that can be used for economic production or consumption. The naturally occurring assets that provide use benefits through the provision of raw materials and energy used in economic activity (or that may provide such benefits in future) and that are subject primarily to quantitative depletion through human use are subdivided into four categories: mineral and energy resources, soil resources, water resources and biological resources.
Non-renewable natural resources	Exhaustible natural resources such as mineral resources that cannot be regenerated after exploitation.
Nominal holding gains	Nominal holding gains depend upon changes in the prices, or more generally, the monetary values, of assets and liabilities over time. Nominal holding gains may accrue on assets held for any length of time during the accounting period and not merely on assets that appear in the opening or closing balance sheets. Nominal holding gains are calculated with reference to assets or liabilities that remain qualitatively and quantitatively unchanged during the period over which the holding gain is measured.
Opportunity cost	In the System, the cost of using, or using up, some existing asset or good in one particular process of production is measured by the amount of benefits that could have been secured by using the asset or good in alternative ways. Opportunity cost is calculated with reference to the opportunities foregone at the time the asset or resource is used, as distinct from the costs incurred at some time in the past to acquire the asset.
Proved reserves	Such estimated quantities of mineral deposits, at a specific date, as analysis of geological engineering data demonstrates with reasonable certainty to be recoverable in the future under the same economic and operational conditions.
Physical accounting	Natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units, for example, weight, area or number. Qualitative measures, expressed in terms of quality classes, types of uses or ecosystem characteristics, may supplement quantitative measures. The combined changes in asset quality and quantity are called volume changes.
Rent/royalties	The owners of assets, whether private or government units, may grant leases to other institutional units permitting them to extract such deposits over a specified period of time in return for the payment of rents. These payments are often described as royalties, but they are essentially rents that accrue to owners of the assets in return for putting them at the disposal of other institutional units for specified periods of time and are treated as such in the System. The rents may take the form of periodic payments of fixed amounts, irrespective of the rate of extraction or, more likely, they

Term	Description
	may be a function of the quantity or volume of the asset extracted.
Revaluation	Revaluation is the positive or negative holding gain accrued during the accounting period to the owners of financial or non-financial assets and liabilities.
Satellite accounts	Satellite accounts provide a framework linked to the central accounts and which enables attention to be focused on a certain field or aspect of economic and social life in the context of national accounts: common examples are satellite accounts for the environment, tourism or unpaid household work.
Standard Industrial Classification of all Economic Activates (SIC)	A South African version of a classification coding system used to classify an enterprise according to its economic activity. Note: It is based on the United Nation's (UN) International Standard Industrial Classification of all Economic Activities (ISIC), with a number of adaptations for local conditions.
Stocks	Stocks are a position in, or holdings of, assets and liabilities at a point in time and the SNA records stocks in accounts, usually referred to as balance sheets, and tables at the beginning and end of the accounting period. Stocks result from the accumulation of prior transactions and other flows, and they are changed by transactions and other flows in the period (note that stocks of goods are referred to as 'inventories' in the SNA).
Subsoil assets	Subsoil assets are defined in the 1993 SNA as proven resources of mineral deposits located on or below the earth's surface that are economically exploitable, given current technology and relative prices. Subsoil assets consist of coal, oil and natural gas reserves, metallic mineral reserves and non-metallic mineral reserves. The SEEA (System of Integrated Environmental and Economic Accounting) adopts the same definition as the SNA. Subsoil assets are classified according to: -The degree of geological certainty; and -The degree of economic feasibility of the reserves. The boundary between discovered and undiscovered reserves fluctuates as a result of exploration and development, differing geological conditions and technological improvements. The degree of economic feasibility on the other hand categorises the resource as economic, marginally economic and sub-economic; according to the relationship between prices and extraction costs and technological exploitability.
System of Integrated Environmental and Economic Accounting (SEEA)	Satellite system of the System of National Accounts (SNA) proposed by the United Nations for the incorporation of environment concerns (environmental costs, benefits and assets) into national accounts.

Term	Description
Taxes	Taxes are compulsory, unrequited payments, in cash or in kind, made by institutional units to government units. They are transfers because the government provides nothing in return to the individual unit making the payment, although government may use the funds raised in taxes to provide goods and services to other units, either individually or collectively, or to the community as a whole.
1993 System of National Accounts	The revised (1993) system adopted worldwide for conventional economic (national) accounting (Commission of the European Communities and others, 1993).

Annexure 1: methodological notes

This section focuses on the methodologies used to construct EEA, namely the methodologies and development of physical accounts (section 2.1), the calculation of resource rent (section 2.2) and the mythologies followed to develop the monetary accounts (section 2.3)[17]. The latter can only be compiled after resource values have been established. Finally section 2.4 discussed the methodology used to calculate the User-cost method which is a powerful tool for determining the capital component and the part of resource rent that needs to be reinvested to maintain a constant stream of income.

2.1 Physical accounts

The format of the physical account starts with the volume (tons) of opening stocks at the beginning of the reference period, to which additions are added and from which extractions[18] are subtracted to arrive at the volume (tons) of the closing stock. In the case of South Africa, the following four entries are included in the physical accounts:

- Volume sold (in tons)[18];
- Change in inventories (in tons), (calculated as the difference between the production volume (extraction) and the volume sold);
- Closing stock (in tons), including change in inventories; and
- Years to depletion (calculated as the ratio of closing stock over production volume extraction).

Three alternative definitions and measures of the stock (reserves) of minerals are known, namely:

- Total stock of the mineral;
- Economically proven reserves defined as that proportion of the mineral resource that is economically feasible to extract; and
- Economically proven reserves, less any possible waste that may occur during the extraction process.

The second measure was used for the South African mineral accounts, as South Africa only has information on economically proven reserves.

Resources are divided into identified resources and undiscovered resources.

Identified resources are specific bodies of mineral-bearing material whose location, quality and quantity are known from geological evidence, supported by engineering measurements. These identified resources are further sub-divided into:

- *Measured resources*: material for which quantity and quality estimates are within a margin of error of less than 20%, from geologically known sample sites;
- *Indicated resources*: material for which quantity and quality are estimated partly from sample analyses and partly from geological projections; and

[17] SEEA, 2003. Handbook on integrated environmental and economic accounting. United Nations Statistics Division (UNSD).
[18] Source: Department of Minerals and Energy, 2007/2008. South Africa's Mineral Industry 2007/2008.

- *Inferred resources*: material in unexplored extensions of demonstrated resources based on geological projections.
- Undiscovered resources are unspecified bodies of mineral-bearing material surmised to exist on the basis of broad geological knowledge and theory. Undiscovered resources are sub-divided into:
- *Hypothetical resources*: undiscovered materials reasonably expected to exist in a known mining district under known geological conditions; and
- *Speculative resources*: undiscovered materials that may occur in either known types of deposits in favourable geological settings where no discoveries have been made, or in yet unknown types of deposits that remain to be recognised.

It is important to note that the mineral accounts only account for identified resources.

The method of calculating closing and opening stock is as follows:

- Verify the confirmed closing stock for gold, PGM and coal for the last year in question (e.g. coal, 2007, identified resources according to the South African Minerals Industry (SAMI) publication from DME, 2008.
- Calculate the opening stock and closing stock (sub-soil assets) for each year by working backwards from the last year of reference (confirmed closing stock).
- The opening stock for 2007 will thus be the closing stock (confirmed) for 2006 plus the production (extraction) for 2006.
- The closing stock for 2006 will thus equal the opening stock for 2007.

There are three ways to estimate the lifetime of reserves (years to depletion) on the basis of current year information:

- Stock at the beginning of the year / extraction of the year;
- Stock at the beginning of the year plus appearances / extraction of the year; and
- Stock at the end of the year / extraction of the year.

Stock at the end of the year / extraction of the year was used to calculate the years to depletion for minerals in the compilation of the mineral accounts for South Africa.

2.2 Resource rent

Resource rent is a measure of the scarcity value of extractive resources (such as minerals) as their finite stocks are reduced with extraction. Calculation of resource rent is therefore the first step in developing monetary accounts. The method defined in the 1993 System of National Accounts (1993 SNA) was adopted to calculate resource rent for South Africa's mineral accounts. Accordingly, resource rent for each mineral are calculated as follows:

- Value of output (at producer prices) minus production costs.

Production costs include the cost of intermediate inputs in mining, compensation of employees, consumption of fixed capital, and a normal rate of return on investment capital.

The formula for calculating resource rent R is (CEEPA, 2009):

$$R_t = TR_t - IC_t - CE_t - CFC_t - NP_t \quad (1)$$

$$NP_t = i_t K_t \quad (2)$$

Where:

R	= the resource rent
TR	= total revenue from mining sector (output/sales)
IC	= intermediate consumption
CE	= compensation of employees
CFC	= consumption of fixed capital
NP	= 'normal profit', a return to fixed capital
K	= fixed capital stock invested in an industry
i	= the rate of investment considered the opportunity cost of capital

The normal rate of return on fixed capital investments is the opportunity cost or economic value of financial capital that may be invested in alternative profit-making economic activities. The average long-term nominal interest rate minus the prevailing interest inflation rate is used as the rate of return to capital, which is multiplied by the fixed capital stock in mining to derive estimates of normal profits.

In the report *Mineral Accounts for South Africa, 1980–2001 (Report no. 04-05-02),* the average real rate of interest in South Africa was calculated at -2% for the period 1973 to 1982 and 3% for the period 1983 to 2001[19]. A SDR (r)[20] of 3% and an alternative discount rate of 5% were used for calculations of the resource rent tables (refer to Tables 4, 5 and 6).

The Organisation for Economic Co-operation and Development (OECD) suggests two approaches to the measurement of SDR (r). These are:

- The use of national accounts statistics on operating surplus; and
- The use of market interest rates.

Stats SA decided to make use of the market interest rates approach.

[19] Percentages obtained from unpublished data from the SARB.

[20] This letter "r" refers to the stock formula below and not the SDR previously referred to in this document.

According to the OECD (2001:88) the interest that could be earned and the interest that would be paid are equally relevant for investment decisions; thus the average between interest earned and interest paid should be calculated and then taking the harmonic mean of this averaged series to get to the discount rate. One can use for interest paid, government bond rates i.e. the R153 and for interest earned the repurchase rate, which in effect is the earning rate Government makes from lending money. This way, like-for-like is compared in terms of keeping the rates at the government (relatively risk-free) level. But due to the lack of data for government bond rates before 1993 it was decide to only use the repurchase rate[21] to calculate the SDR. The average SDR in South Africa was just below 12% for the period 1980 to 2007.

Average rather than marginal costs were used in calculating resource rent. The unit rent was calculated as total rent divided by the volume of depletion for a specific year.

Due to lack of data regarding intermediate consumption (1980 to 1992), consumption of fixed capital (1980 to 2001) and opportunity cost of capital (1980 to 2001) for the PGM mining sector, these variables were calculated as percentages of output (derived from ratios of gold). For consumption of fixed capital (2002 and 2003) and opportunity cost of capital (2002 and 2003) for gold, PGM and coal, the following method was used, for example the previous years consumption of fixed capital/opportunity cost i.e. 2001 was divide by the output (sales) of 2001 and then multiplied by the output sales for 2002. For gold and coal replacement values were used for the consumption of fixed capital and fixed capital stock (1980 to 2001). Data for consumption of fixed capital for gold, PGM and coal (2004) was sourced from the *Large Sample Survey, Mining industry, 2004* (P2001) and for the years 2005 to 2007, the data was sourced from the *Annual Financial Statistics* (P0021). For intermediate consumption, data are only available every third year (1981, 1984, 1987 and 1990) from the *Census of Mining,* (P2001). The missing years (1980 to 1992) are calculated using interpolation. Intermediate consumption for gold, platinum and coal (1993 to 2007) is sourced from *Gross domestic product* (P0441).

The data for output (sales) and compensation of employees are sourced from the DMR – *South Africa's Mineral Industry (SAMI): 2007/2008* publication along with the Statistical Tables (1985 to 2007).

2.3 Monetary accounts

The three approaches to calculate monetary accounts are discussed in detail in this section, namely:

- Using environmental expenditure. This is the most common approach in most industrialised economies, reflecting the prime concern about pollution and environmental quality in these countries. This approach works within the existing structure of the SNA 93, leading to minor modifications, especially in definition and classifications of income and expenditure entries.
- Using natural asset depreciation. This approach has been mainly adopted on marketed natural resources such as subsoil assets, timber and fisheries.
- Full environmental accounting. This represents an attempt to accommodate all entries of the more comprehensive physical resource account in the 1993 SNA with money values assigned.

[21] Source: South African Reserve Bank (SARB)

Based on the sets of data available in South Africa, option number three was adopted for calculating monetary accounts. Closing stock or resource asset (at the end of the period) in the monetary accounts for mineral resources in South Africa is calculated as follows:

	Value of opening stock (equal to the value of the closing stock of the previous year)
Less	Value of the depleted stock (valued at the unit rent multiplied by the volume of depletion)
Plus	Value of new discoveries, additions and other volume changes (valued at the changes in the present value due to the increase in the number of years over which production can go on at current extraction rates given these new volumes)
Plus	Any revaluation due to time passing (valued by discounting for one year less)
Plus	Nominal holding gain (calculated as a residual)

The formula for calculating the net present value of mineral assets V at period τ is (CEEPA, 2009):

$$\mathbf{V}\tau = \sum_{\mathbf{t}=\tau}^{\mathbf{T}} \frac{\mathbf{p_t Q_t}}{\mathbf{(1+r)^t}} \qquad (3)$$

$$\mathbf{p_t} = \frac{\mathbf{R_t}}{\mathbf{Q_t}} \qquad (4)$$

$$\mathbf{T_t} = \frac{\mathbf{S_t}}{\mathbf{Q_t}} \qquad (5)$$

Where:

V	= value of the asset
p	= unit rent price of the resource
Q	= quantity of resource extracted
r	= the social discount rate
R	= total resource rent
T	= the remaining lifespan of the resource
S	= the stock of mineral reserves at the close of the accounting period

There are two approaches to the valuation of assets that were adopted namely:

- Annual unit rent; and
- The 5-year moving average approach.

The 5-year moving average approach is utilised as a result of the fluctuating annual price of minerals and hence the value of mineral assets is not best represented by the per unit rent in any single year (Lange, 2003). To reduce volatility and better represent the longer-term value of mineral assets, a 5-year lagged moving average of the unit rent is used for the mineral accounts.

Mineral prices can fluctuate a great deal from one year to the next, so the value of mineral assets is not always best represented by the per unit rent in any single year. In order to reduce volatility and better represent the longer-term value of mineral assets, a number of countries, including Australia and Canada, use a multiple-year moving average per unit rent in calculating asset values. To better reflect the longer-term value of mineral assets, a 5-year lagged moving average of the unit rent is used for the mineral accounts.

2.4 Policy analysis

For policy analysis El-Serafy's Use-Cost method was used to help answer the question, "How much of resource rent should be consumed and how much should be reinvested to maintain a constant stream of income?"

The Use-Cost method is a measure of sustainable use of minerals. It divides resource rent into two components:

- Capital component: part of resource rent that needs to be reinvested to maintain a constant stream of income; and
- Income component: residual amount that can be consumed as current income.

2.4.1 The capital component

The part that must be invested depends on the following two factors:

- Remaining life expectancy of the resource; and
- The real rate of return earned on the amount saved.

The share of rent that can be consumed as income (X) is calculated as:

$$\mathbf{X_t} = \mathbf{R_t}\left(\mathbf{1} - \frac{\mathbf{1}}{(\mathbf{1}+\mathbf{r})^{\mathbf{N}+\mathbf{1}}}\right) \qquad (6)$$

Where:

X = the share of rent that can be consumed as income
R = the total resource rent
r = rate of return
N = number of years to depletion that can take place at current rate

The remaining amount of resource rent (R-X) must be reinvested.