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Platinum in the South African economy

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The paper will place into perspective the contribution that platinum makes to the South African economy. It will use statistics from official sources, namely the Department of Minerals and Energy, the Department of Customs and Excise, the South African Reserve Bank and Statistics South Africa.

Surprisingly few people are aware of these statistics, especially Supply and Usage tables, published by Statistics South Africa, and trade statistics, published by the Customs and Excise division of the South African Revenue Service. The paper will therefore contain a concise explanation of input-output tables and supply usage tables, as well as the derivation of gross domestic product and an outline of the System of National Accounts, of which Input-Output Tables and supply and usage tables are components.

GDP is a commonly used, but poorly understood, measure of the wealth of an economy. The paper will explain the methods used by SSA to calculate this indicator and its place in the System of National Accounts (SNA).

South Africa exports almost all its platinum production (87.5% in 2002). Exports are a final demand, as opposed to intermediate demand from secondary industries, and therefore do not enter the value-adding process, which is the essence of GDP. By definition, therefore, platinum on its own is not a major contributor to GDP.

The platinum industry does, however, have an impact (known as the multiplier effect) on other sectors of the economy. The paper will explain the meaning and derivation of these multipliers, using a model based on an Inverse Leontief Matrix.

Introduction

This paper puts in perspective the contribution that platinum makes to the South African economy. In order to do this, it is necessary to understand the system of national accounts (SNA) framework and its various components. SNA is an integrated set of macroeconomic accounts, balances sheets and tables based on internationally accepted concepts (OECD 2004).

In particular, it is necessary to understand input-output (IO) tables, supply and usage (SU) tables and gross domestic product (GDP).

The paper uses data from official sources, namely the South African Reserve Bank, the Department of Minerals and Energy, the SARS Department of Customs and Excise, and Statistics South Africa.

Surprisingly few people are aware of this data, especially the SU tables, published by Statistics South Africa (SSA), and the trade statistics, published by the Customs and Excise division of the South African Revenue Service. The paper therefore contains a concise explanation of these documents, as well as the derivation of gross domestic product (GDP) and an outline of the System of National Accounts, of which SU Tables are components.

GDP is a commonly used, but poorly understood, measure of the wealth of an economy. The paper explains the methods used by SSA to calculate this indicator and its place in the System of National Accounts.

South Africa exports almost all its platinum production. According to data published by the Department of Minerals and Energy, South Africa exported platinum worth R30.458 bn out of total production worth R34.828 bn in 2002 (87.45%). However, data from the Customs and Excise division of the South African Revenue Service indicates that exports were slightly less, at R29.042 bn. Gold remains the highest value export at R40.933 bn and R42.347 bn, according to data published by the Department of Minerals and Energy and Customs and Excise, respectively.

Exports are a final demand, as opposed to intermediate demand from secondary industries, and therefore do not enter the value-adding process, which is the essence of GDP. By definition, therefore, neither platinum nor gold, on their own, are major contributors to GDP.

Both the platinum and the gold industries do, however, have an impact (known as the multiplier effect) on other sectors of the economy. The paper explains the meaning and derivation of these multipliers, using a model based on an inverse Leontief matrix. This model uses another component of SNA, i.e., input-output (IO) tables. Unfortunately, South Africa discontinued the use of IO tables in 1999, and the multipliers are not current.

The system of national accounts

In 1936, John Maynard Keynes examined the relationships between production, consumption, savings and investment, and developed the General Theory of Employment, Interest and Money (Keynes, 1936).

Building on these theories, several economists published a System of National Accounts, or SNA, in 1953. SNA is probably one of the most important developments in twentieth-century economics, and is a main macro-economic building block that frames economic analysis and policy (SA Reserve Bank, 1999).

In 1993, five international organizations (the Organization for Economic Co-operation and Development, the United Nations Statistical Division, the International Monetary Fund, the World Bank, and the Statistical Office of the European Communities) jointly published a major revision of the System of National Accounts, called SNA93, based on internationally agreed concepts, definitions, classifications and accounting rules. SNA93 is a detailed framework that produces a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables. It presents a great mass of information about the working of an economy, especially the economic indicator, gross domestic product, or GDP (OECD 2004).

South Africa has used a form of national accounting since 1922, when R.A. Lehfeldt published estimates of South Africa's national income, but it was not until 1947 that the Bureau of Census and Statistics (a forerunner of the present Statistics South Africa) published official estimates of domestic and national income. Soon after 1950, the South African Reserve Bank published a set of annual national accounts. The first set of quarterly accounts appeared in the March 1971 issue of the Bank's *Quarterly Bulletin* (SA Reserve Bank, 1999).

Input-output tables and Supply and Usage tables

Input-output tables

In 1936, Vassily Leontief, a Russian born American, published the first input-output tables. In 1973, he received the Nobel Prize for Economics for this work. Alongside SNA, which they pre-date, IO tables are one of the twentieth century's major advances in economics. They allow analysis of an economic system using real numbers, instead of complicated economic formulae, and are numerical models of the relationships between the production sectors of an economic system. By showing details of the flow of goods and services between sectors, they provide an analysis of the production process, the use of these goods and services and the income generated in the production process.

Input-output tables have a square matrix format, i.e., equal numbers of rows and columns, showing all the sectors in an economic system. They are a vital part of the national accounting system, and incorporate the product and expenditure accounts, which form the cornerstone of the SNA.(SARB 1999)

A set of IO tables published by Statistics South Africa, the government agency authorized to compile and publish official statistics, consists of three separate tables, i.e.,

- A transaction table, that shows the value of transactions between industries at basic prices*
- An input coefficient table, that shows the direct requirements of each industry in relation to its output, or the input necessary to produce one rand of output
- An inverse or total requirement table, which shows the total direct and indirect requirements per rand of output delivered to final demand, from which it is possible to calculate the impact of a change in demand from the various industries.

In 1998, SSA published its final IO tables (containing 1993 data), and switched to Supply and usage tables in June 1999.

Supply and usage tables

SU tables are a special non-symmetric format of IO tables, used to check the internal consistency of data production and standards (UN, 1999).

SU tables depict products in rows and industries in columns. Because the number of products may not necessarily equal the number of industries, the SU matrix may not be square, unlike IO tables. The major conceptual difference between IO and SU tables is that an IO table relates industries to industries or products to products, whereas an SU table relates products to industries. Another major difference between the two is that SU tables contain two prices: the supply table is at basic prices and the Usage Table is at purchasers' prices†.

The Supply Table shows the origin of the goods and services, and the Use Table shows the uses of the goods and services.

The Usage Table has three sections:

- The first section shows goods and services used as intermediate consumption at purchaser's prices.
- The second section shows the components of final demand at purchaser's prices. These components are: exports; household consumption expenditure; general government consumption expenditure; fixed capital formation; changes in inventories; and a residual item.
- The third section elaborates on the production costs of producers other than intermediate consumption expenditure, namely compensation of employees, taxes less subsidies on production and imports, consumption of capital, and net operating surplus (SSA 2003).

Gross domestic product

Gross domestic product, or GDP, is the main concept in current use for measuring aggregate economic activity (SARB 1999). Although widely used, it is generally poorly understood. GDP is neither a cash flow nor a profit, but an indicator of the value added during the production process.

The calculation of GDP is according to one of three methods.

- The production method derives GDP at market prices from the sum of gross value added at basic prices plus taxes less subsidies on products
- GDP derived by the expenditure method is the sum of the final uses of goods and services by resident institutional units plus the export of goods and services purchased by foreigners minus imports of goods and services.
- GDP derived by the income method is the sum of factor income paid by resident producers, comprising compensation of employees, gross operating surplus including mixed income and net taxes on production.

*The basic price is the amount received by the producer from the purchaser for a unit of a good or service produced as output minus any tax payable plus any subsidy received on that unit as a consequence of its production or sale. Basic prices exclude any transport charges invoiced separately by the producer (SSA 2003)

†The purchaser's price is the amount paid by the purchaser, excluding any deductible VAT, or similar deductible tax, in order to take delivery of a unit of a good or service at the time and place required by the purchaser. The purchaser's price of good includes any transport charges paid separately by the purchaser to take delivery at the required time and place (SSA 2003)

Table I
A highly simplified input-output accounting framework

	Consuming industries	Net final demand	Total output
Supplying industries	F	Y	X
Value added (primary inputs)	V		
Total input	X		

Source: UN 1999
Note: This table comes directly from the United Nations Handbook. It may appear that V = Y, i.e., net final demand equals value added, but this is misleading

Table II
A high simplified usage table

Suppiers of products	Supply at purchasers' prices	Taxes less subsidies	Industry 1	.....	Industry n	Total	Final demand
Product 1	60000		30000	10000	10000	50000	10000
:	100000		5000	5000	10000	20000	80000
Product n	200000		50000	25000	25000	100000	100000
Total uses	360000		85000	40000	45000	170000	190000
Total gross value/GDP		10000	50000	20000	25000	95000	
Total			135000	60000	70000	265000	

Adopted from SSA 2003
GDP@Basic prices = 50000 + 20000 + 25000 = 95000
GDP@Producers' prices = 50000 + 20000 + 25000 + 10000 = 105000

Theoretically, these three methods should provide identical estimates of GDP, but because the measurement of flows of goods and services in the economy is inexact, the three methods will rarely produce the same answers. For this reason GDP is shown as a balancing item in the production and expenditure account.

This paper uses GDP at purchaser's prices, as published in the supply and usage tables, and calculated according to the Production method.

The flow of goods and services according to the 2000 SU tables

Economies have three basic industrial sectors, primary, secondary and tertiary, into which all the economic activities are classified. Table III shows these basic sectors, with their sub-divisions, as used in South Africa.

Tertiary industries neither supply nor add value to raw materials. They exist to manange and consume the wealth created in the primary and secondary industries.

For any economy to work, goods and services must flow through it. The process starts with raw material from the primary sectors. This passes either into the secondary industries as intermediate input or it becomes a final demand. Output from the secondary industries fulfils either intermediate or final demand.

As these goods and services pass from one sector to another, so is value added. One function of SNA93 is to measure this flow and the value added. Figure 1 is a schematic representation of this process.

Figure 1 shows that the gross value added to goods and services in 2000 amounted to eight hundred and eight billion, two hundred and forty-one million rands. Taxes less subsidies on products amounted to seventy-nine billion, eight hundred and sixteen million rands. According to the production method, therefore, GDP at market prices in the year 2000 is the sum of these two components, i.e., eight hundred and eighty-eight billion and fifty-seven million rands.

The SU table shows the GDP produced by every sector. Table IV is a condensed form of the Table, as this is a very large document and it is not practical to reproduce here.

The GDP at purchasers' prices is shown in the lower right hand corner.

The contribution of platinum to GDP

Because South Africa exports the greatest part of its platinum production, and because exports are a final demand and therefore do not form part of the production process, platinum, on its own, is not a significant direct contributor towards the gross national product.

Table III
Basic industrial sectors

Primary industries	Secondary industries	Tertiary industries
Agriculture, hunting, forestry and fishing	Manufacturing	Wholesale and retail trade, catering and accommodation
Mining and quarrying	Electricity and water	Transport, storage and communication
	Construction	Financial intermediation, insurance, real estate and business services
		Community, social and personal services

Source: SARB 1999

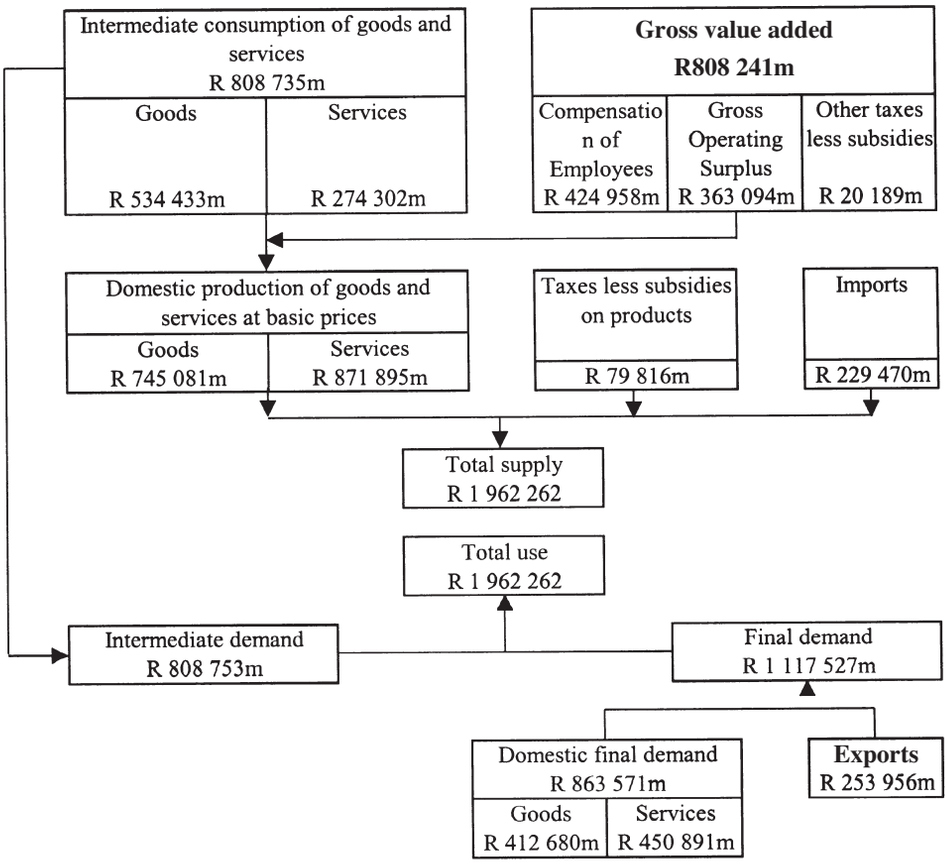

Figure 1. Flow of goods and services (according to 2000 S-U Tables)

Table IV
Condensed use of products at purchasers' prices

			Industry									Total	Total	Final
Supply of products	Supply at purchasers' prices	Taxes less subsidies on products	Agri-culture	Mining	Manu-fac-turing	Elec-tricity	Construc-tion	Trade	Trans-port	Business services	Commu-nity services	Industry	Economy	Demand
Agriculture	62 481		2 289	35	41 160	12	5	557	3	20	444	44 524		17 957
Mining	131 512		149	274	36 757	4 451	1 317	12	120	28	372	43 480		88 032
Manufacturing	839 365		18 800	18 169	223 056	3 378	27 860	20 262	30 097	14 407	36 821	392 850		446 515
Electricity	41 543		641	4 050	9 025	6 795	265	2 375	2 304	1 517	1 905	28 877		12 666
Construction	83 443		202	911	–	1 567	15 691	2 017	649	2 000	1 664	24 701		58 742
Trade	53 627		261	457	1 154	166	194	8 158	6 094	3 760	3 558	23 802		29 825
Transport	139 451		3 121	15 725	10 823	539	1 137	17 756	12 897	7 957	7 312	77 267		62 184
Business services	268 314		1 236	2 444	20 841	1 753	4 773	27 909	10 010	53 894	14 729	137 589		130 725
Community services	291 290		643	5 563	10 762	48	772	964	1 797	2 506	12 590	35 645		255 645
Direct purchases abroad by residents	15 236													15 236
Direct purchases by non-residents	–													–
Total uses	1 926 262		27 342	47 628	353 578	18 709	52 014	80 010	63 971	86 089	79 395	808 735		1 117 527
Total gross value added/GDP		79 816	26 060	54 950	150 198	22 657	23 842	107 299	80 799	160 936	181 498	808 241	888 057	
Total			53 402	102 578	503 776	41 366	75 856	187 309	144 770	247 025	260 893	1 616 976		

Source: SSA 2003

The SU tables identify only three mining industries: 'coal', 'gold' and 'other mining'. This system of classification is a relic of the time when coal, gold and diamonds were the principal minerals produced. It is outdated and needs revision.

Total supply, including imports by the mining industry at purchasers' prices in 2000, was R131 513b n, consisting of R20.986 bn, R29.286 bn and R81.241 bn from the coal, gold and other mining sectors, respectively. Removing taxes and transport margins converts these amounts into basic prices, i.e., R20.343 bn, R29.286 bn and R78.618 bn for coal, gold and other mining, respectively, totalling R128.247 bn

Total intermediate use, i.e., that part of production that did form part of the value-adding process, for the coal, gold and other sectors respectively, in purchasers' prices, was R13.218 bn, zero and R30.262 bn.

Total final use, i.e., that part of production that did not form part of the value adding process, was R7.767 bn, R29.286 bn and R50.979 bn for coal, gold and other mining respectively. The total final demand is the sum of these three amounts, i.e., R88.032 bn, also at purchaser's prices

Because the SU tables do not identify platinum group metals separately, it is not possible to determine their direct contribution to GDP. However, it is possible to estimate this contribution from data available from two other government publications: Customs and Excise and the Department of Minerals and Energy.

Customs and Excise data indicates that the value of platinum group metals exported in 2000 was R29.042 billion.

Data available from the Department of Minerals and energy indicates that total sales of platinum group metals in 2000 were R27.095 billion and that PGM exports amounted to R24.645 billion. (The DME and C&E export data do not agree, but his is often the case when comparing data from different government departments.)

Either way, it is clear that South Africa exports a major portion of its PGM production, which, as a final use, does not directly enter the value-adding chain.

This assertion does not, however, mean that platinum does not impact on the national GDP. It does, and quantification of this impact, called impact analysis, is the subject of the next section.

The impact of platinum on the rest of the economy

The relationship between a change in output from a sector (which implies a change in intermediate spending) and the effects generated on the economy is the multiplier effect of the sector. The study of multipliers is generally called impact analysis (Kuhn, 1997).

Impact analysis requires the use of input-output tables.

If the total inputs for each industry are reduced to 1 unit, then it is possible to calculate the output required from the other industries to produce this one unit, as shown in Tables VI and VII.

One unit of output from industry B requires 0.1 units of output from industry A, 0.4 units from industry C, and generates 0.5 units of value added.

The amount of product from industry A used as intermediate input to produce the outputs from the other industries, B and C, is therefore:

Intermediate use of output from industry A

$$A = 0.0X_A + 0.1X_B + 0.3X_c \qquad [1]$$

Where X_A = the output from A entering A as intermediate input

X_B = the output from B entering A as intermediate input

X_C = the output from C entering A as intermediate input

The total output of industry A is intermediate demand plus final demand, i.e.,

Table V
Mining contribution to GDP according to 2000 Su Tables (producers' prices)

	Coal Rm	Gold Rm	Other Rm	Total mining Rm	National Rm
Compensation of employees	4607	11962	9148	25717	424958
Taxes less subsidies	270	373	327	970	20189
Gross operating surplus	5497	4958	17809	28264	363094
GDP	10374	17293	27284	54951	808241
Per cent of mining	18.8	31.47	49.65		
Per cent of national	1.28	2.14	3.38	6.80	

Source: SSA 2003

Table VI
Input-output flow table and accounts

Supplying Industries	Consuming Industries			Final	Total
	A	B	C	Demand	Output
A	0	20	45	35	100
B	30	0	30	140	200
C	0	80	0	70	150
Value added	70	100	75		
Total input	100	200	150		

Source: UN 1999

Table VII
Input-output coefficient: inputs per unit of output

	Industry A	Industry B	Industry C
Industry A	0.0	0.1	0.3
Industry B	0.3	0.0	0.2
Industry C	0.0	0.4	0.0
Value added	0.7	0.5	0.5
Total input	1.0	1.0	1.0

Source: UN 1999

Table VIII
Direct coefficients in general terms

	Industry 1	Industry 2	Industry 3	: : N	Industry N	Final demand
Industry 1	a_{11}	a_{12}	a_{13}	: :	a_{1n}	Y_1
Industry 2	a_{21}	a_{22}	a_{23}	: :	a_{2n}	Y_2
Industry 3	a_{31}	a_{32}	a_{33}	: :	a_{3n}	Y_3
: : :	: : :	: : :	: : :	: :	: : :	: : :
Industry N	N_{n1}	N_{n2}	N_{n3}	: :	N_{nn}	Y_N
Value added	V_1	V_2	V_3	: :	V_n	

Source UN 19999

$$0.0X_A + 0.1X_B + 0.3X_c + 35 = 100 \qquad [2]$$

Direct coefficients only relate to their own specific industries and do not show the effect on the other industries. If industry A increases (or decreases) its output, it will require more (or less) input from industries B and C, i.e., they will need to increase (or decrease) their output to meet the demands from industry A. The relationship between a change in output from a sector and the effects this change generates on the rest of the economy is called the multiplier effect of the sector.

Equation [3] expresses the relationship in Table VIII as a series of simultaneous linear equations, i.e.:

$$\begin{aligned}
&a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + ...a_{\ln}X_n + Y_1 = X_1 \\
&a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + ...a_{2n}X_n + Y_2 = X_2 \\
&a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + ...a_{3n}X_n + Y_3 = X_3 \\
&:: \qquad :: \qquad :: \qquad :: \quad :: \quad :: \\
&a_{\mathrm{nl}}X_1 + a_{n2}X_2 + a_{n3}X_3 + ...a_{nn}X_n + Y_n = X_n
\end{aligned} \qquad [3]$$

In matrix form, Equation [3] becomes a square matrix, i.e.:

$$\begin{vmatrix} a_{11} & a_{12} & a_{13} & a_{\ln} \\ a_{21} & a_{22} & a_{23} & a_{2n} \\ a_{31} & a_{32} & a_{33} & a_{3n} \\ : & : & : & : \\ a_{nl} & a_{n2} & a_{n3} & a_{nn} \end{vmatrix} \mathrm{X} \begin{vmatrix} X_1 \\ X_2 \\ X_3 \\ : \\ X_n \end{vmatrix} + \begin{vmatrix} Y_1 \\ Y_2 \\ Y_3 \\ : \\ Y_n \end{vmatrix} = \begin{vmatrix} X_1 \\ X_2 \\ X_3 \\ : \\ X_n \end{vmatrix} \qquad [4]$$

Equation [4] has the general form.:

$$AX + Y = X \qquad [5]$$

Or

$$X = Y\left[I - A\right]^{-1} \qquad [6]$$

Where: A is the IO coefficient matrix

Table IX
1993 Ranking of sectors by total GDP multipliers

Sector	Multiplier	Standard deviation
Financial institutions and financial services	2.0132	2.8891
Other services—non-profit seeking	1.8258	1.9164
Wholesale, retail and motor trade	1.6596	1.0538
Other services—profit seeking	1.6407	0.9557
Business services	1.6124	0.8088
Railway and other transport equipment	1.5961	0.7242
Building construction	1.5902	0.6936
Gold mining	**1.5809**	**0.6453**
Transport and storage	1.5755	0.6173
Communication	1.5737	0.6079
Civil engineering and other construction	1.5645	0.5602
Other, scrap and government services	1.5434	0.4506
Catering and accommodation services	1.5390	0.4278
Wood and furniture	1.4976	0.2129
Fabricated metal products	1.4810	0.1268
Engines, machinery and equipment	1.4667	0.0525
Paper, printing and publishing	1.4517	0.0253
Electrical machinery and appliances	1.4470	-0.0497
Pottery, glass, refractories and other non-metallics	1.4425	-0.0731
Medical, dental and other health and veterinary services	1.4201	-0.1893
Other manufacturing services	1.4144	-0.2189
Textiles, clothing, cordage and leather	1.3957	-0.3160
Other mining	**1.3923**	**-0.3336**
Coal mining	**1.3877**	**-0.3575**
Iron, steel and non-ferrous basic industries	1.3830	-0.3819
Food, liquor, beverages and tobacco	1.3780	-0.4078
Electricity, gas and steam	1.3760	-0.4182
Remuneration of employees	1.3541	-0.5319
Water supply	1.3463	-0.5724
Motor vehicles, parts and accessories	1.3292	-.06611
Agriculture, forestry and fishing	1.3059	-0.7821
Chemicals, plastics, petroleum and rubber	1.1771	-1.4506
Machinery and equipment renting and leasing	1.1699	-1.4880
Real estate	1.1119	-1.7890
Jewellery and related articles	0.9371	-2.6963

X is the output vector
Y is the net final demand vector
I is the identity matrix

$[I-A]^{-1}$ is the Leontief inverse, which is the key to calculation of multipliers.

When the values of the coefficients and of net final demand are known, then it is possible to find *X*, the value of various industries necessary to satisfy the specified level of net final demand.

I.e. to find the impact of each sector on the GDP for instance, one would multiply the Leontief inverse by the GDP vector, and to find the impact on employment, the same is done with the employment vector, and so on for the sectors of the economy.

Further explanation of matrix algebra and the Leontief inverse is beyond the scope of this paper. A good reference for readers who may wish to explore the subject is Chiang (1984).

Conclusions

The multipliers presented in this paper use 1993 data, published in the 1999 input-output tables. Unfortunately, Statistics South Africa ceased production of IO tables in 1999, and changed to SU tables. It is therefore not possible to update these multipliers. They do, however, give an indication of the impact the 'Other' mining sector had on the national GDP at that time.

GDP multipliers are the factor by which the total GDP of an economy will increase due to a unit increase in final demand for a specific sector's product (Kuhn, 1997).

Table IX shows the 1993 multiplier effect of main industrial sector on GDP. For instance, if output from Financial Institutions and Financial Services increased by RI, then the GDP would increase by R1.0132, and if output from the gold, coal and other mining sectors each increase by R1. then the GDP would increase by R0.5809, R0.3923 and R0.3877 respectively. None of these impacts, except those of the Financial Institutions and Financial Services sector, are significantly different from the standard deviation of the GDP Multiplier distribution.

In view of the current debate surrounding the mining industry and its role in the national economy, it is important to update these multipliers. However, this will require new IO tables, which, as mentioned earlier, SSA no longer publishes.

This paper demonstrates that it is possible to quantify the contribution of any commodity to the national economy. Because South Africa exports almost all its gold and platinum, they do not directly enter the domestic secondary industries, and any impact on GDP is either indirect or induced

Lombard and Stadler (1980), in a study commissioned by the Chamber of Mines twenty-four years ago, found that:

- The extent to which the manufacturing industries in South Africa depended directly on inputs from domestic mining was low
- The forward linkages between mining and the rest of the economy were indirect and through the world economy. In other words, the South African economy consumes imported foreign goods manufactured fro exported domestic raw minerals.

This situation continues today. The value of platinum and its associated metals to the South African economy remains through the export markets, subject to the vagaries of demand from these markets and to the volatility of the foreign exchange markets.

In a country with a huge mineral endowment that exports almost all its mineral production, such as South Africa does, the wealth generated by the mineral production can last only as long as do the minerals. Unless a portion of the revenues generated by the sale of minerals is invested in sustainable industries, as advocated by Edwards (1985), all benefits will disappear when the resources are exhausted. This may seem an unnecessary concern in a country with such huge endowments, but the fact is that mineral resources are finite and non-renewable.

There are proposals to compel mining companies to 'beneficiate', or add value to raw minerals. These proposals are, in the opinion of the author, misguided. South African mining houses have completed a decades long process of 'unbundling' their non-mining activities. The engineering expertise in the South African mining industry is peerless, and the focus of the industry should remain where it is to meet the technical challenges that lie ahead.

Another forum, outside the mining industry, must address the matter of adding value to South Africa's raw minerals. Both capital and skills will be required, and South Africa will attract these only if the economic environment will allow goods to be manufactured at internationally competitive prices

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