

## MINERAL ENDOWMENTS AND DEVELOPING ECONOMIES

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### ABSTRACT

This Paper will give a brief introduction to the System of National Accounts (1993) as used by the United Nations, and will explain the concepts of Gross Domestic Product, Gross National Product per Capita, Gross National Income and Gross National Income per Capita. It will examine the degree to which the citizens of mineral rich African countries benefit from the exploitation of their mineral endowments. It will do this using data from the United Nations' System of National Accounts, or SNA, and will emphasise the need for these countries to implement such a System. The Paper will conclude by proposing greater application of the System of National Accounts in order to measure and manage the benefits flowing into African economies from exploitation of mineral endowments.

#### 1. Introduction

Africa's developing economies have huge mineral endowments. The known deposits are vast, and include virtually every known mineral. Who knows what other riches remain undiscovered?

As geological exploration increases throughout the continent, new discoveries attract attention from international investors and mine operators. What does this mean for Africa?

Sadly, in the past, Africa's mineral riches have all too often resulted in war, misery and poverty. The legacies of blood gold, blood oil, blood diamonds etc., etc., need no repeating.

Harold MacMillan's Winds of Change continue to blow throughout the Continent, except now these are blowing away the despots and dictators.

International mining companies, large and small, with their vast experience, strict corporate governance and transparent business ethics, are moving the African mining industry out of the abyss of greed and corruption. The days of reckless destruction of the environment, callous exploitation of cheap, largely illiterate labour, and unbridled corruption and greed, the cause of so much misery in Africa, are rapidly disappearing. The mining companies that design, build and operate large complex mines can unlock wealth in the remotest of regions. They are, almost all, bound by strict corporate governance and business ethics. They bring with them, not only technical expertise and demanding standards, but also benefits in safety, health and protection of the environment.

#### 2. Mineral endowments and economic growth

There is an extensive literature on the relationship between mineral endowments and economic growth. Some economists believe that economies richly endowed with mineral resources should use these resources to fuel economic growth by exporting raw minerals (Davis, 1994). At the other end of the debate is the view that mineral endowments are a curse, best left in the ground (Gelb, 1988). Between these two extremes are those who advocate the development of secondary industries to produce consumer goods from raw minerals. This leads into the quagmire of relative advantages and the ability to compete with developed economies that produce the same goods at much cheaper prices, using raw minerals imported from Africa.

Research conducted in the latter part of the 20<sup>th</sup> century shows that mineral rich economies experienced lower rates of economic growth than those that relied on imported raw minerals. Gelb

(1988) and Auty (1990) suggest that economic and political factors caused the failure of many economies to benefit from their mineral endowments. These factors included restrictive trade policies, prohibitive investment rates, political instability and bureaucratic inefficiency.

A more basic reason for the failure of mineral rich developing countries to match the growth of developed, but mineral deficient countries, also became apparent at the end of the 20<sup>th</sup> century. (Lane & Tornell (1995), quoted in Sachs & Warner (1995, page 4)) contend that “resource rich economies are subject to more extreme rent seeking behaviour than resource poor economies, as national politics in the resource rich countries is directed towards grabbing the rent earned by the natural resource endowments”.

Many of these factors still exist in Africa today.

### 3. Mineral Economics

In 1931, Harold Hotelling, a German born American economist., published a seminal paper, “The Economics of Exhaustible Resources”. This remains the corner stone of mineral economics. It examines the conflicting interests of present and future generations, and the problem of depleting non-renewable resources.

With remarkable foresight, he wrote:

“Great wastes arise from the suddenness and unexpectedness of mineral discoveries, leading to wild rushes, immensely wasteful socially, to get hold of valuable property. New discoveries lead to feeding frenzies in a fight for the rents, which only serve to harm the public good”.(Hotelling, 1931)

What was true in 1931 is still true today, and the questions Hotelling posed in 1931 remain as relevant now as they did then:

- “How much of the proceeds of a mine should be reckoned as income, and how much as return on capital?
- What is the value of a mine when its contents are supposedly fully known, and what is the effect of uncertainty of estimate?
- If a mine-owner produces too rapidly he will depress the price [of his product], perhaps to zero. If he produces too slowly his profits, though larger, may be postponed further into the future than the rate of interest warrants. Where is his golden mean?
- How does this most profitable rate of production vary as exhaustion approaches?
- Is it more profitable to complete the extraction within a finite time, to extend it indefinitely in such a way that the amount [of the mineral] remaining in the mine approaches zero as a limit, or to exploit so slowly that mining operations will not only continue at a diminishing rate forever, but leave an amount in the ground which does not approach zero?
- How should exploitation take place for the greatest general good, and how does a course having such an objective compare with that of the profit-seeking entrepreneur?
- How can the State, by regulation or taxation, induce the mine-owner to adopt a schedule of production more in harmony with the public good?
- What of the plight of the workers and subsidiary industries when a mine is exhausted?” (Hotelling 1931)

The answers to all these questions have occupied mineral economists ever since, and are beyond the scope of this paper. We will, however, partially examine the final question, and look at the extent to which a country’s populace benefits from its mining industry. We will do this using data from the United Nations, and contained in the Systems of National Accounts, or SNA.

Before proceeding, it is necessary to explain briefly the SNA and some of the instruments it uses to measure various aspects of an economy.

#### 4. The System of National Accounts

All industries in an economy interact with each other.

In 1953, the United Nations devised a System of National Accounts, or SNA., to quantify this interaction and the value of each industry to the economy. The system currently in use is the 1993 revision, SNA (1993).

“The System of National Accounts consists of a coherent, consistent and integrated set of macroeconomic accounts, balance sheets, and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. It provides a comprehensive accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision taking and policy-making. The accounts themselves present in a condensed way a great mass of detailed information, organized according to economic principles and perceptions, about the working of an economy. They provide a comprehensive and detailed record of the complex economic activities taking place within an economy and of the interaction between the different economic agents, and groups of agents that takes place on markets or elsewhere. In practice, the accounts are compiled for a succession of periods, thus providing a continuing flow of information that is indispensable for the monitoring, analysis and evaluation of the performance of an economy over time. The SNA provides information not only about economic activities, but also about the levels of an economy's productive assets and the wealth of its inhabitants at particular points of time. Finally, the SNA includes an external account that displays the links between an economy and the rest of the world.”

(United Nations, 2009)

Of all the countries in Africa, South Africa has the most advanced System of National Accounts, and produces highly detailed data on its mining industry. Preparation of National Accounts requires extensive and sophisticated data capture and processing facilities, which many African countries, including those with the most abundant mineral endowments, simply do not possess.

For the purposes of this Paper, the following SNA instruments require a brief explanation:

- Gross Domestic Product, or GDP
- GDP/Capita
- Gross National Income, or GNI
- GNI/Capita
- Mineral Exports.

##### 4.1. Gross Domestic Product

“Gross domestic product (GDP) is one of the most important barometers or indicators of the performance of the economy. It is the total value of all final goods and services produced within the boundaries of a country in a particular period.(S.A. Reserve Bank 2009)

GDP is not a balance sheet item. It is a measure of value added in the production process, a measure of the strength of the economy. The System of National Accounts has three approaches to computing GDP, each of which considers different aspects of an economy, and which all arrive at the same total. These approaches are:

- The Production Approach
  - Production based GDP is the sum of all gross values added by all resident producers at market prices<sup>1</sup>, plus taxes less subsidies on imports.
- The Expenditure Approach
  - Expenditure based GDP is total final expenditures at purchaser's prices<sup>2</sup> (including the f.o.b. value of exported good and services), less the f.o.b. value of imported goods and services.
- The Income Approach.
  - Income based GDP is compensation of employees, plus taxes less subsidies on production and imports, plus gross mixed income, plus gross operating surplus.

The United Nations uses the Expenditure Approach to compute GDP.

#### 4.2. Gross Domestic Product per Capita

GDP per Capita is the GDP divided by the population of the country concerned at the time of measurement

#### 4.3. Gross National Income

Gross National Income is GDP less net taxes on production and imports, less compensation of employees and property income payable to the rest of the World, plus the corresponding items receivable for the rest of the World, in other words GDP less primary incomes payable to non-residents plus primary incomes receivable from non-residents.

#### 4.4. Gross National Income per Capita

GDP per Capita is the GDP divided by the population of the country concerned at the time of measurement

#### 4.5. Exports.

Exports are a final output, i.e., no further value is added. They are goods and services consisting of sales, barter or gifts from residents to non-residents.

A shortcoming of the data published on the United Nations' website is the failure to isolate the value of raw mineral exports. This is particularly important in an African context.

### 5. Mining in Africa.

Table 1 (illustrated by Figure1) contains the value, expressed in constant 1990 US Dollars, of the Gross Domestic Product of African countries that submitted post 1990 data to the United Nations. Countries submit this data to the UN on a voluntary basis, but, unfortunately, many do not do this.

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<sup>1</sup> Market prices for transactions are the amounts of money willing buyers pay to acquire something from willing sellers.

<sup>2</sup> A Producer's Price is the amount receivable by the producer from the purchaser for a unit of a good or service produced as output, minus any VAT or similar deductible tax, invoiced by the purchaser; it excludes any transport charges invoiced separately by the producer.

|                    | GDP                |                                |
|--------------------|--------------------|--------------------------------|
|                    | Constant 1990 US\$ |                                |
|                    | \$ Actual          | \$ Billions (10 <sup>9</sup> ) |
| South Africa 2007  | 179,764,640,952    | 179.765                        |
| Egypt 2006 2006    | 84,023,270,788     | 84.023                         |
| Algeria 2003       | 83,983,136,911     | 83.983                         |
| Nigeria 2005       | 70,988,176,884     | 70.988                         |
| Libya 2007         | 51,443,745,098     | 51.444                         |
| Morocco 2006       | 47,750,116,186     | 47.750                         |
| Ethiopia 2007      | 23,278,706,057     | 23.279                         |
| Cameroon 2006      | 17,149,937,581     | 17.150                         |
| Kenya 2006         | 16,855,120,921     | 16.855                         |
| Côte d'Ivoire 2000 | 15,155,787,565     | 15.156                         |
| Ghana 2006         | 12,912,874,110     | 12.913                         |
| Senegal 2006       | 10,779,651,489     | 10.780                         |
| Tanzania 2007      | 10,288,255,517     | 10.288                         |
| Uganda 2006        | 10,026,614,649     | 10.027                         |
| Botswana 2007      | 8,524,752,847      | 8.525                          |
| Mozambique 2007    | 8,246,823,514      | 8.247                          |
| Burkina Faso 2007  | 8,018,943,962      | 8.019                          |
| Zimbabwe 2005      | 7,487,919,159      | 7.488                          |
| Zambia 2007        | 5,678,582,284      | 5.679                          |
| Mauritius 2007     | 5,553,030,537      | 5.553                          |
| Mali 2006          | 5,367,720,454      | 5.368                          |
| Guinea 2006        | 4,979,944,421      | 4.980                          |
| Namibia 2006       | 4,654,352,787      | 4.654                          |
| Madagascar 2007    | 4,569,632,254      | 4.570                          |
| Chad 2007          | 4,514,151,416      | 4.514                          |
| Niger 2007         | 4,216,127,847      | 4.216                          |
| Malawi 2005        | 3,597,885,999      | 3.598                          |
| Rwanda 2002        | 3,085,516,062      | 3.086                          |
| Swaziland 2005     | 1,332,112,445      | 1.332                          |
| Lesotho 2006       | 1,078,454,447      | 1.078                          |
| Sierra Leone 2006  | 843,160,043        | 0.843                          |
| Djibouti 1998      | 501,514,171        | 0.502                          |
| Gambia 1994        | 376,177,697        | 0.376                          |
| Guinea-Bissau 1991 | 240,406,414        | 0.240                          |

Table 1

Source: United Nations

The date next to each country's name indicates the latest year of data available on the United Nations' website.

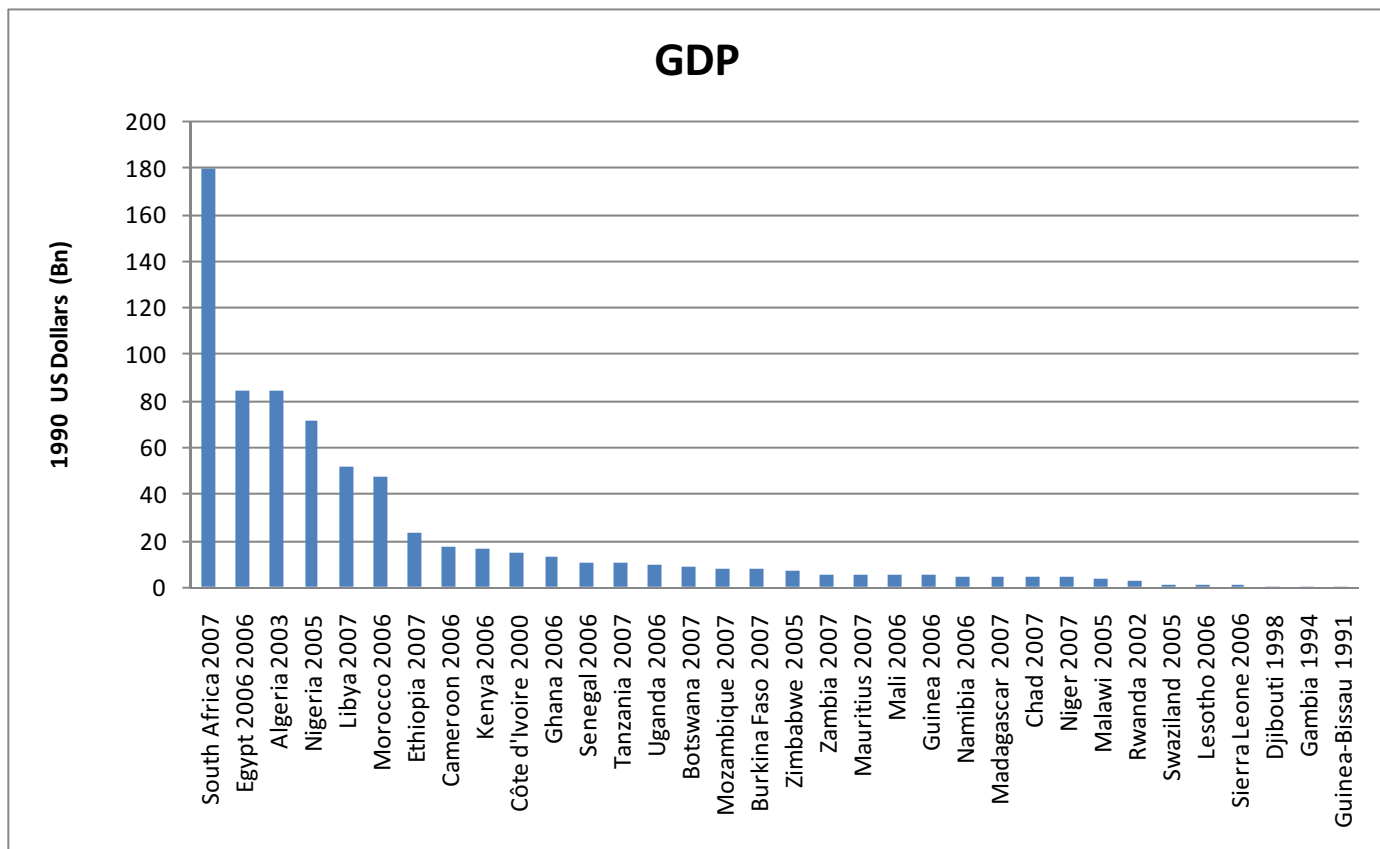


Figure 1

Source: Table 1

Table 2 adds the percentage contributed by the mining industry in each country to its GDP. We obtain this percentage from United Nations' data in current local currency terms, which data is not included in this paper.

In Table 2 we see that that the mining industry in Libya (which produces mainly crude oil) is the biggest percentage contributor of value to the national GDP, followed by Botswana, Chad and Nigeria.

|                    | GDP                |                                | Mining as<br>percent of<br>GDP |
|--------------------|--------------------|--------------------------------|--------------------------------|
|                    | Constant 1990 US\$ |                                |                                |
|                    | \$ Actual          | \$ Billions (10 <sup>9</sup> ) |                                |
| Libya 2007         | 51,443,745,098     | 51.444                         | 74.3%                          |
| Botswana 2007      | 8,524,752,847      | 8.525                          | 41.9%                          |
| Chad 2007          | 4,514,151,416      | 4.514                          | 41.5%                          |
| Nigeria 2005       | 70,988,176,884     | 70.988                         | 38.1%                          |
| Algeria 2003       | 83,983,136,911     | 83.983                         | 36.5%                          |
| Guinea 2006        | 4,979,944,421      | 4.980                          | 17.5%                          |
| Zimbabwe 2005      | 7,487,919,159      | 7.488                          | 16.9%                          |
| Egypt 2006 2006    | 84,023,270,788     | 84.023                         | 14.6%                          |
| Namibia 2006       | 4,654,352,787      | 4.654                          | 11.7%                          |
| Cameroon 2006      | 17,149,937,581     | 17.150                         | 10.3%                          |
| Guinea-Bissau 1991 | 240,406,414        | 0.240                          | 8.5%                           |
| Mali 2006          | 5,367,720,454      | 5.368                          | 7.5%                           |
| South Africa 2007  | 179,764,640,952    | 179.765                        | 6.8%                           |
| Lesotho 2006       | 1,078,454,447      | 1.078                          | 5.9%                           |
| Ghana 2006         | 12,912,874,110     | 12.913                         | 5.1%                           |
| Zambia 2007        | 5,678,582,284      | 5.679                          | 4.7%                           |
| Sierra Leone 2006  | 843,160,043        | 0.843                          | 4.1%                           |
| Tanzania 2007      | 10,288,255,517     | 10.288                         | 3.5%                           |
| Niger 2007         | 4,216,127,847      | 4.216                          | 2.7%                           |
| Malawi 2005        | 3,597,885,999      | 3.598                          | 2.0%                           |
| Morocco 2006       | 47,750,116,186     | 47.750                         | 1.8%                           |
| Uganda 2006        | 10,026,614,649     | 10.027                         | 0.8%                           |
| Senegal 2006       | 10,779,651,489     | 10.780                         | 0.8%                           |
| Burkina Faso 2007  | 8,018,943,962      | 8.019                          | 0.7%                           |
| Rwanda 2002        | 3,085,516,062      | 3.086                          | 0.5%                           |
| Kenya 2006         | 16,855,120,921     | 16.855                         | 0.5%                           |
| Ethiopia 2007      | 23,278,706,057     | 23.279                         | 0.4%                           |
| Côte d'Ivoire 2000 | 15,155,787,565     | 15.156                         | 0.3%                           |
| Swaziland 2005     | 1,332,112,445      | 1.332                          | 0.3%                           |
| Djibouti 1998      | 501,514,171        | 0.502                          | 0.2%                           |
| Madagascar 2007    | 4,569,632,254      | 4.570                          | 0.1%                           |
| Gambia 1994        | 376,177,697        | 0.376                          | 0.0%                           |
| Mauritius 2007     | 5,553,030,537      | 5.553                          | 0.0%                           |
| Mozambique 2007    | 8,246,823,514      | 8.247                          | 0.0%                           |

Table 2

Source; United Nations

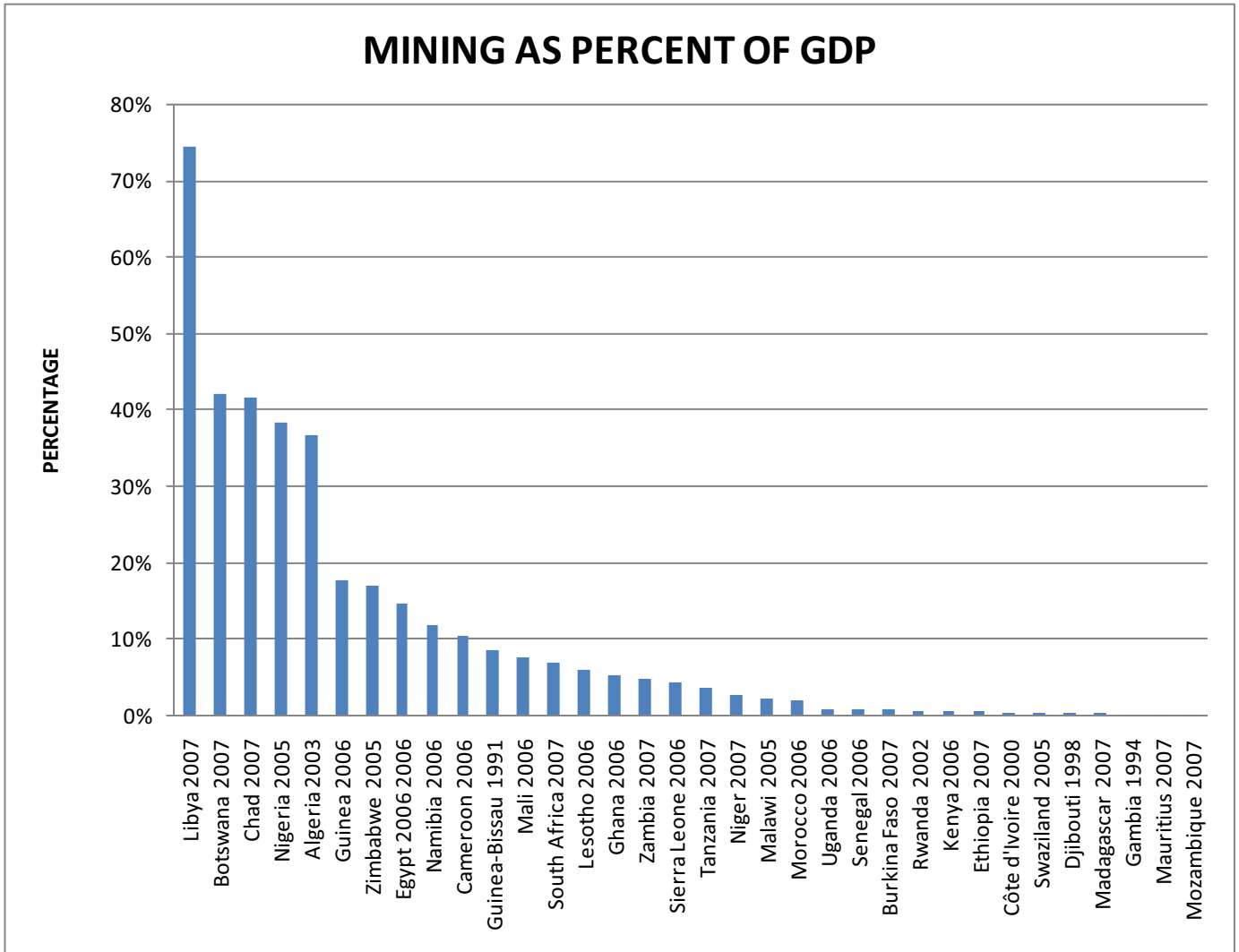


Figure 2

Source: Table 2

By applying the percentage contributed by the mining industry to the size of GDP, we arrive at Table 3, which quantifies the contribution of the industry to each country's GDP.

Here we find that Libya's mining industry (oil, remember) adds 1.25, 1.41, 3.11, 3.13 and 10.70 times as much value to its GDP than do those in Algeria (oil), Nigeria (oil), Egypt, South Africa and Botswana, respectively. The mining industries in all other countries add relatively modest values to their respective Gross Domestic Products.



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|                    | GDP                |                                | Mining as<br>percent of<br>GDP | Value added by<br>Mining Industry to<br>GDP |
|--------------------|--------------------|--------------------------------|--------------------------------|---------------------------------------------|
|                    | Constant 1990 US\$ |                                |                                | \$ Billions (10 <sup>9</sup> )              |
|                    | \$ Actual          | \$ Billions (10 <sup>9</sup> ) |                                |                                             |
| Libya 2007         | 51,443,745,098     | 51.4437                        | 74.3%                          | 38.211                                      |
| Algeria 2003       | 83,983,136,911     | 83.9831                        | 36.5%                          | 30.687                                      |
| Nigeria 2005       | 70,988,176,884     | 70.9882                        | 38.1%                          | 27.082                                      |
| Egypt 2006 2006    | 84,023,270,788     | 84.0233                        | 14.6%                          | 12.291                                      |
| South Africa 2007  | 179,764,640,952    | 179.7646                       | 6.8%                           | 12.213                                      |
| Botswana 2007      | 8,524,752,847      | 8.5248                         | 41.9%                          | 3.572                                       |
| Chad 2007          | 4,514,151,416      | 4.5142                         | 41.5%                          | 1.873                                       |
| Cameroon 2006      | 17,149,937,581     | 17.1499                        | 10.3%                          | 1.765                                       |
| Zimbabwe 2005      | 7,487,919,159      | 7.4879                         | 16.9%                          | 1.268                                       |
| Guinea 2006        | 4,979,944,421      | 4.9799                         | 17.5%                          | 0.873                                       |
| Morocco 2006       | 47,750,116,186     | 47.7501                        | 1.8%                           | 0.853                                       |
| Ghana 2006         | 12,912,874,110     | 12.9129                        | 5.1%                           | 0.658                                       |
| Namibia 2006       | 4,654,352,787      | 4.6544                         | 11.7%                          | 0.547                                       |
| Mali 2006          | 5,367,720,454      | 5.3677                         | 7.5%                           | 0.403                                       |
| Tanzania 2007      | 10,288,255,517     | 10.2883                        | 3.5%                           | 0.365                                       |
| Zambia 2007        | 5,678,582,284      | 5.6786                         | 4.7%                           | 0.269                                       |
| Niger 2007         | 4,216,127,847      | 4.2161                         | 2.7%                           | 0.112                                       |
| Ethiopia 2007      | 23,278,706,057     | 23.2787                        | 0.4%                           | 0.103                                       |
| Senegal 2006       | 10,779,651,489     | 10.7797                        | 0.8%                           | 0.085                                       |
| Kenya 2006         | 16,855,120,921     | 16.8551                        | 0.5%                           | 0.083                                       |
| Uganda 2006        | 10,026,614,649     | 10.0266                        | 0.8%                           | 0.081                                       |
| Malawi 2005        | 3,597,885,999      | 3.5979                         | 2.0%                           | 0.072                                       |
| Lesotho 2006       | 1,078,454,447      | 1.0785                         | 5.9%                           | 0.064                                       |
| Burkina Faso 2007  | 8,018,943,962      | 8.0189                         | 0.7%                           | 0.056                                       |
| Côte d'Ivoire 2000 | 15,155,787,565     | 15.1558                        | 0.3%                           | 0.042                                       |
| Sierra Leone 2006  | 843,160,043        | 0.8432                         | 4.1%                           | 0.035                                       |
| Guinea-Bissau 1991 | 240,406,414        | 0.2404                         | 8.5%                           | 0.020                                       |
| Rwanda 2002        | 3,085,516,062      | 3.0855                         | 0.5%                           | 0.015                                       |
| Madagascar 2007    | 4,569,632,254      | 4.5696                         | 0.1%                           | 0.006                                       |
| Swaziland 2005     | 1,332,112,445      | 1.3321                         | 0.3%                           | 0.004                                       |
| Djibouti 1998      | 501,514,171        | 0.5015                         | 0.2%                           | 0.001                                       |
| Mauritius 2007     | 5,553,030,537      | 5.5530                         | 0.0%                           | 0.000                                       |
| Gambia 1994        | 376,177,697        | 0.3762                         | 0.0%                           | 0.000                                       |
| Mozambique 2007    | 8,246,823,514      | 8.2468                         | 0.0%                           | 0.000                                       |

Table 3

Source: United Nations

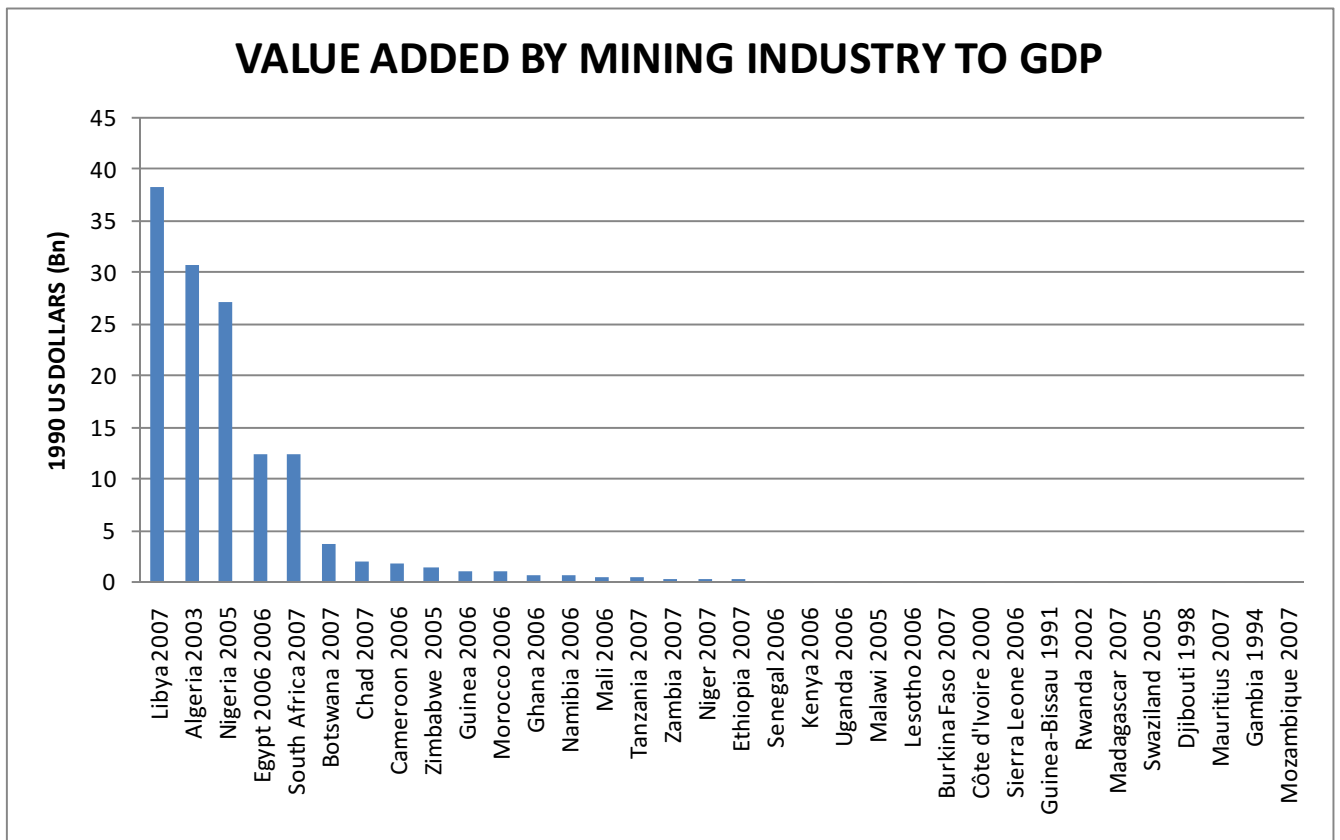


Figure 3

Source: Table 3

We now examine the Gross National Income per Capita, and arrive at Table 4. Here we should note that Mauritius, although posting the second highest GNI per capita, hardly has a mining industry of any significance.

We should also note the size of the various populations, as this obviously does affect the distribution of wealth. (Figure 4B)

|                    | GDP                |                                | Mining as percent of GDP | Value added by Mining Industry to GDP | GNI per Capita per annum |
|--------------------|--------------------|--------------------------------|--------------------------|---------------------------------------|--------------------------|
|                    | Constant 1990 US\$ |                                |                          | \$ Billions (10 <sup>9</sup> )        | 1990 US dollars          |
|                    | \$ Actual          | \$ Billions (10 <sup>9</sup> ) |                          |                                       |                          |
| Libya 2007         | 51,443,745,098     | 51.4437                        | 74.3%                    | 38.2114                               | 6352.73                  |
| Mauritius 2007     | 5,553,030,537      | 5.5530                         | 0.0%                     | 0.0003                                | 3711.90                  |
| South Africa 2007  | 179,764,640,952    | 179.7646                       | 6.8%                     | 12.2127                               | 3557.43                  |
| Botswana 2007      | 8,524,752,847      | 8.5248                         | 41.9%                    | 3.5721                                | 3319.45                  |
| Namibia 2006       | 4,654,352,787      | 4.6544                         | 11.7%                    | 0.5468                                | 2174.50                  |
| Swaziland 2005     | 1,332,112,445      | 1.3321                         | 0.3%                     | 0.0036                                | 1533.29                  |
| Algeria 2003       | 83,983,136,911     | 83.9831                        | 36.5%                    | 30.6867                               | 1460.58                  |
| Morocco 2006       | 47,750,116,186     | 47.7501                        | 1.8%                     | 0.8525                                | 1334.77                  |
| Egypt 2006 2006    | 84,023,270,788     | 84.0233                        | 14.6%                    | 12.2909                               | 992.68                   |
| Cameroon 2006      | 17,149,937,581     | 17.1499                        | 10.3%                    | 1.7654                                | 661.28                   |
| Lesotho 2006       | 1,078,454,447      | 1.0785                         | 5.9%                     | 0.0635                                | 609.03                   |
| Djibouti 1998      | 501,514,171        | 0.5015                         | 0.2%                     | 0.0009                                | 584.54                   |
| Zambia 2007        | 5,678,582,284      | 5.6786                         | 4.7%                     | 0.2694                                | 573.30                   |
| Nigeria 2005       | 70,988,176,884     | 70.9882                        | 38.1%                    | 27.0817                               | 499.66                   |
| Senegal 2006       | 10,779,651,489     | 10.7797                        | 0.8%                     | 0.0852                                | 487.37                   |
| Côte d'Ivoire 2000 | 15,155,787,565     | 15.1558                        | 0.3%                     | 0.0419                                | 448.57                   |
| Kenya 2006         | 16,855,120,921     | 16.8551                        | 0.5%                     | 0.0829                                | 402.77                   |
| Ghana 2006         | 12,912,874,110     | 12.9129                        | 5.1%                     | 0.6585                                | 361.24                   |
| Mali 2006          | 5,367,720,454      | 5.3677                         | 7.5%                     | 0.4030                                | 343.55                   |
| Burkina Faso 2007  | 8,018,943,962      | 8.0189                         | 0.7%                     | 0.0558                                | 296.13                   |
| Gambia 1994        | 376,177,697        | 0.3762                         | 0.0%                     | 0.0001                                | 293.87                   |
| Chad 2007          | 4,514,151,416      | 4.5142                         | 41.5%                    | 1.8727                                | 246.46                   |
| Madagascar 2007    | 4,569,632,254      | 4.5696                         | 0.1%                     | 0.0063                                | 233.86                   |
| Tanzania 2007      | 10,288,255,517     | 10.2883                        | 3.5%                     | 0.3649                                | 229.89                   |
| Guinea 2006        | 4,979,944,421      | 4.9799                         | 17.5%                    | 0.8730                                | 228.95                   |
| Uganda 2006        | 10,026,614,649     | 10.0266                        | 0.8%                     | 0.0805                                | 216.53                   |
| Guinea-Bissau 1991 | 240,406,414        | 0.2404                         | 8.5%                     | 0.0204                                | 199.76                   |
| Mozambique 2007    | 8,246,823,514      | 8.2468                         | 0.0%                     | 0.0001                                | 196.17                   |
| Niger 2007         | 4,216,127,847      | 4.2161                         | 2.7%                     | 0.1117                                | 183.65                   |
| Sierra Leone 2006  | 843,160,043        | 0.8432                         | 4.1%                     | 0.0348                                | 182.36                   |
| Rwanda 2002        | 3,085,516,062      | 3.0855                         | 0.5%                     | 0.0152                                | 146.99                   |
| Ethiopia 2007      | 23,278,706,057     | 23.2787                        | 0.4%                     | 0.1027                                | 126.40                   |
| Zimbabwe 2005      | 7,487,919,159      | 7.4879                         | 16.9%                    | 1.2678                                | 105.86                   |
| Malawi 2005        | 3,597,885,999      | 3.5979                         | 2.0%                     | 0.0721                                | 103.10                   |

Table 4

Source: United Nations

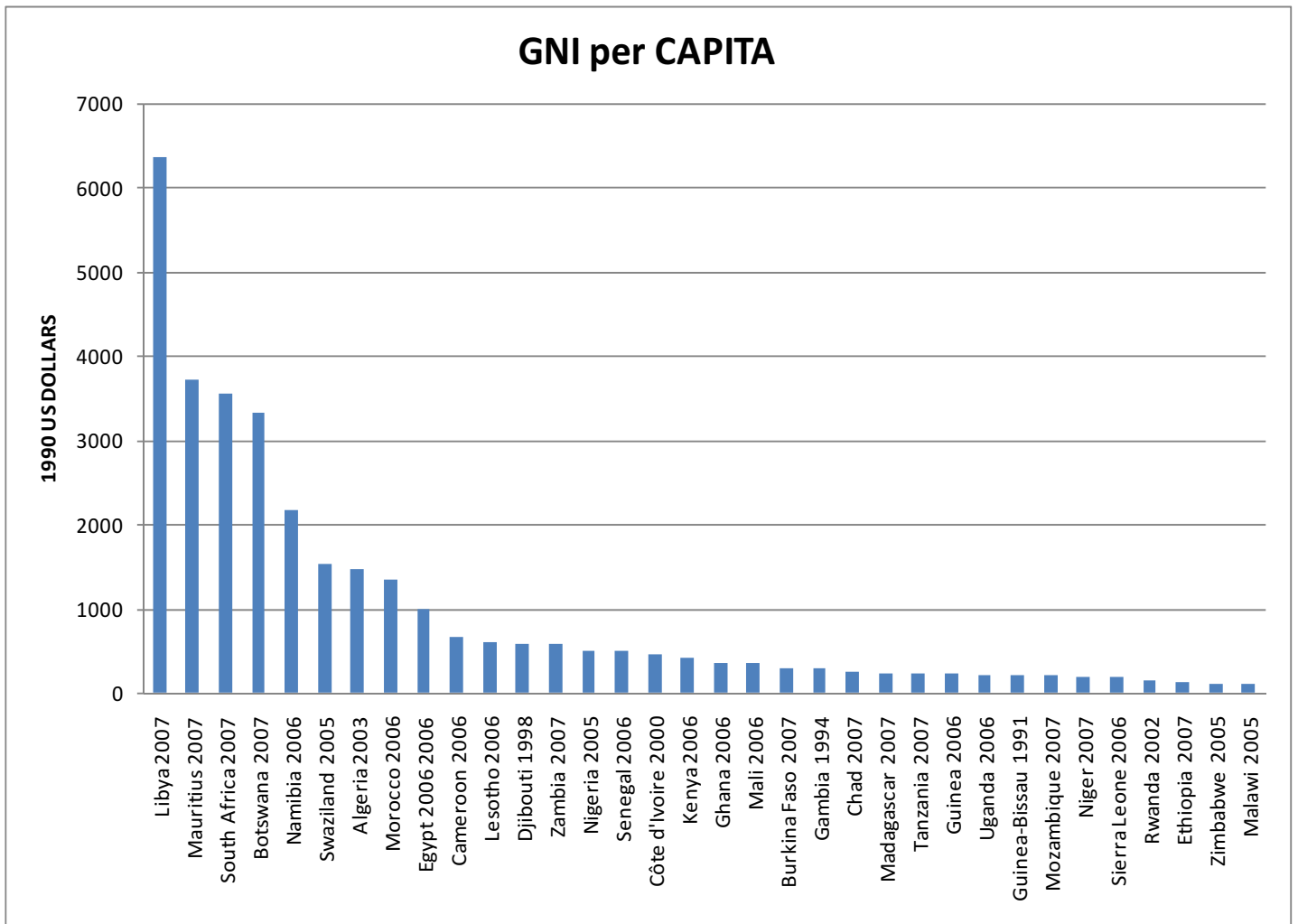


Figure 4

Source: Table 4

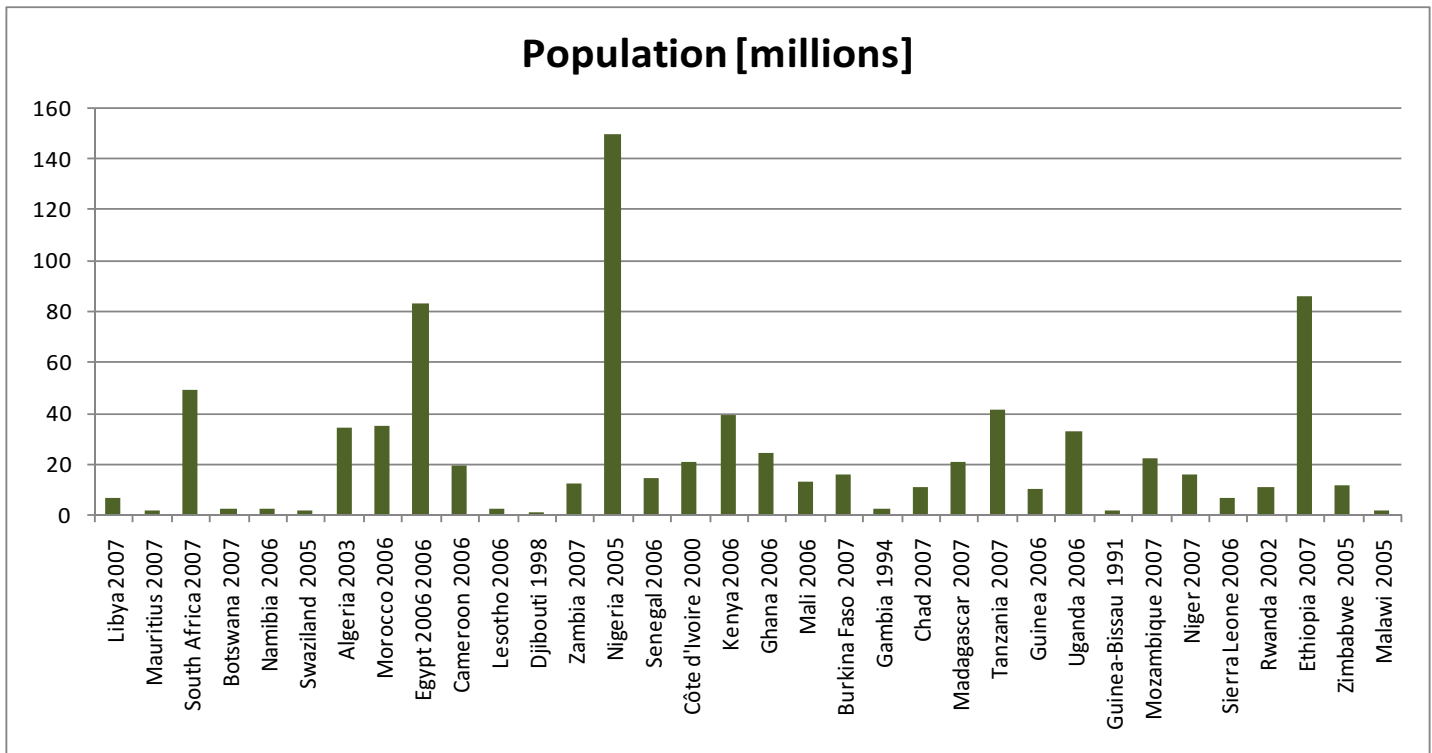


Figure 4B

Source: CIA 2009

#### 6. GNI and GDP

If we apply the percentage of GDP contributed by the mining industry in each country (Column 1 in Table 5: to the National GNI, we arrive at an approximation of the GNI attributable to the mining industry (Column 4 in Table 5).

This approximation is necessary because the United Nation's data does not break GNI into sector contributions

This data indicates that, of the countries included in this review, the populace of Libya, and Botswana appear to benefit from their mining industries more than do the others.

The last column in Table 5 inflates the 1990 US Dollars to 2008 values, using Cost Price Indices published on the United States Department of Labour website.

|                    | 1     | 2                              | 3               | 4    | US Cost Price Index      |                                       |                          |                            |      |       |
|--------------------|-------|--------------------------------|-----------------|------|--------------------------|---------------------------------------|--------------------------|----------------------------|------|-------|
|                    |       |                                |                 |      | Mining as percent of GDP | Value added by Mining Industry to GDP | GNI per Capita per annum | GNI attributable to mining | 1990 | 130.7 |
|                    |       |                                |                 |      |                          |                                       |                          |                            | 2008 | 215.3 |
|                    |       | \$ Billions (10 <sup>9</sup> ) | 1990 US dollars |      | 2008 US Dollars          |                                       |                          |                            |      |       |
| Libya 2007         | 74.3% | 38.2114                        | 6353            | 4719 | 7773.02                  |                                       |                          |                            |      |       |
| Botswana 2007      | 41.9% | 3.5721                         | 3319            | 1391 | 2291.25                  |                                       |                          |                            |      |       |
| Algeria 2003       | 36.5% | 30.6867                        | 1461            | 534  | 879.13                   |                                       |                          |                            |      |       |
| Namibia 2006       | 11.7% | 0.5468                         | 2174            | 255  | 420.80                   |                                       |                          |                            |      |       |
| South Africa 2007  | 6.8%  | 12.2127                        | 3557            | 242  | 398.12                   |                                       |                          |                            |      |       |
| Nigeria 2005       | 38.1% | 27.0817                        | 500             | 191  | 314.01                   |                                       |                          |                            |      |       |
| Egypt 2006 2006    | 14.6% | 12.2909                        | 993             | 145  | 239.20                   |                                       |                          |                            |      |       |
| Chad 2007          | 41.5% | 1.8727                         | 246             | 102  | 168.42                   |                                       |                          |                            |      |       |
| Cameroon 2006      | 10.3% | 1.7654                         | 661             | 68   | 112.13                   |                                       |                          |                            |      |       |
| Guinea 2006        | 17.5% | 0.8730                         | 229             | 40   | 66.11                    |                                       |                          |                            |      |       |
| Lesotho 2006       | 5.9%  | 0.0635                         | 609             | 36   | 59.11                    |                                       |                          |                            |      |       |
| Zambia 2007        | 4.7%  | 0.2694                         | 573             | 27   | 44.81                    |                                       |                          |                            |      |       |
| Mali 2006          | 7.5%  | 0.4030                         | 344             | 26   | 42.49                    |                                       |                          |                            |      |       |
| Morocco 2006       | 1.8%  | 0.8525                         | 1335            | 24   | 39.26                    |                                       |                          |                            |      |       |
| Ghana 2006         | 5.1%  | 0.6585                         | 361             | 18   | 30.34                    |                                       |                          |                            |      |       |
| Zimbabwe 2005      | 16.9% | 1.2678                         | 106             | 18   | 29.52                    |                                       |                          |                            |      |       |
| Guinea-Bissau 1991 | 8.5%  | 0.0204                         | 200             | 17   | 27.93                    |                                       |                          |                            |      |       |
| Tanzania 2007      | 3.5%  | 0.3649                         | 230             | 8    | 13.43                    |                                       |                          |                            |      |       |
| Sierra Leone 2006  | 4.1%  | 0.0348                         | 182             | 8    | 12.39                    |                                       |                          |                            |      |       |
| Niger 2007         | 2.7%  | 0.1117                         | 184             | 5    | 8.02                     |                                       |                          |                            |      |       |
| Swaziland 2005     | 0.3%  | 0.0036                         | 1533            | 4    | 6.87                     |                                       |                          |                            |      |       |
| Senegal 2006       | 0.8%  | 0.0852                         | 487             | 4    | 6.34                     |                                       |                          |                            |      |       |
| Malawi 2005        | 2.0%  | 0.0721                         | 103             | 2    | 3.40                     |                                       |                          |                            |      |       |
| Burkina Faso 2007  | 0.7%  | 0.0558                         | 296             | 2    | 3.40                     |                                       |                          |                            |      |       |
| Kenya 2006         | 0.5%  | 0.0829                         | 403             | 2    | 3.26                     |                                       |                          |                            |      |       |
| Uganda 2006        | 0.8%  | 0.0805                         | 217             | 2    | 2.86                     |                                       |                          |                            |      |       |
| Côte d'Ivoire 2000 | 0.3%  | 0.0419                         | 449             | 1    | 2.04                     |                                       |                          |                            |      |       |
| Djibouti 1998      | 0.2%  | 0.0009                         | 585             | 1    | 1.75                     |                                       |                          |                            |      |       |
| Rwanda 2002        | 0.5%  | 0.0152                         | 147             | 1    | 1.19                     |                                       |                          |                            |      |       |
| Ethiopia 2007      | 0.4%  | 0.1027                         | 126             | 1    | 0.92                     |                                       |                          |                            |      |       |
| Madagascar 2007    | 0.1%  | 0.0063                         | 234             | 0    | 0.53                     |                                       |                          |                            |      |       |
| Mauritius 2007     | 0.0%  | 0.0003                         | 3712            | 0    | 0.28                     |                                       |                          |                            |      |       |
| Gambia 1994        | 0.0%  | 0.0001                         | 294             | 0    | 0.11                     |                                       |                          |                            |      |       |
| Mozambique 2007    | 0.0%  | 0.0001                         | 196             | 0    | 0.00                     |                                       |                          |                            |      |       |

Table 5

Source: United Nations and US Department of Labour

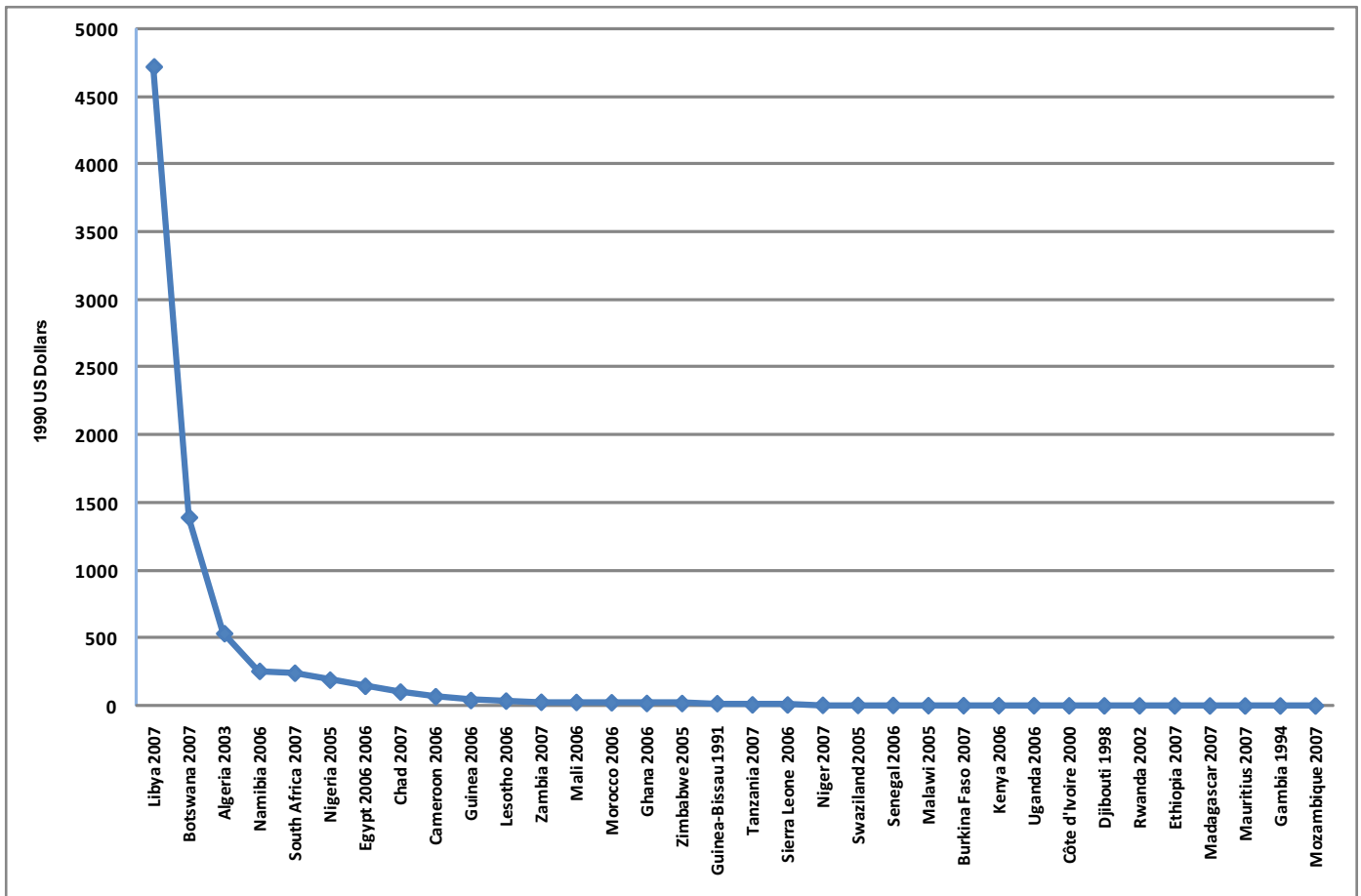


Figure 5

Source: Table 5

## 7. Exports

The next important topic we must discuss is mineral exports.

Production and export of raw mineral ore is not a process that occurs in isolation. It requires input from many other sectors of the economy. By providing goods and services to the mining industry these other sectors themselves generate value and contribute to GDP. The instruments used by the SNA to quantify this interaction are the Supply and Usage Tables and the Input-Output Tables. We will not discuss the instruments in this paper, but details are available on the United Nations' website. Mineral export data is a vital statistic, because exported raw minerals are forever lost to an economy, and any value they may add will only last as long as do the minerals.

Exports are a final demand. This means the export sector does not add value to the input it receives; it simply passes on the good or service in an unchanged condition. It is easy enough to understand, that if they are products of an economy's secondary value adding industries, exports do directly contribute value to an economy. It is less easy to understand the contribution of exported raw minerals, as these do not enter the value adding process in the secondary industries. Their contribution to GDP is indirect. It is precisely because of this conundrum that it is vital to measure the interaction between mining, a prime industry, and value adding secondary industries.

The uncontrolled depletion of mineral endowments, especially through illicit mining and smuggling, is a huge problem in Africa.

## 8. Conclusions

Of particular concern must be the observation that, of fifty-six countries in Africa recognised by the United Nations, only thirty-four have data relating to their mining industries available on the UN website, and not all of this is current. Of these, the most notable absentee is perhaps the Democratic Republic of the Congo, a country with vast mineral endowments attracting increasing interest from international mining companies, but also beset with illegal mining and smuggling of its mineral wealth.

We have, from the available data, derived the annual Gross National Income attributable to the mining industries in thirty-four African countries, and expressed these in constant 1990 US dollar terms. They range from a high of \$4719 to a low of zero, with a mean of \$232. We can apply the US Consumer Prices Indices for 1990 and 2008 [United States 2008], and express this data in 2008 US Dollar terms, i.e., a high of \$7773, a low of zero and a mean of \$382. When divided by 365, the corresponding maximum, low and mean daily GNI is \$21.30, zero, and \$1.64.

Development of a sustainable economy, based on mineral endowments, requires a system of National Accounts. As noted in paragraph 4, such a system requires extensive data collection and processing facilities, which many African countries do not possess. The United Nations is able to assist these countries in the processing of data, but not in its collection, and this remains the responsibility of the individuals.

If Africa is ever to benefit from its mineral endowments, it is essential, as a start, to measure and control:

- The depletion of its mineral resources,
- The benefits flowing into the economy from this depletion,
- The degree to which economies use these benefits to create sustainable industries.
- Illicit mining and smuggling .

“There is common cause that national statistical systems in Africa still present profound weaknesses, including political support; inadequate legal and institutional framework for statistical activities; a lack of coordination and weak management.....If you cannot measure it, you cannot manage it”. (Manuel, 2006)



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