

# National Accounts



Environmental Economic Accounts

Mineral accounts for South Africa: 1980–2006

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## List of Abbreviations and Acronyms

AFS	Annual Financial Survey
EEA	Environmental Economic Accounting
GDP	Gross Domestic Product
LSS	Large Sample Survey
n/a	not available
R/kg	Rand per kilogram
SAMI	South Africa's Mineral Industry
SARB	South African Reserve Bank
SIC	Standard Industrial Classification of All Economic Activities
SDR	Social Discount Rate
SEEA	System of Integrated Environmental and Economic Accounts
1993 SNA	1993 System of National Accounts
Stats SA	Statistics South Africa
VA	Value Added

## Key findings

Gold production (extraction) has steadily declined from 675,1 tons in 1980 to 272,1 tons in 2006, representing an average decrease of 3,3%. At this current proven extraction rate, gold reserves are estimated to last another 132 years (as at 2006). Platinum production (extraction) increased over this same period from 114,3 tons in 1980 to 307,5 tons in 2006, which represents an average growth of 3.7% over the 26-year period. At the 2006 extraction rate, platinum reserves will last for another 228 years. Coal production (extraction) has an average growth of 2,8% over this period from 115,0 tons in 1980 to 244,8 tons in 2006. The estimated number of years to depletion for proven coal reserves in 2006 was 114 years.

For the same period there was an increase in the output (sales) of the gold mining industry over the period from R10 395 million in 1980 to R37 443 million in 2006. Intermediate consumption also increased over the same period from R1 454 million in 1980 to R14 906 million in 2006. Gold's resource rent at a social discount rate (SDR) of 3,0% was R7 013 million in 1980 decreasing to R2 931 million in 2006. The output (sales) for the platinum mining industry increased from R851 million in 1980 to R65 444 million in 2006 and the resource rent (at SDR of 3,0%) for platinum increased from R456 million in 1980 to R23 957 million in 2006. The output (sales) for the coal mining industry increased from R1 497 million in 1980 to R37 991 million in 2006. Resource rent (at SDR of 3,0%) for the coal mining industry increased from R331 million to R3 112 million in 2006.

The value of the proven gold reserves (stock) in South Africa depreciated over the period from R207 338 million in 1980 to R95 737 million in 2006. Platinum reserves appreciated over the period from R15 215 million in 1980 to R797 618 million in 2006. Finally, the value of South Africa's proven coal reserves appreciated over the period from R11 021 million in 1980 to R100 191 million in 2006.

## 1. Introduction

The purpose of this discussion document is to present the updated mineral accounts for South Africa for 1980 to 2006. This is the third document for mineral accounts compiled by Statistics South Africa (Stats SA)<sup>1</sup>. These previously published mineral accounts (Report no. 04-05-02) included mineral accounts for the years 1980 to 2001 as this was the most comprehensive data that was available at that time. All the previous mineral account documents, including this document, have physical, monetary and resource rent accounts for the gold, platinum and coal mining industries. The reason accounts were constructed for only these three minerals, is that they are the most prominent minerals in South Africa based on their contribution to the mining industry. In 2006 the gold mining industry contributed 1,7% to the gross domestic product (GDP)<sup>2</sup>, the platinum mining industry 2,1% and the coal mining industry 1,4%. Coal does not contribute so much to GDP yet coal is the major source of energy production in South Africa, (85,0% of electricity produced in South Africa is from burning coal)<sup>3</sup>.

The mining industry in South Africa may only have contributed 7,7% to GDP in 2006 but it is responsible for a large number of the formal jobs in South Africa (506 000 people or 6,0% of the total labour force are employed in the mining sector as reported for March 2008)<sup>4</sup>.

Section 2 of this report gives a brief description of the possible future and present uses of mineral accounts. Section 3 provides an overview of the completed physical mineral accounts and provides an analysis of these accounts. Section 4 examines the resource rent which will be used to assist to compile the monetary accounts. In section 5 the monetary accounts are presented where the monetary value of the country's gold, platinum and coal reserves (stock) are shown. Finally section 6 looks at the policy analysis of minerals, with the use of the El-Serafy's Use-Cost method.

Annexure 1 presents a table for the consumption of capital at replacement value and the fixed capital stock at current prices. Annexure 2 explains the methodologies used in compiling the mineral accounts as well as presenting the flow of the data between the accounts and giving a brief background into the physical, monetary and resource rent account calculations. Annexure 2 ends off with a description of the methodologies that can be used to calculate the Use-Cost method.

## 2. Possible future and present uses of mineral accounts

Future improvements planned for mineral accounts are to add a spatial dimension to the data presented in the accounts through the development of maps. This will improve the presentation of the mineral accounts data and make it easier to read and understand the importance and use of the data.

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<sup>1</sup> First discussion document in September 2002 and an official document in September 2004.

<sup>2</sup> Statistics South Africa, 2007. Gross domestic product, November 2007, Statistical release P0441. Pretoria.

<sup>3</sup> Department of Minerals and Energy, 2006. Energy Balances for South Africa.

<sup>4</sup> Statistics South Africa, 2008. Quarterly employment statistics, March 2008, Statistical release P0277. Pretoria.



Mineral accounts have many uses but they may not have been realised yet by the policy makers and other possible interested parties. Mineral accounts can be used by policy makers to assist in mineral related policy decisions. Minerals are a resource that will be depleted over time and the policy makers have to insure that there is still employment for those in the mining industry when the minerals are depleted. This can be done through the proper investment of resource rent in alternative measures to insure the sustainable growth of the economy.

### 3. Physical accounts for the South African mining industry

This section presents the updated physical accounts for South Africa's three most prominent minerals, (gold, platinum and coal) as they are the major contributors to the country's mining industry as measured by the GDP. Table 1 show the percentage contribution to nominal value added (VA) at basic prices of the mining industry for the years 2000 to 2006.

**Table 1: Percentage contribution to total nominal value added at basic prices of the mining industry, 2000–2006**

Industry	2000	2001	2002	2003	2004	2005	2006
Coal	1,4	1,7	1,6	1,4	1,3	1,3	1,4
Gold	2,0	2,0	2,5	2,0	1,6	1,6	1,7
Platinum group metals	1,9	2,3	2,0	1,9	1,9	2,2	2,1
Other metal ores	1,5	1,5	1,7	1,3	1,4	1,6	1,7
Other mining and quarrying	0,7	0,8	0,8	0,8	0,9	0,9	0,9
<b>Total mining and quarrying</b>	<b>7,6</b>	<b>8,3</b>	<b>8,7</b>	<b>7,4</b>	<b>7,1</b>	<b>7,5</b>	<b>7,7</b>

Source: Statistics South Africa, 2007. *Gross domestic product, November 2007*, Statistical release P0441

#### 3.1 Gold

Table 2 shows the physical accounts for proven gold reserves in South Africa from 1980 to 2006. Gold production (extraction) has steadily declined over this period from 675,1 tons in 1980 to 272,1 tons in 2006 (representing an average decrease of 3.3%). At these current extraction rates, proven gold reserves were estimated to last 132 years (in 2006). This is a notable increase from the estimated 74 years in 1980. The proven gold reserves in South Africa dropped from 49 777,9 tons in 1980 to 36 000,0 tons in 2006.

Closing stock data from the physical accounts (column 6 of Table 2) for the year 2006 (36 000,0 tons) was obtained from South Africa's Mineral Industry (SAMI) 2006/2007 publication. This figure was used to calculate the opening stock (column 2 of Table 2) for the following years by calculating the sum of closing stock and the production (extraction) of the specific year. Opening stock for the year 2006 is equal to the closing stock of 2005, and so on for the following years.

The same methodology (Annexure 2) was used to calculate the opening and closing stock for both platinum (Table 3) and coal (Table 4).

**Table 2: Gold: Physical accounts for South Africa, 1980–2006 (tons)**

Year	Opening Stock	Production (extraction)	Discoveries	Other volume changes	Closing Stock (sub-soil assets)	Volume sold	Net changes in inventories	Closing stock (incl. inventories)	Years to depletion
1	2	3	4	5	6	7	8	9	10
1980	50 453,0	675,1	0	0	49 777,9	674,8	0,3	49 778,2	74
1981	49 777,9	657,7	0	0	49 120,2	661,1	-3,4	49 116,8	75
1982	49 120,2	664,4	0	0	48 455,8	661,9	2,5	48 458,3	73
1983	48 455,8	679,7	0	0	47 776,1	669,2	10,5	47 786,6	70
1984	47 776,1	681,9	0	0	47 094,2	685,1	-3,2	47 091,0	69
1985	47 094,2	672,9	0	0	46 421,2	677,5	-4,6	46 416,7	69
1986	46 421,2	640,0	0	0	45 781,2	642,1	-2,0	45 779,2	72
1987	45 781,2	604,3	0	0	45 176,9	602,0	2,3	45 179,2	75
1988	45 176,9	619,9	0	0	44 557,0	618,0	1,9	44 558,9	72
1989	44 557,0	607,7	0	0	43 949,3	605,9	1,8	43 951,1	72
1990	43 949,3	605,1	0	0	43 344,2	595,8	9,3	43 353,5	72
1991	43 344,2	601,0	0	0	42 743,2	601,4	-0,4	42 742,8	71
1992	42 743,2	613,0	0	0	42 130,2	613,0	0,0	42 130,2	69
1993	42 130,2	619,3	0	0	41 510,8	619,0	0,4	41 511,2	67
1994	41 510,8	580,2	0	0	40 930,6	580,2	0,0	40 930,6	71
1995	40 930,6	523,8	0	0	40 406,8	524,1	-0,3	40 406,6	77
1996	40 406,8	498,3	0	0	39 908,6	496,2	2,0	39 910,6	80
1997	39 908,6	490,6	0	0	39 417,9	507,9	-17,3	39 400,6	80
1998	39 417,9	465,1	0	0	38 952,8	464,8	0,3	38 953,1	84
1999	38 952,8	451,2	0	0	38 501,6	455,4	-4,2	38 497,4	85
2000	38 501,6	430,8	0	0	38 070,8	406,2	24,6	38 095,4	88
2001	38 070,8	395,0	0	0	37 675,8	386,5	8,5	37 684,3	95
2002	37 675,8	398,5	0	0	37 277,3	395,9	2,6	37 279,8	94
2003	37 277,3	373,2	0	0	36 904,0	375,6	-2,4	36 901,7	99
2004	36 904,0	337,2	0	0	36 566,8	347,0	-9,8	36 557,0	108
2005	36 566,8	294,7	0	0	36 272,1	270,1	24,6	36 296,7	123
2006	36 272,1	272,1	0	0	36 000,0	283,1	-10,9	35 989,1	132

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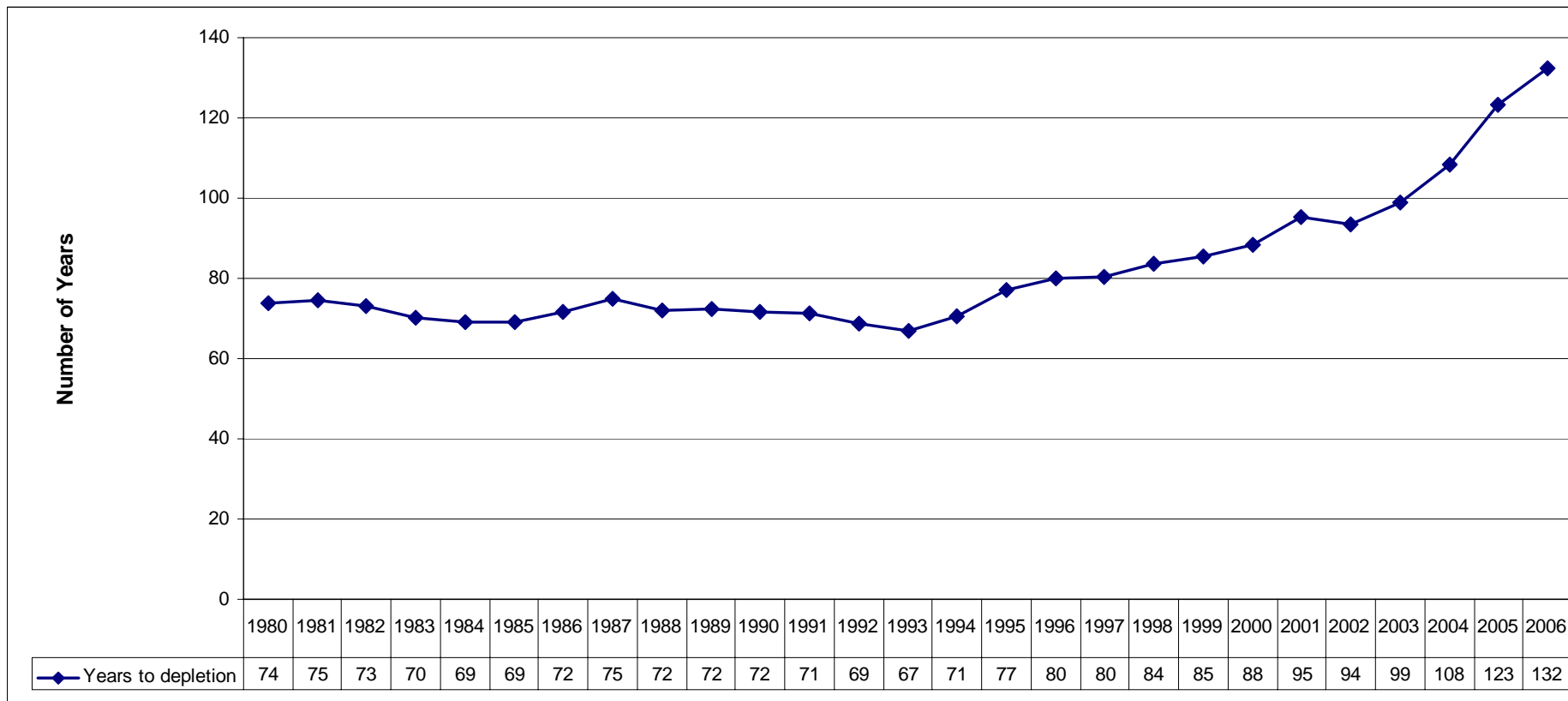
See Annexure 2, Methodological notes, for the definition of the variables

Source: Department of Minerals and Energy (SAMI 1999/2000, SAMI 2006/2007, Statistical Tables 1980–2006 and Statistical Tables 1985–2006)

Calculations done by Stats SA

Figure 1 below shows the estimated number of years to depletion in the production of gold for South Africa for the period 1980 to 2006. In 1980 the years to depletion were 74 at a production rate of 675,1 tons per year and this had increased to 132 years by 2006 at a production rate of 272,1 tons per year.

**Figure 1: Gold: Estimates of years to depletion for South Africa, 1980–2006**



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA Census of mining and AFS surveys.  
 Calculations done by Stats SA

### 3.2 Platinum

Table 3 shows the physical accounts for proven platinum reserves in South Africa from 1980 to 2006. Platinum production (extraction) increased over this period from 114,3 tons in 1980 to 307,5 tons in 2006 (representing an average growth of 3,7% over the 26-year period). At the 2006 extraction rate, it is estimated that platinum reserves will last for another 228 years to depletion for proven reserves.

**Table 3: Platinum: Physical accounts for South Africa, 1980–2006 (tons)**

Year	Opening Stock	Production (extraction)	Discoveries	Other volume changes	Closing Stock (sub-soil assets)	Volume sold	Net changes in inventories	Closing stock (incl. inventories)	Years to depletion
1	2	3	4	5	6	7	8	9	10
1980	74 755,3	114,3	0	0	74 641,0	112,1	2,2	74 643,2	653
1981	74 641,0	115,9	0	0	74 525,1	103,5	12,4	74 537,5	643
1982	74 525,1	85,2	0	0	74 439,9	98,2	-13,0	74 426,9	874
1983	74 439,9	89,5	0	0	74 350,4	103,5	-14,0	74 336,4	831
1984	74 350,4	107,0	0	0	74 243,4	112,5	-5,5	74 237,9	694
1985	74 243,4	121,7	0	0	74 121,7	118,1	3,6	74 125,4	609
1986	74 121,7	120,5	0	0	74 001,2	120,4	0,1	74 001,3	614
1987	74 001,2	128,0	0	0	73 873,2	130,1	-2,2	73 871,0	577
1988	73 873,2	131,7	0	0	73 741,5	130,9	0,9	73 742,3	560
1989	73 741,5	133,7	0	0	73 607,8	137,3	-3,6	73 604,2	551
1990	73 607,8	141,9	0	0	73 465,9	135,6	6,3	73 472,2	518
1991	73 465,9	142,9	0	0	73 323,0	141,1	1,7	73 324,8	513
1992	73 323,0	152,9	0	0	73 170,1	137,1	15,8	73 186,0	479
1993	73 170,1	176,2	0	0	72 994,0	153,7	22,5	73 016,4	414
1994	72 994,0	183,9	0	0	72 810,0	162,2	21,8	72 831,8	396
1995	72 810,0	183,1	0	0	72 626,9	175,2	7,9	72 634,9	397
1996	72 626,9	188,6	0	0	72 438,3	184,0	4,7	72 443,0	384
1997	72 438,3	196,6	0	0	72 241,7	187,2	9,4	72 251,1	367
1998	72 241,7	200,0	0	0	72 041,7	193,5	6,5	72 048,2	360
1999	72 041,7	216,5	0	0	71 825,3	198,7	17,8	71 843,0	332
2000	71 825,3	206,8	0	0	71 618,5	198,9	7,8	71 626,3	346
2001	71 618,5	229,5	0	0	71 389,0	193,4	36,2	71 425,1	311
2002	71 389,0	236,6	0	0	71 152,3	207,6	29,0	71 181,3	301
2003	71 152,3	265,4	0	0	70 886,9	241,3	24,1	70 911,0	267
2004	70 886,9	276,4	0	0	70 610,5	259,7	16,7	70 627,2	255
2005	70 610,5	303,0	0	0	70 307,5	259,0	44,0	70 351,5	232
2006	70 307,5	307,5	0	0	70 000,0	266,5	41,0	70 041,0	228

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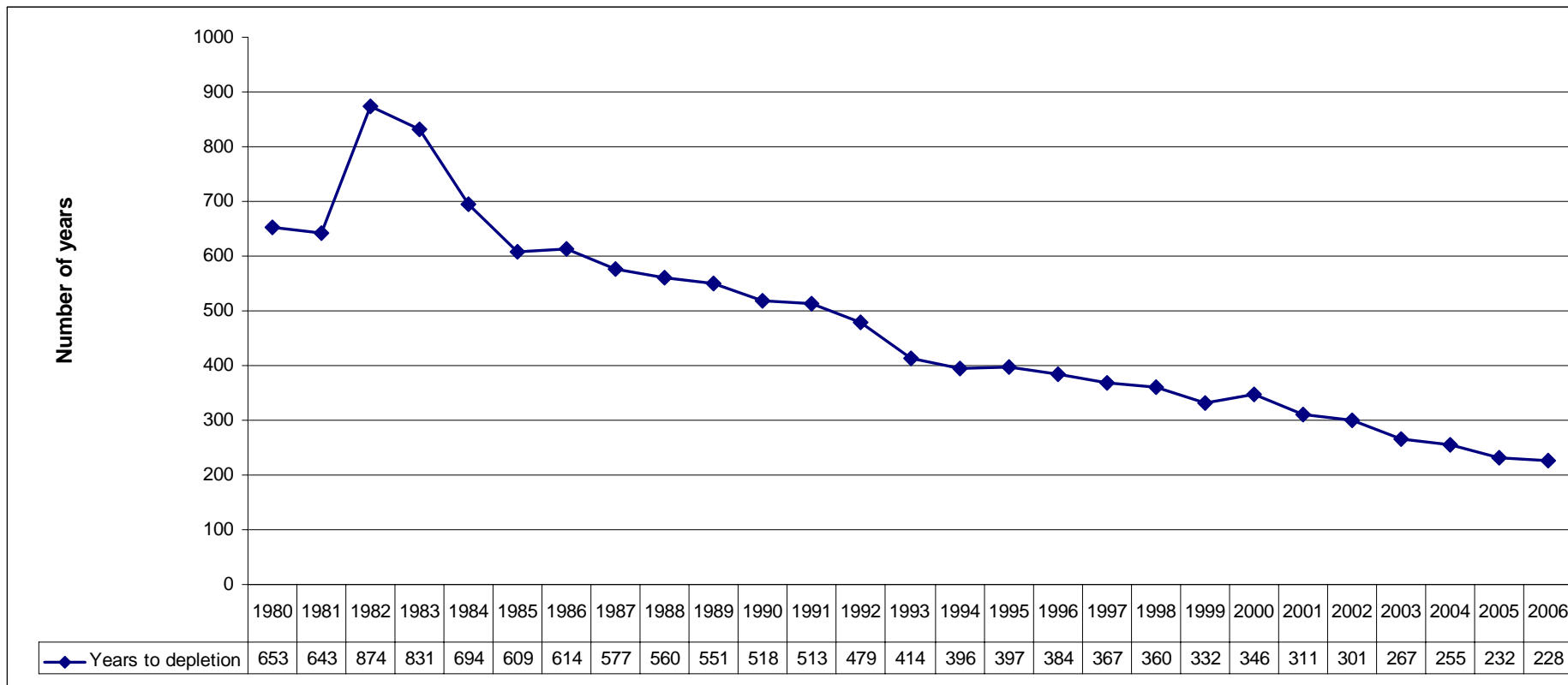
See Annexure 2, Methodological notes, for the definition of the variables

Source: Department of Minerals and Energy (SAMI 1999/2000, SAMI 2006/2007, Statistical Tables 1980–2006 and Statistical Tables 1985–2006)

Calculations done by Stats SA

Figure 2 below shows that the estimated number of years to depletion for the platinum’s proven reserves declined over the 26-year period as shown in the graph, from 653 years in 1980 to 228 years in 2006. In contrast to other minerals, the years to depletion for proven reserves do not follow a smooth trend in the case of platinum reserves

**Figure 2: Platinum: Estimates of years to depletion for South Africa, 1980–2006**



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining* and AFS surveys.  
 Calculations done by Stats SA

### 3.3 Coal

Table 4 shows the physical accounts for the proven coal reserves in South Africa from 1980 to 2006. Coal production (extraction) showed an average growth of 2,8% over this period from 115,0 million tons in 1980 to 244,8 million tons in 2006.

**Table 4: Coal: Physical accounts for South Africa, 1980–2006 (million tons)**

Year	Opening Stock	Production (extraction)	Discoveries	Other volume changes	Closing Stock (sub-soil assets)	Volume sold	Net changes in inventories	Closing stock (incl. inventories)	Years to depletion
1	2	3	4	5	6	7	8	9	10
1980	33 192,7	115,0	0	0	33 077,7	113,1	1,9	33 079,6	288
1981	33 077,7	130,3	0	0	32 947,4	129,9	0,4	32 947,8	253
1982	32 947,4	143,0	0	0	32 804,4	140,3	2,7	32 807,1	229
1983	32 804,4	145,6	0	0	32 658,8	144,6	1,0	32 659,8	224
1984	32 658,8	162,8	0	0	32 496,0	161,3	1,5	32 497,5	200
1985	32 496,0	175,7	0	0	32 320,2	171,9	3,8	32 324,0	184
1986	32 320,2	176,8	0	0	32 143,4	174,3	2,5	32 146,0	182
1987	32 143,4	176,2	0	0	31 967,3	172,6	3,6	31 970,9	181
1988	31 967,3	181,7	0	0	31 785,6	183,6	-1,9	31 783,7	175
1989	31 785,6	177,8	0	0	31 607,9	180,1	-2,3	31 605,6	178
1990	31 607,9	175,0	0	0	31 432,9	185,4	-10,4	31 422,4	180
1991	31 432,9	178,5	0	0	31 254,4	181,9	-3,4	31 251,0	175
1992	31 254,4	177,4	0	0	31 077,1	179,2	-1,8	31 075,2	175
1993	31 077,1	184,0	0	0	30 893,1	184,0	0,0	30 893,1	168
1994	30 893,1	196,5	0	0	30 696,6	193,7	2,8	30 699,4	156
1995	30 696,6	205,6	0	0	30 491,0	205,7	-0,1	30 490,9	148
1996	30 491,0	205,0	0	0	30 286,0	206,2	-1,2	30 284,8	148
1997	30 286,0	219,3	0	0	30 066,7	217,4	1,9	30 068,6	137
1998	30 066,7	223,8	0	0	29 843,0	223,9	-0,1	29 842,8	133
1999	29 843,0	222,3	0	0	29 620,7	221,6	0,7	29 621,3	133
2000	29 620,7	224,9	0	0	29 395,8	225,5	-0,6	29 395,2	131
2001	29 395,8	223,5	0	0	29 172,3	221,5	2,0	29 174,3	131
2002	29 172,3	220,3	0	0	28 952,0	227,1	-6,8	28 945,2	131
2003	28 952,0	237,9	0	0	28 714,1	240,5	-2,6	28 711,5	121
2004	28 714,1	243,4	0	0	28 470,8	246,6	-3,2	28 467,5	117
2005	28 470,8	245,0	0	0	28 225,8	244,9	0,1	28 225,9	115
2006	28 225,8	244,8	0	0	27 981,0	245,8	-1,0	27 980,0	114

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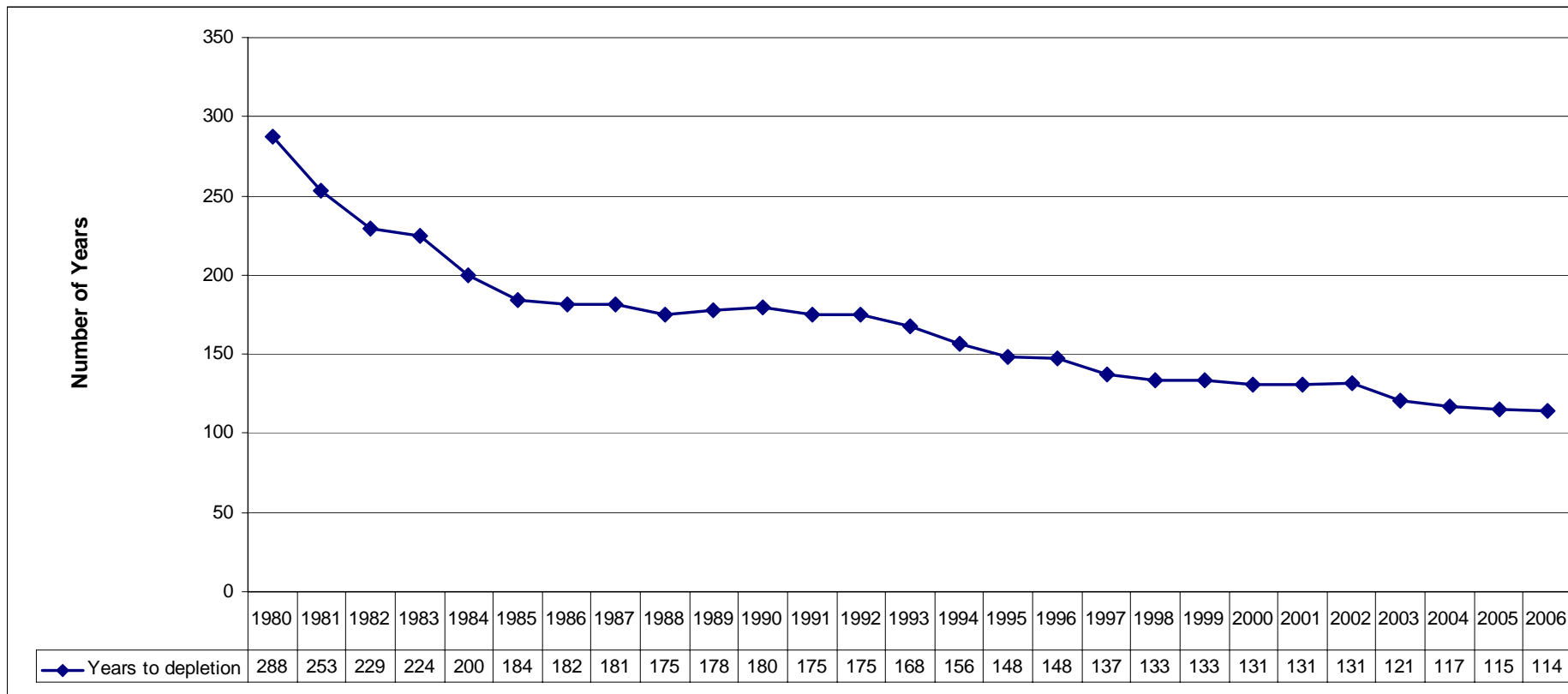
See Annexure 2, Methodological notes, for the definition of the variables

Source: Department of Minerals and Energy (SAMI 1999/2000, SAMI 2006/2007, Statistical Tables 1980–2006 and Statistical Tables 1985–2006)

Calculations done by Stats SA

Below figure 3 shows that the estimated number of years to depletion for coal's proven reserves, measured over the 26-year period, declined from 288 years in 1980 to 114 years in 2006. This is a result of an increase in the production of coal during that period.

**Figure 3: Coal: Estimates of years to depletion for South Africa, 1980–2006**



Source: Department of Minerals and Energy: (SAMI 1999/2000, SAMI 2006/2007, Statistical Tables 1980–2006, Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)  
 Calculations done by Stats SA

## 4. Resource rent for the South African mining industry

This section provides the calculations for resource rent for South Africa's gold, platinum and coal industries. The results of these calculations<sup>5</sup> (Annexure 2) will be used to compile the monetary accounts presented in section 5 of this document. It must be noted that there is no data for fixed capital and fixed capital stock for the years 2001 to 2003 at the required Standard Industrial Classification (SIC) of All Economic Activities level.

### 4.1 Gold

Table 5 shows the output, intermediate consumption, compensation of employees, unit rent, resource rent and other calculations for gold for the period 1980 to 2006. Gold output (sales) increased from R10 395 million in 1980 to R37 443 million in 2006. Intermediate consumption increased from R1 454 million in 1980 to reach its maximum of R17 353 million in 2002 and then only to drop to R8 326 million in 2005 and then increase to R14 906 million in 2006. Unit rent fluctuated over the same period from R10 389 per kilogram in 1980 to reach a maximum of R31 480 per kilogram in 2002 and then decreased to a negative of R1 874 in 2005, and then recovered to R10 770 in 2006. Total compensation of employees increased in the 26-year period from R1 448 million in 1980 to R12 869 million in 2006.

Intermediate consumption for gold was obtained from the *Large Sample Survey (LSS) Census of Mining (P2001)* published by Stats SA for the years 1980 to 1992. This census is conducted every three years. Data was extrapolated for the intercensal years. For the years 1993 to 2006, data from the GDP release<sup>6</sup> was used. Opportunity cost of capital, rent and unit rent were calculated using a SDR of both 3,0% and 5,0%. Consumption of capital and opportunity cost of capital were calculated using the replacement values shown in Annexure 1.

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<sup>5</sup> Note on negative values: Please note that the negative values can not be explained at this time. To address the negative values, an academic exercise will be conducted to explain why the resource rent is negative (research work to be included in the next update of the mineral accounts for South Africa. This will be done by looking at the equation for the resource rent calculation and analysing the individual components; this would also possibly require doing primary surveys with the major players in the industry to try to explain specific components of the resource rent equation; and why they may give a negative value.

<sup>6</sup> Statistics South Africa. 2007. Gross domestic product, November 2007, Statistical release P0441. Pretoria



**Table 5: Gold: Resource rent and other calculations for South Africa at current prices, 1980–2006 (R millions)**

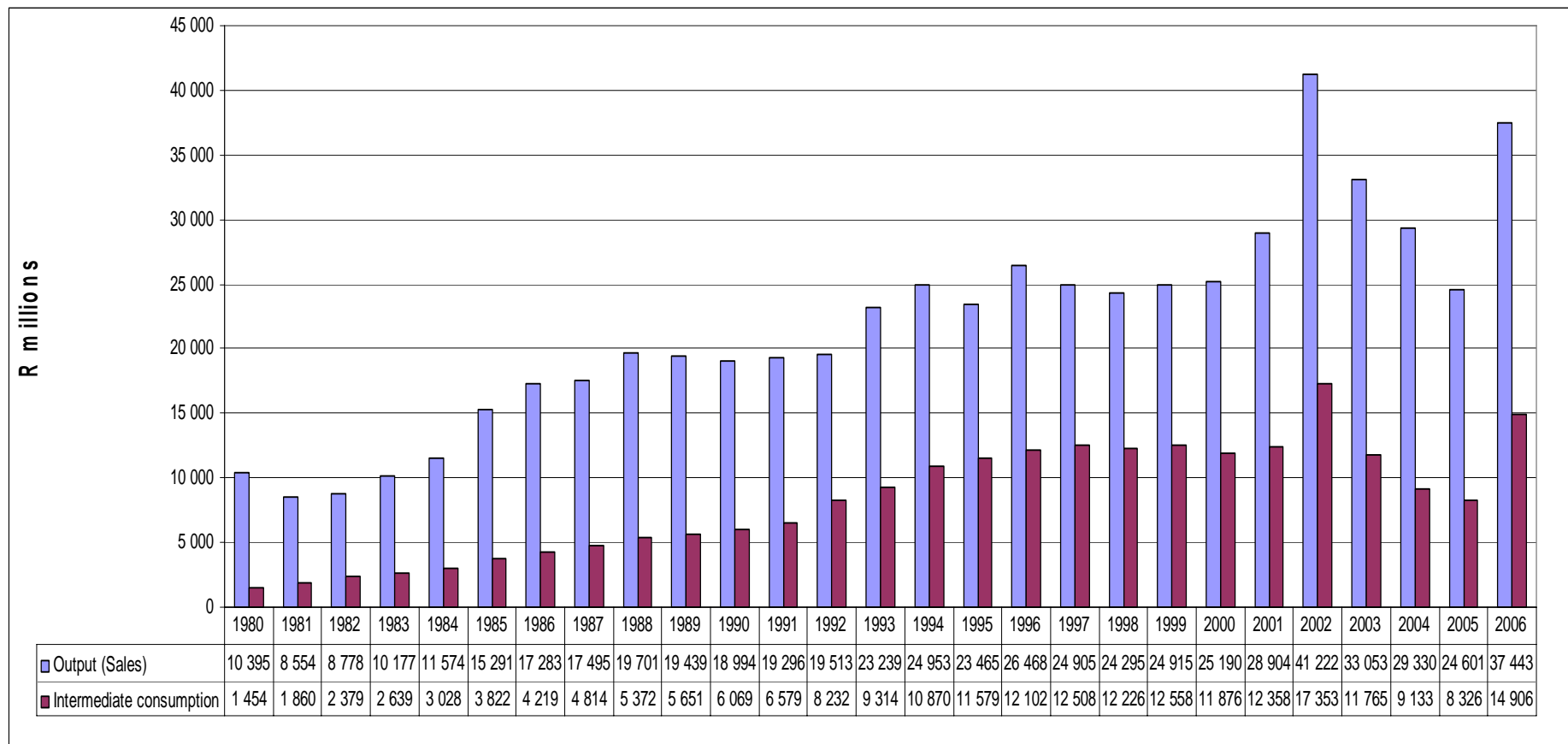
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Output (Sales)</b>	10 395	8 554	8 778	10 177	11 574	15 291	17 283	17 495	19 701	19 439	18 994	19 296	19 513	23 239	24 953	23 465	26 468	24 905	24 295	24 915	25 190	28 904	41 222	33 053	29 330	24 601	37 443
<b>Intermediate consumption</b>	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	14 906
<b>Compensation of employees (total)</b>	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	7 612	8 292	8 807	9 613	9 372	9 100	9 846	10 904	11 324	12 496	12 610	12 153	12 869
<b>Compensation of employees (male)</b>	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	7 462	8 107	8 602	9 390	9 164	8 902	9 623	10 674	11 081	12 219	12 320	11 787	12 439
<b>Compensation of employees (female)</b>	18	24	30	36	43	56	69	89	103	117	135	148	145	149	150	185	205	223	208	198	224	230	243	277	289	367	431
<b>Consumption of fixed capital</b>	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	0	0	0	2 049	3 442	4 658
<b>Opportunity cost of capital (SDR 3%)</b>	173	223	279	339	394	495	651	752	902	1 053	1 201	1 318	1 411	1 499	1 595	1 693	1 779	1 862	1 875	1 917	2 002	0	0	0	904	1 232	2 078
<b>Opportunity cost of capital (SDR 5%)</b>	289	372	464	565	657	826	1 085	1 254	1 504	1 756	2 002	2 196	2 352	2 498	2 659	2 822	2 964	3 103	3 125	3 195	3 337	0	0	0	1 507	2 053	3 464
<b>Rent (SDR 3%)</b>	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	1 786	-1 481	119	-3 026	-3 304	-3 030	-3 268	5 643	12 546	8 791	4 635	-552	2 931
<b>Rent (SDR 5%)</b>	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	723	-2 610	-1 067	-4 267	-4 554	-4 308	-4 603	5 643	12 546	8 791	4 032	-1 374	1 545
<b>Unit rent (R/kg) (SDR 3%)</b>	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	3 079	-2 827	239	-6 168	-7 103	-6 716	-7 586	14 285	31 480	23 555	13 744	-1 874	10 770
<b>Unit rent (R/kg) (SDR 5%)</b>	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	1 246	-4 982	-2 141	-8 697	-9 791	-9 549	-10 684	14 285	31 480	23 555	11 956	-4 662	5 678
<b>Unit rent (R/kg) Five - year moving average (SDR 3%)</b>	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	3 218	1 683	992	-360	-2 556	-4 515	-5 467	-2 658	4 872	11 004	15 095	16 238	15 535
<b>Unit rent (R/kg) Five --year moving average (SDR 5%)</b>	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	1 665	-37	-911	-2 462	-4 873	-7 032	-8 172	-4 887	3 148	9 817	14 118	15 323	13 602

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

**Figure 4: Gold: Output and intermediate consumption, 1980–2006 (R millions)**

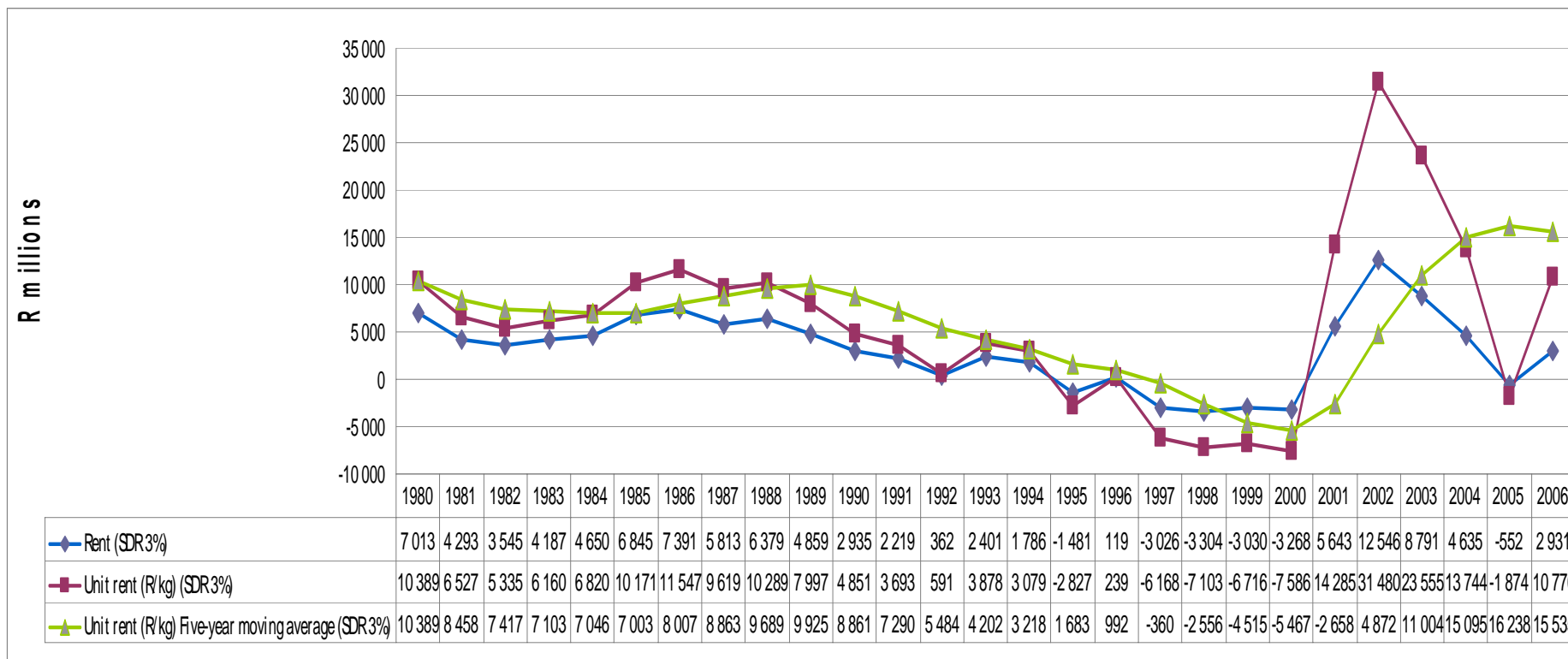


Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)  
 Calculations done by Stats SA

Figure 4 above shows an increase in the output of the gold mining industry over the period 1980–2006 from R10 395 million in 1980 to R37 443 million in 2006, while intermediate consumption also increased over the same period from R1 454 million in 1980 to R14 906 million in 2006.

Figure 5 below shows resource rent as well as unit rent for gold for a SDR of 3,0% and also including unit rent for gold for a SDR of 3,0% for a five - year moving average. From the graph it is evident that resource and unit rent show corresponding trends, meaning that when resource rent declines, unit rent also declines. Both curves show a downward movement from 1980 to 1982, but from 1982 to 1986 both curves show positive movements. A sharp decline in rent (resource and unit) was also experienced between 1996 and 2000, with a sharp increase towards 2003 especially for unit rent which reached R23 555. After 2000 until 2005, resource rent was on a declining trend and then started increasing towards 2006. By the year 2000, unit rent for gold experienced its lowest level in the 26-year period. The unit rent for the five - year moving average followed a similar pattern to annual unit rent but with a smother trend.

Figure 5: Gold: Resource and unit rent for South Africa, 1980–2006 (R millions R/kg)



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).  
 Calculations done by Stats SA

## 4.2 Platinum

Table 6 shows the output, employment figures, unit rent, resource rent as well as other calculations for platinum for the period 1980 to 2006. Platinum output (sales) increased from R851 million in 1980 to R65 444 million in 2006. Intermediate consumption was for 1980 was R128 million and for 1992 it increased to R1 637. Intermediate consumption increased from R2 243 million in 1993 to R24 310 million in 2006. Unit rent fluctuated from R3 993 million in 1980 to R77 903 million in 2006. Total compensation of employees increased from R224 million in 1980 to R12 593 in 2006.

Information on intermediate consumption was obtained from the *LSS Census of Mining (P2001)* published by Stats SA for the years 1980 to 1992. The census is done every three years. Data were extrapolated for the intercensal years. For the years 1993 to 2006 data from the GDP release<sup>7</sup> was used. Opportunity cost of capital, rent and unit rent were calculated using a SDR of both 3,0% and 5,0%.

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<sup>7</sup> Statistics South Africa. 2007. Gross domestic product, November 2007, Statistical release P0441. Pretoria

**Table 6: Platinum: Resource rent and other calculations for South Africa at current prices, 1980–2006 (R millions)**

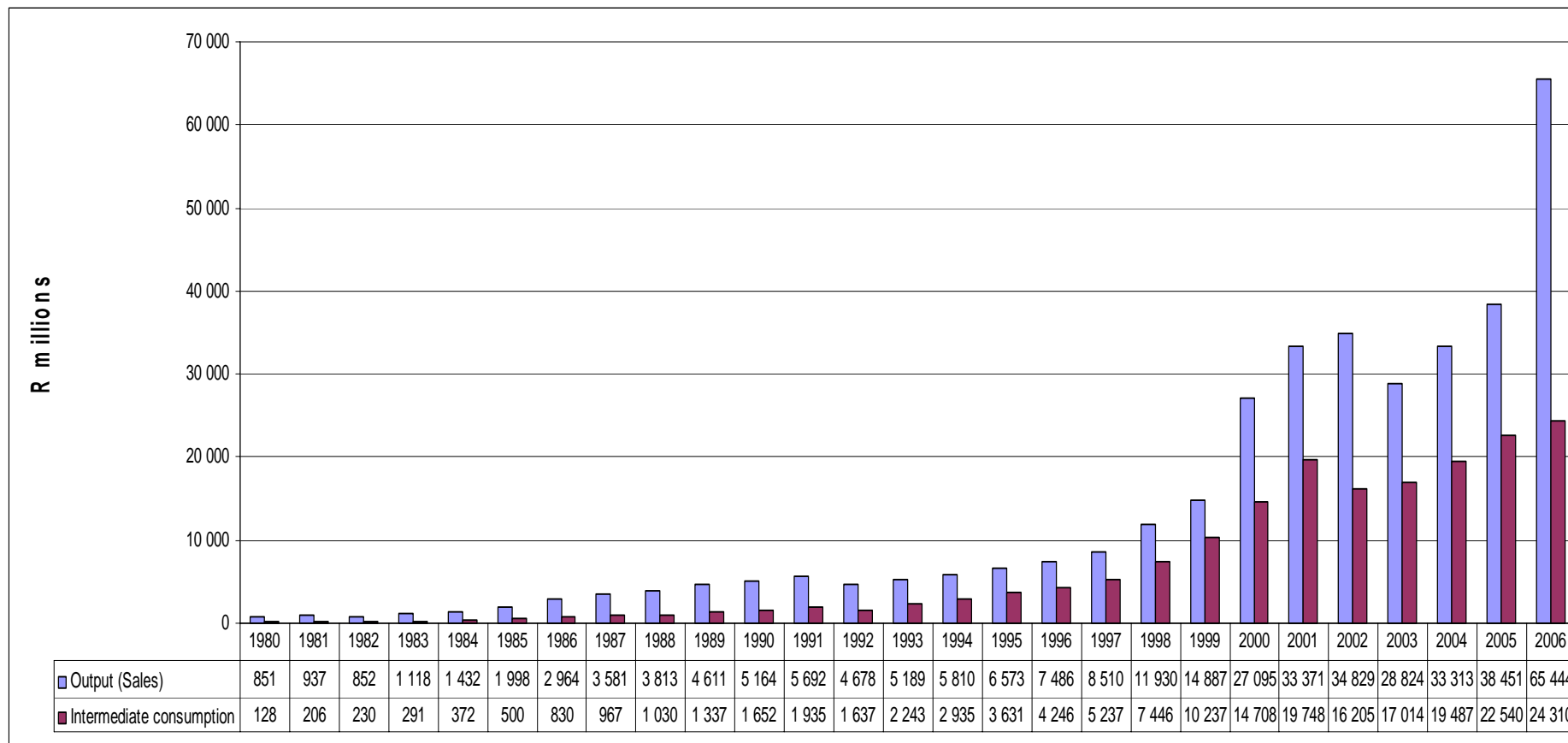
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Output (Sales)</b>	851	937	852	1 118	1 432	1 998	2 964	3 581	3 813	4 611	5 164	5 692	4 678	5 189	5 810	6 573	7 486	8 510	11 930	14 887	27 095	33 371	34 829	28 824	33 313	38 451	65 444
<b>Intermediate consumption</b>	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	24 310
<b>Compensation of employees (total)</b>	224	278	235	254	341	450	570	768	933	1 136	1 505	1 658	1 901	2 111	2 241	2 522	2 725	2 979	3 444	3 740	4 373	4 915	5 937	7 243	9 064	11 358	12 593
<b>Compensation of employees (male)</b>	221	273	231	250	337	444	564	758	921	1 119	1 472	1 631	1 869	2 079	2 199	2 471	2 664	2 920	3 364	3 653	4 278	4 806	5 783	7 022	8 743	10 925	11 958
<b>Compensation of employees (female)</b>	3	5	4	4	4	6	7	9	12	16	32	27	33	33	43	51	61	59	80	88	96	109	154	221	321	432	635
<b>Consumption of fixed capital</b>	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	0	0	0	2 060	2 428	3 357
<b>Opportunity cost of capital (SDR 3%)</b>	17	28	26	34	43	60	119	143	191	231	310	398	327	311	349	460	524	596	954	1 191	2 168	0	0	0	970	1 090	1 226
<b>Opportunity cost of capital (SDR 5%)</b>	26	37	43	67	86	100	178	251	305	415	568	626	561	571	639	789	823	1 021	1 551	1 935	3 522	0	0	0	1 616	1 816	2 043
<b>Rent (SDR 3%)</b>	456	378	319	472	590	889	1 268	1 452	1 355	1 493	1 130	1 018	204	-100	-412	-961	-1 057	-1 664	-1 943	-2 812	1 240	8 708	12 687	4 567	1 733	1 035	23 957
<b>Rent (SDR 5%)</b>	448	369	302	439	547	849	1 208	1 345	1 240	1 309	872	790	-30	-359	-703	-1 290	-1 356	-2 089	-2 540	-3 556	-115	8 708	12 687	4 567	1 086	309	23 140
<b>Unit rent (R/kg) (SDR 3%)</b>	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	-2 241	-5 250	-5 601	-8 463	-9 718	-12 989	5 998	37 935	53 613	17 207	6 270	3 417	77 903
<b>Unit rent (R/kg) (SDR 5%)</b>	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	-3 820	-7 045	-7 188	-10 628	-12 701	-16 428	-554	37 935	53 613	17 207	3 931	1 020	75 245
<b>Unit rent (R/kg) Five --year moving average (SDR 3%)</b>	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	2 722	80	-2 465	-4 424	-6 255	-8 404	-6 155	2 552	14 968	20 353	24 204	23 688	31 682
<b>Unit rent (R/kg) Five --year moving average (SDR 5%)</b>	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	1 123	-1 514	-4 058	-6 144	-8 276	-10 798	-9 500	-475	12 373	18 355	22 426	22 741	30 203

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006, and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

**Figure 6: Platinum: Output and intermediate consumption, 1980–2006 (R millions)**



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

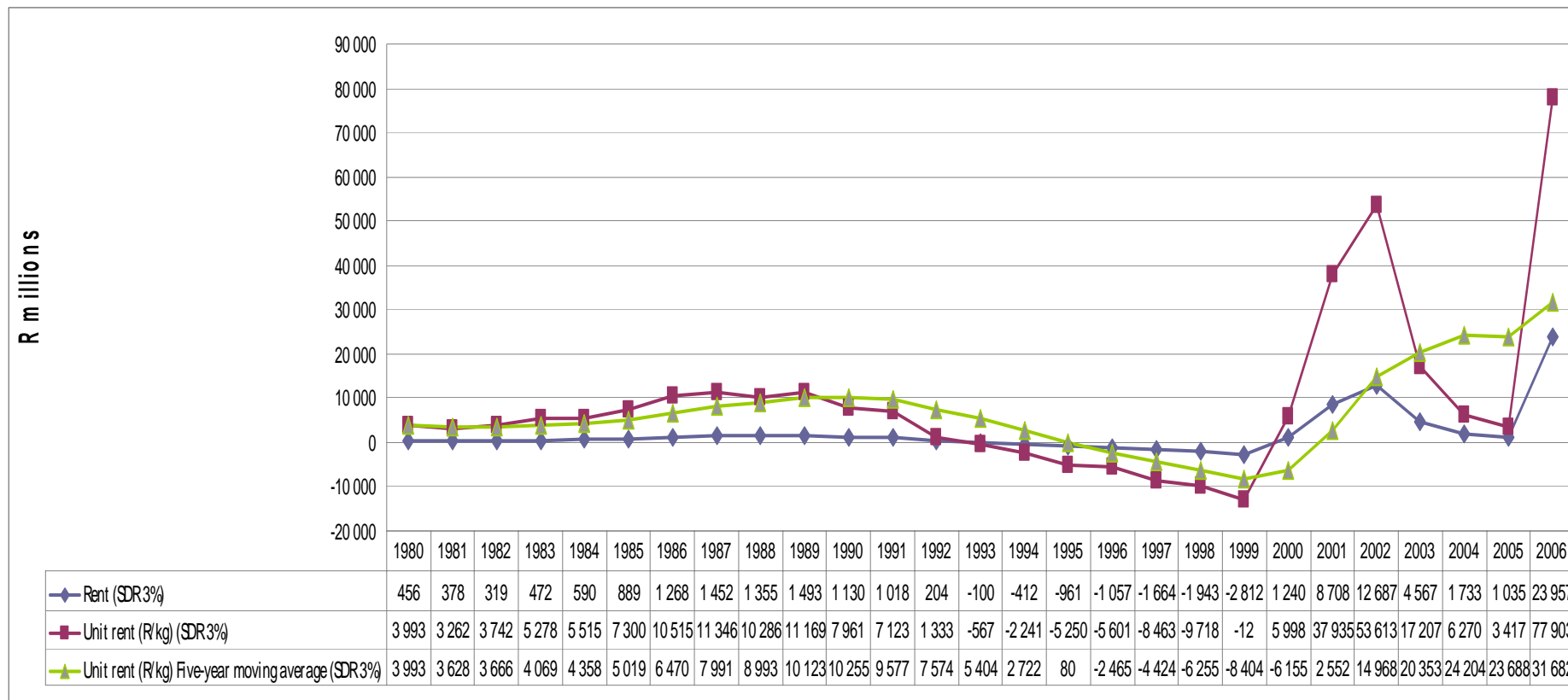
Calculations done by Stats SA

Figure 6 above shows an increase in the output of the platinum mining industry over the period from 1980 (R851 million) to 2001 (R33 371 million) with a sharp rise in 2006 (R65 444 million). Similarly, intermediate consumption also increased over the period from 1980 to 2006. Output and intermediate consumption showed a positive increase during the 26-year period, with output increasing faster than intermediate consumption.

Figure 7 below shows the resource rent and unit rent for platinum for the period 1980 to 2006. It shows that the resource rent was relatively stable over the 26-year period, while the unit rent fluctuated substantially between 1980 and 2006. Unit rent (five – year moving average) followed a similar but smoother trend to annual unit rent over the same period.



**Figure 7: Platinum: Resource and unit rent for South Africa, 1980–2006 (R millions R/kg)**



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)  
 Calculations done by Stats SA

### 4.3 Coal

Table 7 shows the output, intermediate consumption, employment figures, unit rent, resource rent as well as other calculations for coal for the period 1980 to 2006. Coal output (sales) increased from R1 497 million in 1980 to R37 991 million in 2006 and intermediate consumption also increased from R507 million in 1980 to R22 915 million in 2006. Over the same period, unit rent fluctuated from R2 876 million per kilogram in 1980 to R12 712 million per kilogram in 2006.

Intermediate consumption was obtained from the *LSS Census of Mining (P2001)* published by Stats SA for the years 1980 to 1992. The census is done every three years. Data were extrapolated for the intercensal years. For the years 1993 to 2006 data from the GDP release<sup>8</sup> was used. Opportunity cost of capital, rent and unit rent were calculated using a SDR of both 3,0% and 5,0%. Consumption of capital and opportunity cost of capital was calculated using the replacement values shown in Annexure 1.

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<sup>8</sup> Statistics South Africa. 2007. Gross domestic product, November 2007, Statistical release P0441. Pretoria

**Table 7: Coal: Resource rent and other calculations for South Africa at current prices, 1980–2006 (R millions)**

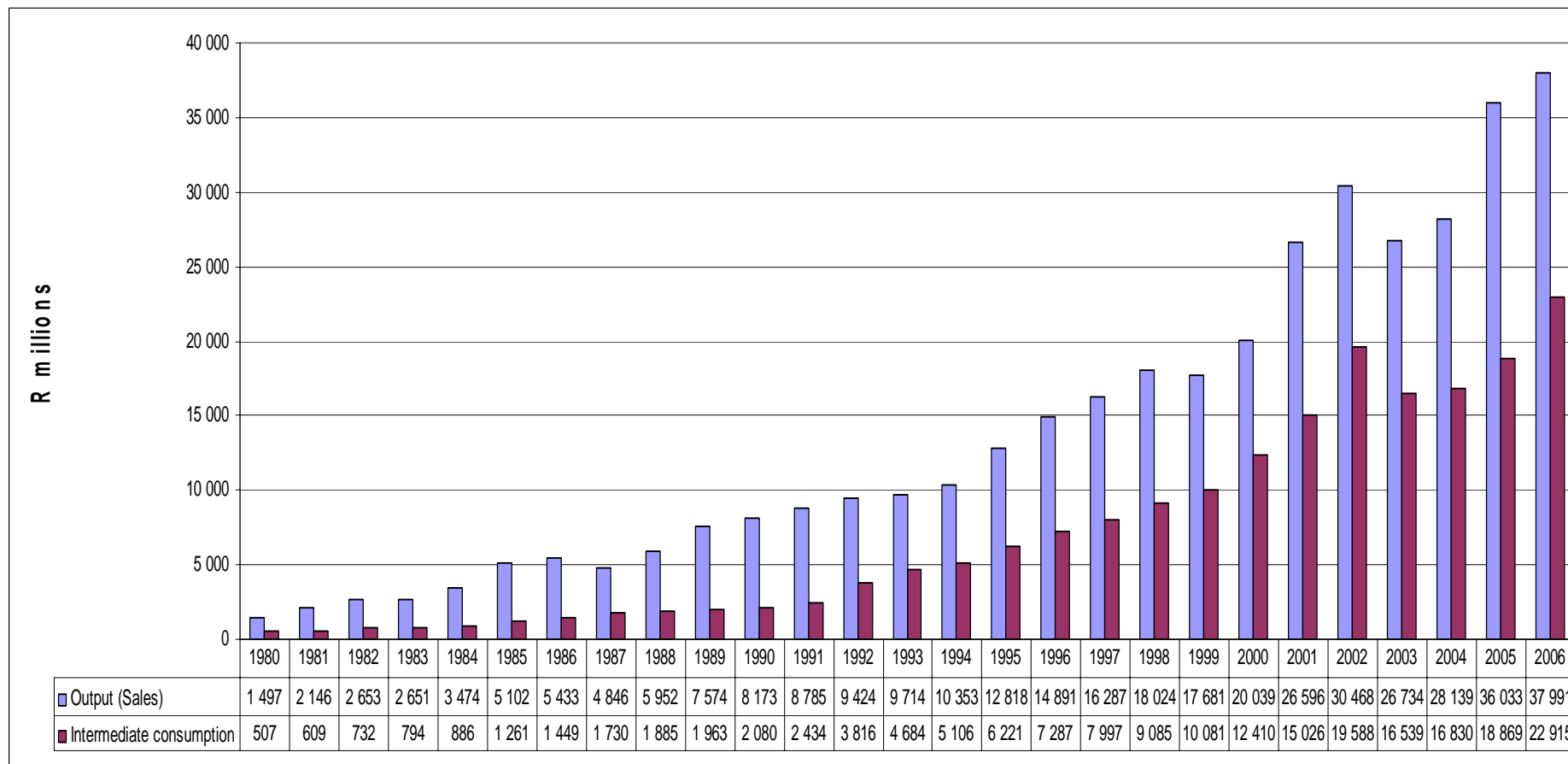
	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>Output (Sales)</b>	1 497	2 146	2 653	2 651	3 474	5 102	5 433	4 846	5 952	7 574	8 173	8 785	9 424	9 714	10 353	12 818	14 891	16 287	18 024	17 681	20 039	26 596	30 468	26 734	28 139	36 033	37 991
<b>Intermediate consumption</b>	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	22 915
<b>Compensation of employees (total)</b>	567	738	792	803	903	1 064	1 246	1 383	1 545	1 870	2 130	2 441	2 082	1 884	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
<b>Compensation of employees (male)</b>	554	720	769	777	872	1 028	1 203	1 332	1 487	1 802	2 046	2 344	2 010	1 821	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
<b>Compensation of employees (female)</b>	13	18	23	26	31	37	43	51	58	68	84	97	71	62	72	83	95	109	124	133	161	158	180	229	281	326	415
<b>Consumption of fixed capital</b>	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	0	0	0	3 154	3 879	3 968
<b>Opportunity cost of capital (SDR 3%)</b>	38	51	68	83	98	124	161	186	228	270	334	401	442	481	526	574	633	686	729	780	873	0	0	0	678	758	726
<b>Opportunity cost of capital (SDR 5%)</b>	63	85	113	139	164	207	269	310	380	450	557	668	736	802	876	956	1 056	1 144	1 215	1 301	1 455	0	0	0	1 130	1 263	1 211
<b>Rent (SDR 3%)</b>	331	676	965	850	1 444	2 468	2 333	1 261	1 938	3 041	3 095	2 865	2 356	1 851	1 788	2 633	3 045	3 131	3 311	1 481	760	7 118	6 411	4 714	1 614	6 045	3 112
<b>Rent (SDR 5%)</b>	305	642	920	795	1 378	2 385	2 226	1 137	1 786	2 861	2 872	2 598	2 061	1 530	1 438	2 251	2 622	2 674	2 825	961	178	7 118	6 411	4 714	1 162	5 540	2 627
<b>Unit rent (R/kg) (SDR 3%)</b>	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	9 103	12 805	14 852	14 282	14 793	6 663	3 380	31 851	29 107	19 818	6 631	24 676	12 712
<b>Unit rent (R/kg) (SDR 5%)</b>	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	7 319	10 945	12 792	12 195	12 622	4 323	792	31 851	29 107	19 818	4 773	22 614	10 734
<b>Unit rent (R/kg) Five-- year moving average (SDR 3%)</b>	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	13 239	12 262	12 021	12 221	13 167	12 679	10 794	14 194	17 159	18 164	18 157	22 417	18 589
<b>Unit rent (R/kg) Five-- year moving average (SDR 5%)</b>	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	11 647	10 553	10 200	10 314	11 175	10 576	8 545	12 357	15 739	17 178	17 268	21 633	17 409

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)

Calculations done by Stats SA

**Figure 8: Coal: Output and intermediate consumption, 1980–2006 (R millions)**

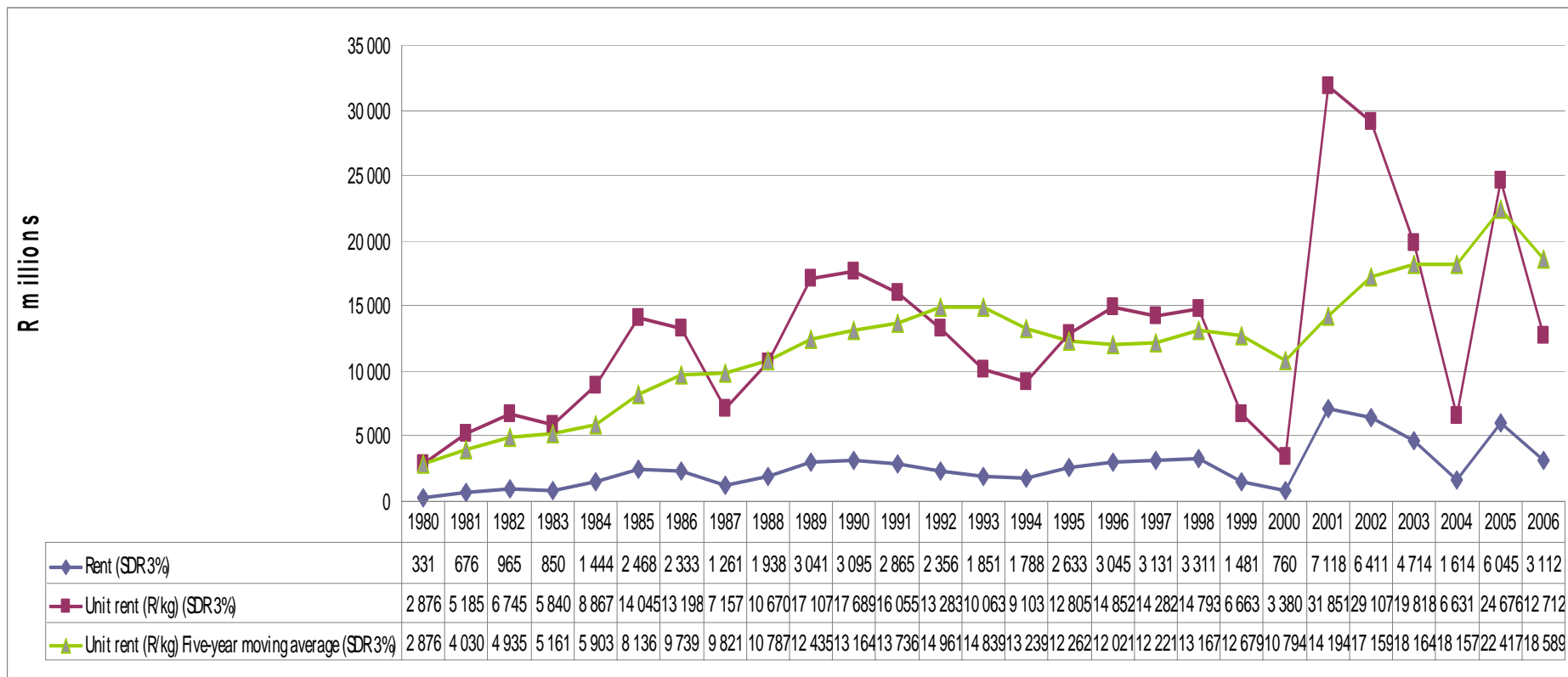


Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)  
 Calculations done by Stats SA

Figure 8 above shows that there was an increase in the output of the coal mining industry over the period from R1 497 million in 1980 to R37 911 million in 2006. Similarly, intermediate consumption also increased, although at a slower rate, over this period.

Figure 9 below shows resource and unit rent for coal in South Africa for the period 1980 to 2006 at a SDR of 3,0% (SDR 3,0%). This graph shows a steady increase in resource rent from 1982 onwards, with a sharp decrease in 2000. The annual unit rent fluctuated throughout the period from 1993 through to 2006. The unit rent (five - year moving average) followed a similar but smother trend to unit rent over the same period.

Figure 9: Coal: Resource and unit rent for South Africa, 1980–2006 (R millions R/kg)



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)  
 Calculations done by Stats SA

## 5. Monetary accounts for the South African mining industry

This section describes the monetary accounts for South Africa's gold, platinum and coal mining industries. As mentioned before, the results from the calculation of resource rent presented in section 4 were used in the compilation of these monetary accounts. Monetary accounts are presented both in annual and five-year moving average.

### 5.1 Gold

Table 8 shows the opening and closing stock, and depletion in the monetary accounts for gold for South Africa for the period 1980 to 2006. The value of the country's gold proven reserves (stock) depreciated over the period from R207 338 million in 1980 to R95 737 million in 2006, and reached its maximum level of R391 849 million in 2002.

**Table 8: Gold: Monetary accounts for South Africa at current prices, 1980–2006 (R millions)**

Year	Opening stock	Depletion	Revaluation	Closing stock
1980	214 352	7 013	0	207 338
1981	131 659	4 293	0	127 366
1982	108 013	3 545	0	104 468
1983	126 267	4 187	0	122 081
1984	139 536	4 650	0	134 885
1985	205 309	6 845	0	198 464
1986	224 003	7 391	0	216 613
1987	178 329	5 813	0	172 515
1988	193 593	6 379	0	187 214
1989	147 743	4 859	0	142 883
1990	89 004	2 935	0	86 068
1991	67 158	2 219	0	64 938
1992	10 854	362	0	10 492
1993	71 412	2 401	0	69 010
1994	53 929	1 786	0	52 142
1995	-45 795	-1 481	0	-44 315
1996	3 717	119	0	3 598
1997	-94 511	-3 026	0	-91 485
1998	-104 164	-3 304	0	-100 860
1999	-95 930	-3 030	0	-92 900
2000	-104 211	-3 268	0	-100 943
2001	182 513	5 643	0	176 870
2002	404 394	12 546	0	391 849
2003	286 078	8 791	0	277 286
2004	152 858	4 635	0	148 223
2005	-18 480	-552	0	-17 927
2006	98 668	2 931	0	95 737

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)

Calculations done by Stats SA

Table 9 shows the opening and closing stock, and depletion in the monetary accounts for gold for South Africa for the period 1980 to 2006. These values are calculated at a five - year moving average. The value of the country's gold proven reserves (stock) depreciated over the period from R207 338 million in 1980 to R138 093 million in 2006, and reached its maximum level of R176 297 million in 1988.

**Table 9: Gold: Monetary accounts for South Africa at current prices, 1980–2006 (R millions)**

Year	Opening stock	Depletion	Revaluation	Closing stock
1980	214 352	7 013	0	207 338
1981	169 330	4 293	0	165 037
1982	148 782	3 545	0	145 238
1983	144 958	4 187	0	140 772
1984	144 012	4 650	0	139 362
1985	143 479	6 845	0	136 635
1986	157 586	7 391	0	150 195
1987	164 772	5 813	0	158 958
1988	182 675	6 379	0	176 297
1989	182 189	4 859	0	177 330
1990	160 147	2 935	0	157 212
1991	130 418	2 219	0	128 199
1992	97 732	362	0	97 369
1993	77 183	2 401	0	74 781
1994	56 291	1 786	0	54 505
1995	24 893	-1 481	0	26 374
1996	15 048	119	0	14 929
1997	-8 364	-3 026	0	-5 338
1998	-39 598	-3 304	0	-36 294
1999	-65 482	-3 030	0	-62 452
2000	-76 012	-3 268	0	-72 744
2001	-27 263	5 643	0	-32 905
2002	73 190	12 546	0	60 644
2003	138 325	8 791	0	129 534
2004	167 437	4 635	0	162 803
2005	154 748	-552	0	155 300
2006	141 023	2 931	0	138 093

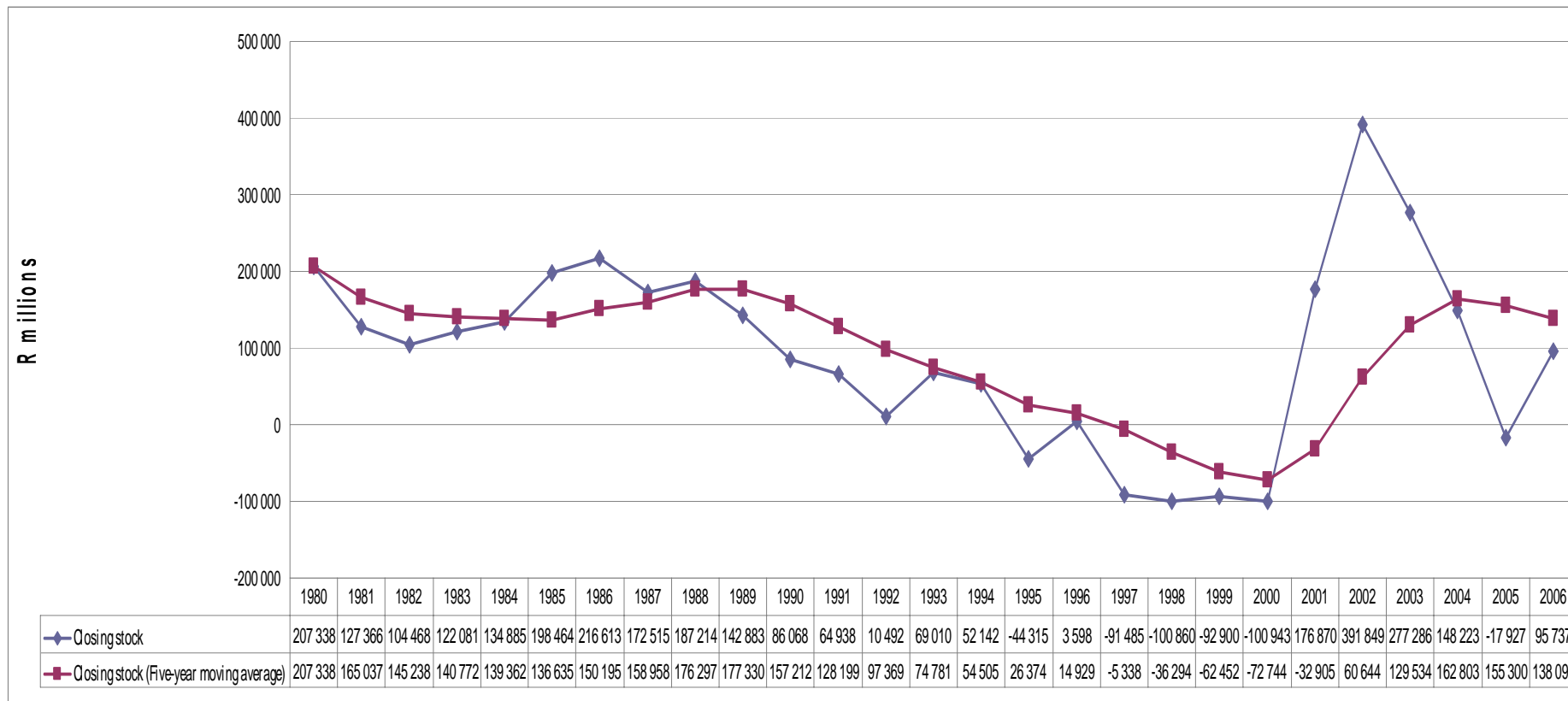
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Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)

Calculations done by Stats SA



**Figure 10: Gold: The value of closing stock for South Africa at current prices, 1980–2006 (R millions)<sup>9</sup>**



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006)  
 Calculations done by Stats SA

<sup>9</sup> Calculations at an SDR of 3,0%

## 5.2 Platinum

Table 10 shows the opening and closing stock, and the depletion in the monetary accounts for platinum in South Africa for the period 1980 to 2006. The value of the country's platinum reserves appreciated over the period from R15 215 million in 1980 to R797 618 million in 2006.

**Table 10: Platinum: Monetary accounts for South Africa at current prices, 1980–2006 (R millions)**

Year	Opening stock	Depletion	Revaluation	Closing stock
1980	15 671	456	0	15 215
1981	12 979	378	0	12 601
1982	10 947	319	0	10 628
1983	16 218	472	0	15 746
1984	20 261	590	0	19 671
1985	30 510	889	0	29 621
1986	43 519	1 268	0	42 251
1987	49 855	1 452	0	48 403
1988	46 516	1 355	0	45 162
1989	51 262	1 493	0	49 769
1990	38 788	1 130	0	37 658
1991	34 938	1 018	0	33 920
1992	6 996	204	0	6 792
1993	-3 430	-100	0	-3 330
1994	-14 150	-412	0	-13 737
1995	-33 001	-961	0	-32 040
1996	-36 275	-1 057	0	-35 218
1997	-57 128	-1 664	0	-55 464
1998	-66 713	-1 943	0	-64 770
1999	-96 536	-2 812	0	-93 724
2000	42 579	1 240	0	41 338
2001	298 940	8 708	0	290 232
2002	435 526	12 687	0	422 839
2003	156 737	4 567	0	152 170
2004	59 468	1 733	0	57 735
2005	35 509	1 035	0	34 474
2006	821 575	23 957	0	797 618

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

Table 11 shows the opening and closing stock, and the depletion in the monetary accounts for platinum in South Africa for the period 1980 to 2006. These values are calculated at a five - year moving average. The value of the country's platinum reserves appreciated over the period from R15 215 million in 1980 to R324 379 million in 2006.

**Table 11: Platinum: Monetary accounts for South Africa at current prices, 1980–2006 (R millions)**

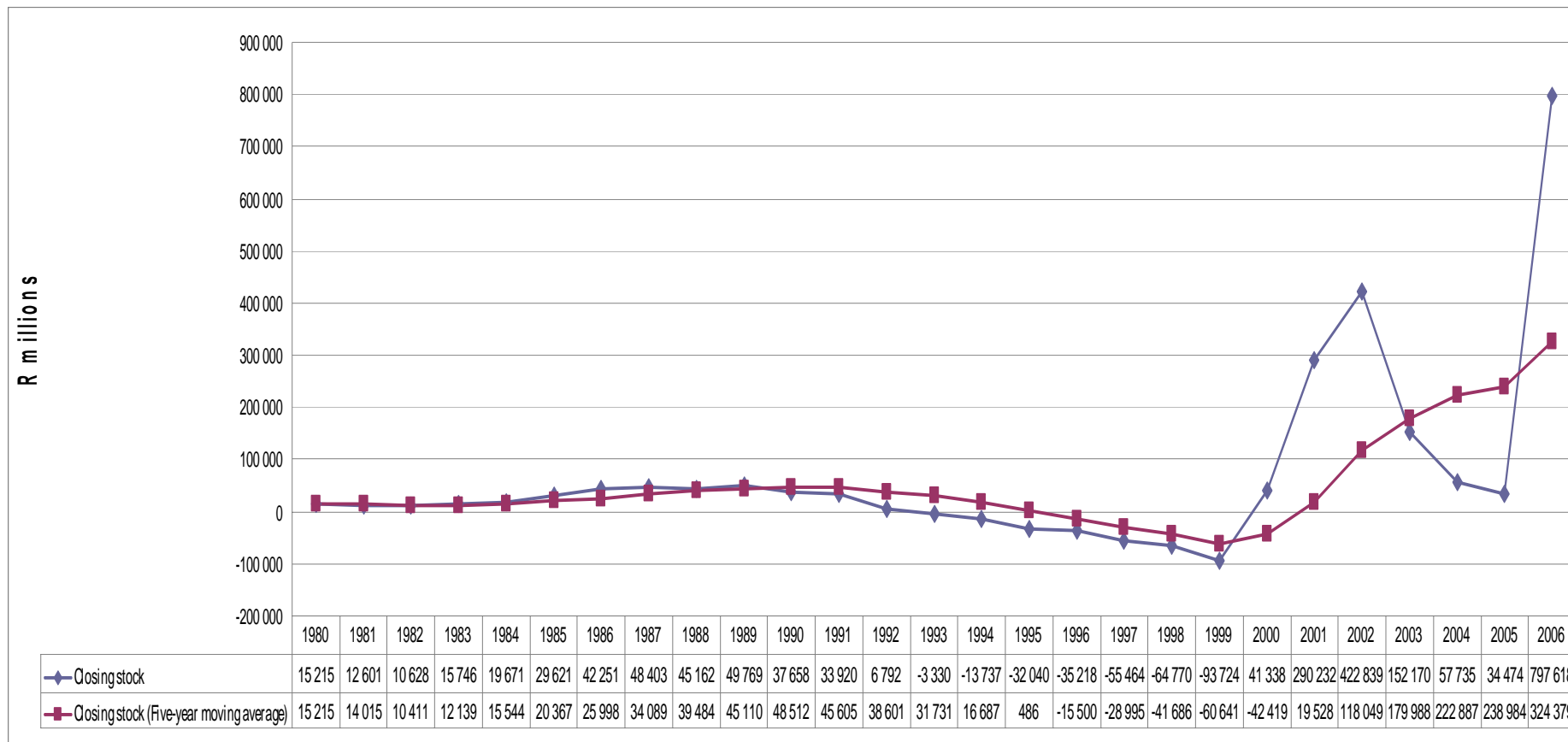
Year	Opening stock	Depletion	Revaluation	Closing stock
1980	15 671	456	0	15 215
1981	14 393	378	0	14 015
1982	10 730	319	0	10 411
1983	12 611	472	0	12 139
1984	16 134	590	0	15 544
1985	21 256	889	0	20 367
1986	27 265	1 268	0	25 998
1987	35 542	1 452	0	34 089
1988	40 839	1 355	0	39 484
1989	46 603	1 493	0	45 110
1990	49 642	1 130	0	48 512
1991	46 623	1 018	0	45 605
1992	38 804	204	0	38 601
1993	31 631	-100	0	31 731
1994	16 274	-412	0	16 687
1995	-475	-961	0	486
1996	-16 557	-1 057	0	-15 500
1997	-30 659	-1 664	0	-28 995
1998	-43 630	-1 943	0	-41 686
1999	-63 453	-2 812	0	-60 641
2000	-41 179	1 240	0	-42 419
2001	28 236	8 708	0	19 528
2002	130 736	12 687	0	118 049
2003	184 555	4 567	0	179 988
2004	224 620	1 733	0	222 887
2005	240 019	1 035	0	238 984
2006	348 337	23 957	0	324 379

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

Figure 11: Platinum: The value of closing stock for South Africa at current prices, 1980–2006 (R millions)<sup>10</sup>



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

<sup>10</sup> Calculations at an SDR of 3.0%.

### 5.3 Coal

Table 12 shows the opening and closing stock and depletion in the monetary accounts for coal in South Africa for the period 1980 to 2006. The value of South Africa's coal reserves appreciated over this period from R11 021 million in 1980 to R100 191 million in 2006.

**Table 12: Coal: Monetary accounts for South Africa at current prices, 1980–2006 (R millions)**

Year	Opening stock	Depletion	Revaluation	Closing stock
1980	11 352	331	0	11 021
1981	23 181	676	0	22 506
1982	33 081	965	0	32 116
1983	29 157	850	0	28 306
1984	49 430	1 444	0	47 987
1985	84 376	2 468	0	81 908
1986	79 749	2 333	0	77 416
1987	43 087	1 261	0	41 827
1988	66 181	1 938	0	64 243
1989	103 882	3 041	0	100 841
1990	105 756	3 095	0	102 661
1991	97 836	2 865	0	94 971
1992	80 445	2 356	0	78 089
1993	63 125	1 851	0	61 274
1994	60 811	1 788	0	59 022
1995	89 312	2 633	0	86 678
1996	103 244	3 045	0	100 200
1997	105 701	3 131	0	102 570
1998	111 519	3 311	0	108 209
1999	49 886	1 481	0	48 405
2000	25 565	760	0	24 805
2001	239 393	7 118	0	232 274
2002	215 730	6 411	0	209 319
2003	157 423	4 714	0	152 708
2004	53 710	1 614	0	52 097
2005	200 872	6 045	0	194 827
2006	103 302	3 112	0	100 191

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

Table 13 shows the opening and closing stock and depletion in the monetary accounts for coal in South Africa for the period 1980 to 2006. These values are calculated at a five - year moving average. The value of South Africa's coal reserves appreciated over this period from R11 021 million in 1980 to R146 504 in 2006.

**Table 13: Coal: Monetary accounts for South Africa at current prices, 1980–2006 (R millions)**

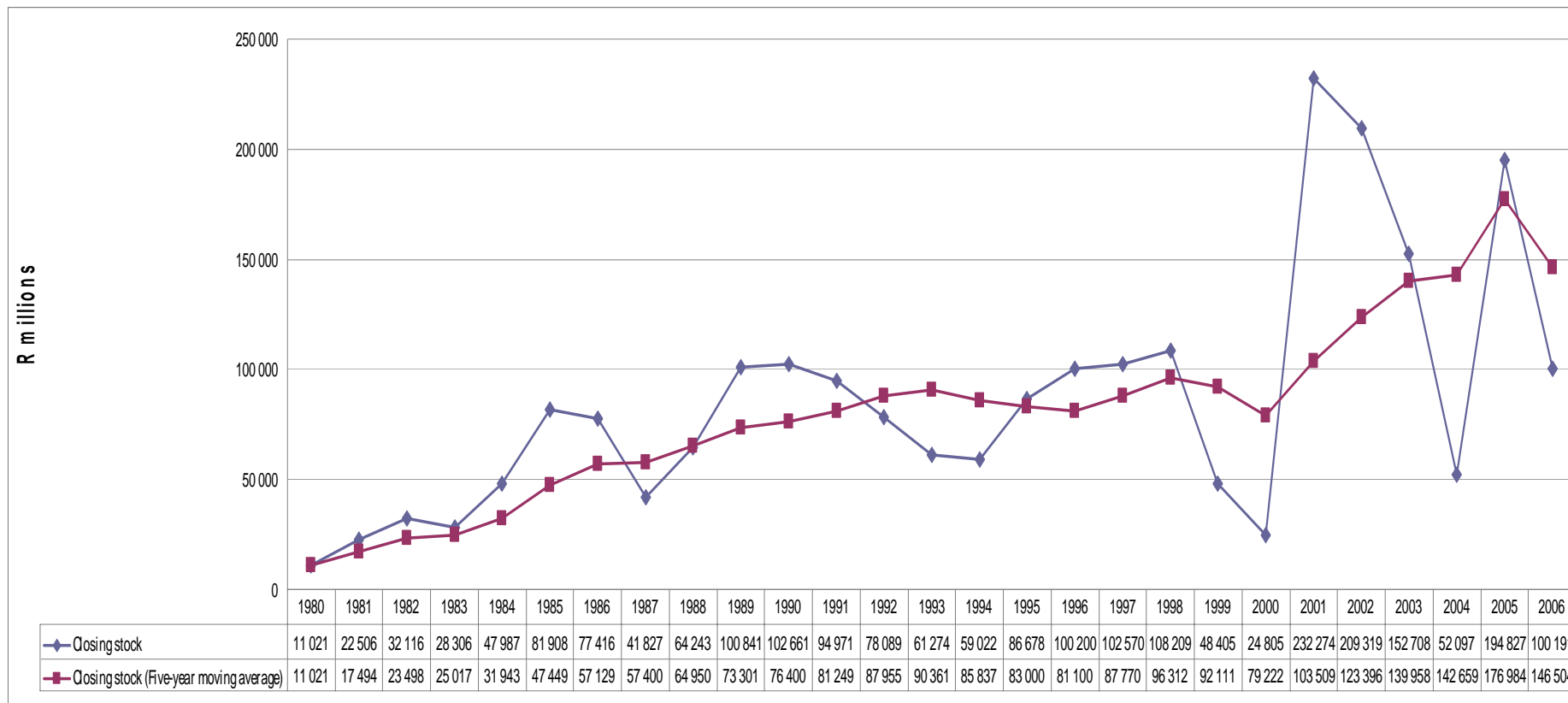
Year	Opening stock	Depletion	Revaluation	Closing stock
1980	11 352	331	0	11 021
1981	18 170	676	0	17 494
1982	24 462	965	0	23 498
1983	25 867	850	0	25 017
1984	33 387	1 444	0	31 943
1985	49 917	2 468	0	47 449
1986	59 462	2 333	0	57 129
1987	58 661	1 261	0	57 400
1988	66 888	1 938	0	64 950
1989	76 342	3 041	0	73 301
1990	79 495	3 095	0	76 400
1991	84 115	2 865	0	81 249
1992	90 311	2 356	0	87 955
1993	92 212	1 851	0	90 361
1994	87 625	1 788	0	85 837
1995	85 633	2 633	0	83 000
1996	84 145	3 045	0	81 100
1997	90 901	3 131	0	87 770
1998	99 623	3 311	0	96 312
1999	93 592	1 481	0	92 111
2000	79 982	760	0	79 222
2001	110 627	7 118	0	103 509
2002	129 807	6 411	0	123 396
2003	144 672	4 714	0	139 958
2004	144 273	1 614	0	142 659
2005	183 030	6 045	0	176 984
2006	149 616	3 112	0	146 504

0: Data not available

Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).

Calculations done by Stats SA

**Figure 12: Coal: The value of closing stock for South Africa at current prices, 1980–2006 (R millions)<sup>11</sup>**



Source: Department of Minerals and Energy: Statistical Tables 1980–2006 and Statistical Tables 1985–2006), Stats SA, *Census of Mining*, GDP publication (1993–2006) and AFS surveys (2005–2006).  
 Calculations done by Stats SA

<sup>11</sup> Calculations at an SDR of 3.0%.

## 6. Policy Analysis

Policy analysis represents the main purpose and use for the mineral accounts.

Mineral accounts can help answer the following important policy questions:

- How much resource rent does government collect? (resource rent versus years);
- What is the share of resource rent in total taxes? (resource rent, taxes, years); and
- What share of resource rent should fund current consumption and what share should be invested to maintain consistent consumption?

The answer to the first question may be obtained from the relevant government departments i.e. South African Revenue Service and question two can be sourced from the annual reports of mining companies in South Africa although this method may prove to be time consuming. A better method may be to use tax data from the LSS Census of mining, but this census is only run periodically.

Question three can be answered with the help of the El-Serafy's Use-Cost method, which is explained in detail under Annexure 2 (methodological methods).

## 7. Conclusion and recommendations

During the construction of the mineral accounts for South Africa the majority of the challenges were experienced while updating the resource rent and monetary accounts. There is no data for fixed capital and fixed capital stock for the years 2001 to 2003<sup>12</sup>. This necessitated having to make use of different data sources i.e. having to source data from LSS Census of mining, GDP and Annual Financial Survey (AFS) to obtain the required data items like consumption of fixed capital, intermediate consumption, gross fixed capital formation, fixed capital stock, taxes and royalties. The implications of using these different data sources have not yet been ascertained. There is also a lack of data for platinum (intermediate consumption) for the years 1980 to 1992.

The way forward for the mineral accounts for South Africa are firstly to ensure that with the use of these different data sources, for the accounts, it still gives a true picture and not distorted results. These different data sources should also be available for the same period of reference. This can be achieved through further research into the methodologies used in collecting and analysing the data that is used in the mineral accounts.

To address the negative values in the resource rent table and the corresponding monetary table it is recommended that an academic exercise be conducted to explain why the resource rent is negative. This should be done by looking at the equation for the resource rent calculation and analysing the individual components. This would also possibly require doing primary surveys with the major players in the industry to try explain specific components of the resource rent equation and why they may give a negative value.

An academic exercise with El-Serafy is also recommended. The purpose will be to test if South Africa is under-investing or over-investing the resource rent from the depletion of exhaustible resources. To answer this question comparison of the resource rent recovery by government with what theory tells us should be the optimal recovery plan for an economy to be on a sustainable path should be executed.

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<sup>12</sup> Data not available at the required SIC level for these years.



Another improvement for the future update of the mineral accounts for South Africa is the use of global information systems whereby all the mining accounts can be presented spatially which will add another new dimension to the use of the mineral accounts

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## Glossary

<b>Account</b>	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.
<b>Compensation of employees</b>	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.
<b>Consumption of capital</b>	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.
<b>Depletion</b>	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.
<b>Environmental Economic Accounting</b>	Environmental Economic Accounting (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.

<b>Fixed assets</b>	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 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.
<b>Fixed assets or inventories</b>	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.
<b>Intermediate consumption</b>	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.
<b>Mineral exploration</b>	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.
<b>Natural resource accounting</b>	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.
<b>Natural resources</b>	Natural assets (raw materials) occurring in nature that can be used for economic production or consumption.

<b>Non-renewable natural resources</b>	Exhaustible natural resources such as mineral resources that cannot be regenerated after exploitation.
<b>Nominal holding gains</b>	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.
<b>Opportunity cost</b>	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.
<b>Proved reserves</b>	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.
<b>Physical accounting</b>	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.
<b>Rent/royalties</b>	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 may be a function of the quantity or volume of the asset extracted.

<b>Revaluation</b>	Revaluation is the positive or negative holding gain accrued during the accounting period to the owners of financial or non-financial assets and liabilities.
<b>Standard Industrial Classification of all Economic Activities</b>	<p>A South African version of a classification coding system used to classify an <i>enterprise</i> according to its <i>economic activity</i>.</p> <p>Note: It is based on the United Nation's (UN) <i>International Standard Industrial Classification of all Economic Activities (ISIC)</i>, with a number of adaptations for local conditions.</p>
<b>Satellite accounts</b>	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.
<b>Stocks</b>	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).
<b>Subsoil assets</b>	<p>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.</p> <p><i>Subsoil assets are classified according to:</i></p> <ul style="list-style-type: none"><li>-The degree of geological certainty; and</li><li>-The degree of economic feasibility of the reserves.</li></ul> <p>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.</p>

<p><b>System of integrated Environmental and Economic Accounting (SEEA)</b></p>	<p>Satellite system of the System of National Accounts (SNA) proposed by the United Nations (1993a) for the incorporation of environment concerns (environmental costs, benefits and assets) into national accounts.</p>
<p><b>1993 System of national accounts</b></p>	<p>The revised (1993) system adopted worldwide for conventional economic (national) accounting (Commission of the European Communities and others, 1993).</p>
<p><b>Taxes</b></p>	<p>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.</p>

## Annexure 1: Consumption of capital

Table 11 presents information on consumption of capital for total mining, coal, gold and other mining activities at replacement value; and the fixed capital stock of total mining, coal, gold and other mining in South Africa at current prices for the period 1980–2006 in monetary values (R million).

**Table 11: Consumption of capital at replacement value and the fixed capital stock at current prices, 1980–2006 (R millions)**

Year	Consumption of fixed capital at replacement value (R millions)					Fixed capital stock at current prices: (R millions)				
	Total mining	Coal	Gold	Platinum	Other mining	Total mining	Coal	Gold	Platinum	Other mining
1980	786	55	306	0	425	11 789	1 268	5 781	0	4 741
1981	976	73	385	0	518	14 638	1 694	7 436	0	5 507
1982	1 206	96	478	0	632	18 095	2 254	9 284	0	6 557
1983	1 433	121	575	0	738	21 499	2 782	11 296	0	7 420
1984	1 639	143	658	0	838	24 585	3 271	13 134	0	8 180
1985	2 021	184	817	0	1 019	30 310	4 148	16 514	0	9 648
1986	2 423	243	1 074	0	1 105	36 343	5 372	21 696	0	9 275
1987	2 803	286	1 262	0	1 255	42 041	6 190	25 083	0	10 768
1988	3 374	356	1 527	0	1 492	50 617	7 593	30 083	0	12 941
1989	4 068	430	1 776	0	1 862	61 013	8 995	35 112	0	16 906
1990	4 708	534	2 069	0	2 105	70 621	11 136	40 033	0	19 452
1991	5 285	645	2 331	0	2 309	79 276	13 353	43 922	0	22 001
1992	5 708	728	2 567	0	2 413	85 626	14 727	47 031	0	23 867
1993	6 025	814	2 808	0	2 403	90 375	16 034	49 957	0	24 385
1994	6 418	911	3 090	0	2 417	96 275	17 527	53 173	0	25 576
1995	6 861	1 019	3 382	0	2 459	102 910	19 124	56 441	0	27 345
1996	7 271	1 145	3 661	0	2 465	109 061	21 111	59 288	0	28 662
1997	7 764	1 269	3 948	0	2 547	116 463	22 873	62 062	0	31 528
1998	8 177	1 377	4 125	0	2 675	122 652	24 292	62 508	0	35 852
1999	8 626	1 508	4 370	0	2 748	129 389	26 010	63 909	0	39 469
2000	9 230	1 708	4 734	0	2 788	138 457	29 097	66 736	0	42 624
2001	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0
2004	13 187	3 154	2 049	2 060	5 925	145 710	22 603	30 135	32 324	60 648
2005	17 933	3 879	3 442	2 428	8 184	164 190	25 266	41 066	36 318	61 540
2006	17 785	3 968	4 658	3 357	5 802	193 967	24 216	69 282	40 865	59 604

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Source: Basic data, SARB, Stats SA, *Census of Mining* and AFS surveys (2005–2006).

Calculations done by Stats SA



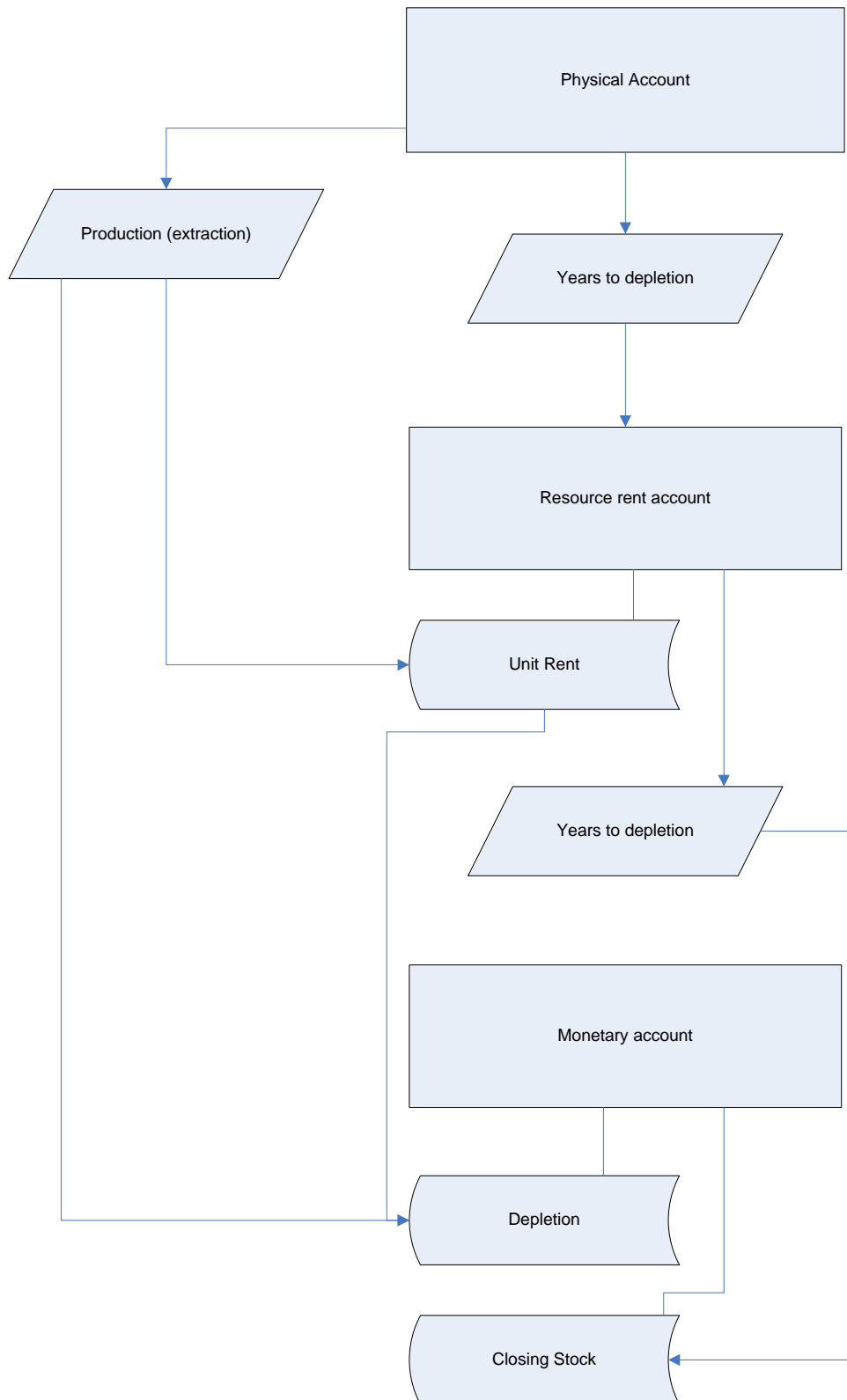
## **Annexure 2: Methodological notes**

This section focuses on the methodologies used to construct the three aspects of the economic environmental accounts (EEAs), namely the methodologies and development of physical accounts (section 2.1), the calculation of resource rent (section 2.2) and the methodological developments of monetary accounts<sup>13</sup>. 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 with the use of the El-Serafy's Use-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.

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<sup>13</sup> SEEA. 2003. Handbook on integrated environmental and economic accounting. UNSD.

**Figure 13: Data flow between mineral accounts**



## 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 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);
- 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.
- Economically proven reserves, less any possible waste that may occur during the extraction process.

The second measure was used for the South Africa 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 per cent, 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
- **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.

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.
- Stock at the end of the year / extraction of the year.

Option three 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 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.

The average real rate of interest in South Africa was -2,0% for the period 1973 to 1982 and 3,3% for the period 1983 to 2001<sup>14</sup>. A social discount rate ( $r$ )<sup>15</sup> of 3,0% and an alternative discount rate of 5,0% were used for calculations of the resource rent tables (refer to Table 5). Average rather than marginal costs were used in calculating resource rent. The unit rent ( $R_t$ ) was calculated as total rent divided by the volume of depletion for a specific year. Due to lack of data regarding intermediate consumption for platinum, and consumption of capital and opportunity cost of capital for the platinum mining sector, these variables were calculated as percentages of output (derived from ratios of gold). Replacement values were used for the consumption of capital and fixed capital stock and the time series data (1980–2006 is shown in Annexure 1).

## 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.

<sup>14</sup> Percentages obtained from unpublished data from the SARB.

<sup>15</sup> This letter "r" refers to the stock formula below and not the SDR previously referred to in this document.

- 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.

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)
<b>Less</b>	Value of the depleted stock (valued at the unit rent multiplied by the volume of depletion)
<b>Plus</b>	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)
<b>Plus</b>	Any revaluation due to time passing (valued by discounting for one year less)
<b>Plus</b>	Nominal holding gain (calculated as a residual)

The following formula was used to calculate the value of the stock of the mineral resource at period t as equivalent to the present value of the discounted expected future stream of net economic benefits from the resource over its remaining production cycle (e.g. until depletion at terminal time N):

$$V_t = R_t * q_t * \frac{(1+r)^N - 1}{r * (1+r)^N}$$

$$N_t = Q_t / q_t$$

Where:

- $V_t$  is the value of the stock at the close of period t
- $R_t$  is the unit rent at t
- $q_t$  is the volume of extraction at t (from the physical accounts)
- $Q_t$  is the volume of the stock at the close of t (from the physical accounts)
- $r$  is the social discount rate
- $N$  is the remaining number of years during which extraction can take place at the current rate (calculated as the volume of the closing stock divided by the current extraction volume).

The compilation of monetary accounts therefore presupposes the calculation of resource rent, unit rent ( $R_t$ ) as well as the number of years to closure at current extraction rates ( $N$ ). Rates of extraction as well as discount rates are usually assumed to remain constant over the production cycle.

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

- Annual unit rent; and
- Five-year moving average approach.

## 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:

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

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 depletion can take place at current rate.

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