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SUSTAINABLE DEVELOPMENT IN MINERAL ECONOMIES: THE EXAMPLE OF BOTSWANA

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1. Introduction

A society's national income and economic well-being depend on its wealth—produced assets, natural capital, and human capital. A widely accepted concept of economic sustainability requires that national wealth is non-decreasing over time (e.g., Hartwick, 1977; Pearce et al., 1989; Solow, 1974, 1986). Although natural capital is a large component of wealth, it has not yet been included in the national economic accounts of most countries, even though the 1993 revision of the System of National Accounts (SNA) recommends this (UN, 1993a).[1] In the case of minerals, a non-renewable resource, exploitation inevitably results in depletion of those assets. By omitting mineral depletion, the national accounts provide a distorted picture of a country's economic health: the accounts record mineral exploitation as a contribution to GDP and income, but do not record the simultaneous loss of wealth due to depletion. Environmental accounts, properly constructed, correct this omission by estimating the economic value of the mineral assets and the cost of depleting minerals, thus providing a more accurate assessment of economic performance and sustainable development (United Nations, 1993b, 2001).

Sustainable development requires that depletion of mineral assets be offset by a compensating increase in other forms of capital. The transformation of mineral assets into other forms of capital raises two related issues: what share of the resource rent generated by mineral extraction should be reinvested to offset depletion, and are the alternative investments as productive as the mineral assets they replace? In most countries, the government is the owner of sub-soil assets. As the owner, government has the right, just like any other owner, to be paid for this resource, but it also bears the responsibility for reinvesting some portion of the revenues in other assets.

Governments are frequently under considerable pressure to spend mineral revenues on current consumption rather than to reinvest revenues. This is particularly the case in developing countries, where many basic needs remain unmet, and rent-seeking behaviour by individuals and interest groups may be especially difficult to resist. As a result, mineral wealth can detract from, rather than enhance, economic performance. Researchers have found that, as a group, resource-rich developing countries have performed worse, economically, than resource-poor developing countries over the past 30 years[2], a phenomenon known as the "resource curse" (Auty and Mikesell, 1998; Sachs and Warner, 1995).

One way to manage this political pressure to consume resource rent is through credible commitment to formal guidelines for reinvestment of rent. Some theoretical guidance regarding the share of resource rent that

[1] Human capital has also been omitted, but there is no agreement yet about how to measure human capital.
[2] While this may also be true in industrialized countries, the dependence of these economies on non-renewable resources is often much lower than in the developing countries under consideration, hence, the management of this wealth is less critical.

must be reinvested has been provided in the literature (e.g., Hartwick, 1977; El Serafy, 1989). In each of these approaches, the policy objective has been to maintain assets at their current level for all time. These rules, if implemented, would provide a significant improvement over past practice in many resource-rich countries. However, these rules are not sufficient for economic development in relatively poor developing countries because they do not take into account the need to increase national wealth in order to improve material standards of living. Pezzey (1992; 2002) recognised this when he proposed that the definition of sustainability impose a minimum 'suvivability' level of consumption.

Appropriate indicators of sustainability for resource-rich countries are based on aggregate measures of wealth and changes in wealth (e.g., Dasgupta and Maler, 2000; Heal and Kristrom, 2001). However, these rules alone are not sufficient for monitoring sustainable development, for at least two reasons. First, two major forms of capital are often omitted: human capital and net foreign financial assets. The problems measuring the former have already been mentioned. The latter can be easily included. In small countries with limited domestic opportunities for investment in manufactured capital, government foreign financial assets may constitute a particularly important and productive component of the asset portfolio. A more useful definition of wealth would include both financial and non-financial assets. Hamilton (2000) provides an indicator, Genuine Savings, which tries to take both of these into account. But this indicator measures year-to-year change in wealth rather than wealth itself, and it is not clear how to assess trends that show positive savings in some years and negative savings in other years. More importantly, it is not adjusted for changes in per capita wealth, as Dasgupta and Maler have pointed out.

The second, and more fundamental, problem concerns implementation of this measure of sustainability: national wealth includes both private and public sector capital, yet public sector capital is subject to serious problems both in definition and measurement. As currently measured in the national accounts, the cost of public investment is taken to be a reasonable measure of the productive additions to the stock of capital, an assumption that is very difficult to sustain (Pritchett, 1997, 2000). No distinction is made between truly productive investments in infrastructure and investments of low productive value, which amount to little more than personal monuments. In addition, with the large role played by public sector investment, the marginal productivity is likely to decline over time, even for well chosen investments.

It is also true that the cost of public infrastructure may underestimate its true economic value because there can be positive externalities to infrastructure and human capital investments. But this can easily be exaggerated and will also decline as the range of public investments is extended outside the provision of core

public goods; public investment may even crowd out rather than complement private investments (Isham and Kuffman, 1999). With much of mineral revenues going into public sector capital, it is not clear that the new investment is as productive as the natural capital that it replaces when public sector capital is valued at the cost of the investment.

In a major report on development and public infrastructure, the World Bank (1994) pointed out that quality of infrastructure, as well as the quantity, are important. Good infrastructure raises productivity and lowers production costs, which can reduce poverty and increase international competitiveness. However, the report also noted that the economic benefits of infrastructure investments have often been reduced by insufficient attention to costs and benefits in project choice, low operating efficiency, inadequate maintenance, and lack of attention to the needs of users.

These issues suggest that in addressing the issue of sustainability from an empirical standpoint, it is necessary to go beyond aggregate indicators and to examine the *process* by which mineral revenues are transformed into other forms of capital. Given the enormous revenues that accrue to governments and their role in reinvestment, it is particularly important to assess public sector capital. Botswana has been chosen as a case study for this paper, and is a particularly relevant example for two reasons. First, natural capital is especially important in Botswana: minerals, mainly diamonds, form the largest single component of its national wealth, and account for one-third of GDP, half of government revenue, and most of its exports. Second, the government of Botswana has been a notable exception to the dismal economic performance of resource-rich developing countries. In the 25 years since the mid-1970s real per capita income growth has averaged 5.4% per annum. Poverty, while still high, has been on a significantly downward trend (Jefferis, 1997).

Botswana has consistently reinvested most of its mineral revenues in accordance with criteria explicitly aimed at sustainability and the enhancement of the stock of physical and human capital, and overall policy is set in a long-term framework, guided by a series of six-year National Development Plans (NDPs) and, more recently the objectives of *Vision 2016* (Presidential Task Group, 1996 and 1997)[3]. As such, Botswana is widely considered to be an excellent example of resource management with future generations in mind. For example, in early 2001 the country was given investor grade sovereign credit ratings higher than any other African country and which compare favourably on a worldwide basis. As a result of prudent management, the country has accumulated a substantial portfolio of international financial assets, valued at $6.3 billion, or approximately 130 percent of GDP, at the end of 2000. At the same time, however, the central role that government has played in developing the economy brings to the fore the issues of investment productivity, and whether this is adequately addressed by the existing policy framework (Wright 1995, 1997a).

This ability to transform one form of wealth, non-renewable mineral wealth, into other forms of productive wealth is the key to successful economic development of resource-rich economies. This paper investigates the process of wealth transformation for Botswana, one of the most successful resource-rich countries. The organisation is as follows. Section 2 discusses the methodology and data used for this study. This section describes the environmental accounts which were recently constructed for Botswana to assess the value of its mineral assets, and reviews policy guidelines for the share of resource rent that should be reinvested, including the one which Botswana has established for itself, the Sustainable Budget Index (SBI). Section 3 reviews Botswana's economic sustainability over the past 20 years with respect to the capital maintenance rule, using an expanded definition of wealth that includes mineral assets and net foreign financial assets. The changing level and composition of Botswana's national wealth is assessed to determine whether depletion of mineral assets has been compensated for by increases in other assets.

This is followed by an analysis of the process by which mineral revenues have been transformed by government into other forms of wealth. The productivity of different categories of public investment is evaluated and the SBI is adjusted for non-productive capital expenditures. This assessment is intended not only to improve the indicator of sustainability, but also to provide more detailed information to improve the allocation of revenues from minerals among different types of public sector investment. Concluding remarks about management of mineral revenues are provided in the final section.

[3] The Vision was prepared by a Presidential Task Force with inputs from all segments of society. It is a bold, long-term view of how Botswana should be in the year 2016. As mineral revenues are the major source of economic development, the Vision's goals indicate how mineral revenues should be spent. The vision aims at a society that is educated and informed; prosperous, productive and innovative; safe and secure; open, democratic and accountable; moral and tolerant; and united and proud.

2. Methodology and Data Sources

This section begins with a brief discussion of wealth as an indicator of sustainability. It then discusses the methodology to value mineral assets and the data sources. The third section reviews conceptual guidelines for achieving non-declining wealth through the exploitation of non-renewable resources, that is, guidelines for reinvestment of mineral rents to offset resource depletion.

2.1 Wealth and sustainability

The Brundtland Commission Report (WCED, 1987) provided a definition of sustainability that has had much popular appeal, but is not very precise in terms of economic theory. In an exhaustive, critical review of definitions of sustainability, Pezzey (1992, 2002) identified the one which has come to be most often used by economists: economic development is sustainable if well-being per capita does not decline at any point over time.

Solow (1974, 1986) and Hartwick (1977) derived the conditions necessary for economic sustainability in an economy dependent on a non-renewable resource, like minerals. The Solow-Hartwick rule requires non-declining total wealth, to be achieved by reinvesting all the rents from the non-renewable resource in other forms of capital (assuming that resources are priced efficiently). The relationship between sustainable well-being and constant wealth was further elaborated by Pearce and Atkinson (1993), and formalised by, among others, Hamilton and Clemmens (1999) and Dasgupta and Maler (2000).

Drawing on Hamilton and Clemmens, a simplified version of this formalisation states that, for a closed economy producing a composite good that can be consumed, or invested in either produced capital or human capital, $F(S_P, Q, S_H) = C + DS_P + m$, where S_i are stocks of produced (S_P), natural (S_N) and human capital (S_H), Q is use of a non-renewable resource, C is consumption, m is investment in human capital, the change in the stock of human capital is a function of investment, $DS_H = q(m)$, and the depletion of natural capital is equal to extraction, $\Delta S_N = -Q$; and where well-being, V, is defined as the discounted sum of all future utility,

$V = \sum_{t=t}^{\infty} \frac{U(C)}{(1+d)^{t-t}}$, then, any change in well-being is proportional to the change in the value of assets: $\Delta V = U_c \cdot \sum p_i \Delta S_i$ (1)

Where U_c is the marginal utility of consumption, p_i are the shadow prices of produced, natural and human capital, respectively. It is relatively straightforward to expand this model for renewable resources, pollution and environmental degradation, and population growth, as well as for other specifications of the utility functions, including for example utility derived from environmental quality (Dasgupta and Maler, 2000) From equation 1, the rule for sustainability can be expressed, adjusted for population growth, as:

$$\frac{K_{t+1}}{P_{t+1}} \geq \frac{K_t}{P_t} \qquad (2)$$

where P is population and K is the value of total wealth the sum of the products of the stocks of assets and their shadow process $K = \sum K_i = \sum p_i S_i$. For an open economic, such as Botswana, the concept of wealth is expanded to take into account the importance of holdings of net foreign financial assets, so K is defined to include K_F, net foreign financial assets as well as produced, natural, and human capital,

$$K = \sum (K_P + K_N + K_H + K_F) \quad (3)$$

Weak sustainability has been criticised for a number of reasons (see, e.g., Perrings and Common, 1997; Victor, 1991), most importantly, the assumption of perfect substitution possibilities between natural capital and other forms of capital in production and consumption. Where natural capital provides 'critical' goods or services that cannot be completely replaced, non-declining wealth alone may not provide a sufficient measure of sustainability. However, in the case of Botswana, the natural capital considered here consists of gem-quality diamonds, which is not critical capital, so the weak sustainability rule can be used.

This rule of non-declining per capita wealth is appropriate for relatively wealthy industrialised countries that have already achieved high material standards of living and do not depend on resources to make substantial improvements in living standards. It is also useful for countries that have not paid much attention to sustainability in the past, such as Saudi Arabia or Nigeria because it indicates the *minimum* amount that should be reinvested. This rule does not take into account the situation of many developing countries, which aspire to much higher standards of living. To meet these aspirations, non-declining capita is an inadequate guide to policy; they must increase their per capita wealth in order to increase standards of living.

In using equations 2 and 3 to monitor sustainability over time, it is essential that all assets be included. Human capital is not readily measurable at this time; however, there are measures for the other three components of wealth: manufactured capital is recorded in the national accounts, net foreign financial assets are

measured and reported by the central bank, and, with the recently implementation of environmental accounts in Botswana, a measure of natural capital has now become available.

2.2 Measuring the value of natural capital

Methodology

The measure of produced capital, its increase through investment, and decrease through depreciation are reported in the asset accounts of the national income accounts and enter into a wide range of economic analyses. Environmental accounting, described in the System of Environmental and Economic Accounts (UN, 1993, 2001) has provided a way to measure the value of natural capital and monetary accounts for sub-soil assets have been compiled for Botswana's Central Statistics Office based on this methodology. (For a more detailed description of methodology and sources, see (Lange, 2001)).

The environmental accounts do not, at this time, include a measure of the value of three other important assets: land, wildlife and water. Based on asset valuation in other countries, land is likely to be the most valuable of the three resources. The value of land is difficult to measure because only 3% is freehold land, for which market prices might be available. The remaining land is either government-owned (42%) or held in communal tenure (55%) (CSO, 2000). The omission of land is unlikely to bias time trends of national wealth because the physical amount does not change, and it has not been seriously degraded. If anything, the value of land around urban areas has increased somewhat, but these changes are expected to be minor compared to other changes in national wealth.

Wildlife is difficult to value because of a lack of market prices and poor data on physical stocks. Water is similarly difficult to measure because of the lack of market prices, and the lack of comprehensive information about water reserves. Fragmentary evidence suggests some depletion of wildlife and water has occurred, but the effects are expected to be small relative to changes in the other components of national wealth. Despite these omissions, the trends in national wealth are not expected to be biased, and the calculation of mineral wealth should be seen as a major step forward toward a more comprehensive measure of national wealth.

The value of minerals is the present discounted value of the stream of income (rent) they are expected to generate in the future. The income, or resource rent, R, is calculated as the value of production or total revenue (TR), minus the marginal exploitation costs, which include intermediate consumption (IC), compensation of employees (CE), consumption of fixed capital (CFC), and the opportunity cost of capital

invested in mining, of 'normal profit' (*NP*), where normal profit is the product of produced capital (*K*) and its rate of return (*i*):

$$R_t = TR_t - IC_t - CE_t - CFC_t - NP_t \quad (4)$$

$$NP_t = iK_{P,t} \quad (5)$$

In actual implementation countries have used average cost rather than marginal cost because data about marginal costs are not generally available. This approach is also recommended in the SEEA.

With the exception of the opportunity cost of capital, i, all data are obtained from the national accounts. A range of different rates of return have been used by the Ministry of Finance and Development Planning (MFDP) in its economic evaluations, with 6% used as the benchmark and higher rates used for more risky projects (Salkin, pers.comm.). Since mining is a commercial undertaking, requiring commercial returns, a somewhat higher rate, 10%, was used. In the full report on the mineral accounts (Lange, 2001), a sensitivity analysis was performed using a 20% return to capital.

Having calculated the value of rent in a given year, the formula for calculating the value of mineral assets is:

$$K_{N,0} = \sum_{t=0}^{T} \frac{p_{N,t} Q_t}{(1+r)^t} \quad (6)$$

$$p_{N,t} = \frac{R_t}{Q_t} \quad (7)$$

$$T_t = \frac{S_{N,t}}{Q_t} \quad (8)$$

where *R* is total rent generated by the resource, *T* is the remaining lifespan of the resource, and other variables are defined as above.

For calculating the value of mineral assets in a given year, valuation should be based on expected future extraction paths, production costs, and market prices. However, in most instances this information is lacking so it is simply assumed that both the future volume of extraction and the per unit rent remain constant over time, although, as will be seen, both have fluctuated over time. A social discount rate of 10% is used, based on MFDP guidelines. Because mineral prices can fluctuate a great deal from one year to the next, a 5-year moving average price (the per unit rent) was used in the calculations of the value of mineral assets in order to

reduce volatility and better represent the longer-term value. Constant value mineral assets were calculated using the unit rent for a given year, in this case, 1993[4].

Data for Botswana Mineral Accounts

Botswana's primary mineral is diamonds, accounting for 94% of mining value added in recent years (CSO, annual). Copper/nickel (mined jointly) and coal are also economically important, and are included in the mineral accounts. Other minerals have not been included at this time because they were not economically important when the environmental accounting programme began; they may be included in future work.[5]

For the physical accounts, information about extraction of diamonds is publicly available from the Annual Reports of the Department of Mines (Department of Mines, various years). In the past, information about the reserves of diamonds was a closely guarded secret, making it impossible to publish complete accounts for diamonds. However, in its 1999 Annual Report, De Beers, the government's joint partner in Debswana, which operates the diamond mines[6], adopted a new policy of openness and transparency, and published the estimated reserves at the end of 1999 for each of its mines throughout the world.

Diamond reserves have not been reported for earlier years, so reserves prior to 1999 were calculated by adding back annual extraction. Consequently, the accounts for the period 1980 to 1999 show only extraction, but not new discoveries and other volume changes. This is not a major concern because the discoveries currently being exploited were already identified by the late 1970s, although it took a number of years to bring these into production.

The physical accounts for copper/nickel were constructed from information published by the Department of Mines. Coal reserves, (obtained from CSO, 2000) have actually been measured for only two of Botswana's eleven coal fields and will last thousands of years at current rates of extraction. The quality of the coal is low, so it has not been economically feasible to export coal and it is only used domestically, mainly for power production.

[4] Botswana's Central Statistics Office uses a year that runs from June 1 to May 31. For simplicity, in the rest of this report, the year will refer to the first half of the CSO year; for example, the year 1993/94 will be called 1993.
[5] For example the extraction of soda ash and salt has been of increasing economic importance in recent years.
[6] In 2001 De Beers became De Beers Investments (DBI) when it was taken into private ownership by a consortium that included the Botswana government together with private sector investors. In itself this demonstrates both the importance of Botswana as a producer of diamonds and the confidence that the private sector has in the Botswana government.

2.3 Rules for reinvestment of rent from non-renewable resources

While sustainability in terms of the level of per capita assets can be assessed *ex post*, government needs a rule to guide its management of revenues from minerals. Hartwick defined the rule necessary for an economy relying on a non-renewable resource: the rent generated by the non-renewable resource must be reinvested in other forms of capital. This concept is known as Hartwick's Rule. Non-declining consumption follows from this rule only under very restrictive assumptions: that there is a high degree of substitutability between natural capital and physical capital, and that the resource is extracted efficiently over time. It further requires that all assets are properly valued to reflect their true productivity so that investment of rent in non-performing assets is not valued incorrectly.

El Serafy (1989) developed an alternative rule, analogous to a sinking fund, whereby two components of resource rent are distinguished: the amount of rent that needs to be reinvested in order to maintain a constant stream of income (capital component), and the residual which can be consumed as current income (income component). From a policy perspective, it should be noted that this method was developed for countries that had not paid much attention to economic sustainability, and that this represents the minimum amount that should be reinvested. It does not take into account population growth or objectives for improving standards of living.

In Botswana, fiscal policy is firmly based in a tradition of prudence and medium-term planning, developed at a time when subsistence under harsh and drought-prone conditions taught the value of effective use of limited resources and saving at times when surpluses occurred. This tradition has been carried over to subsequent years when, since the early 1970s, the successful development of large, low cost, diamond mines dramatically increased the flows of public revenues. Recognising that the revenues from diamonds represented mainly asset sales rather than value added in production, the government of Botswana saw clearly the need for reinvestment of these revenues in order to sustain development (see, for example, Ministry of Finance and Development Planning, 1991, p27).

Without a formal investment rule, the emphasis has been to reserve *all* mineral revenues for investment expenditure (Government of Botswana 1994). From the mid-1990s, a formal rule to this effect was introduced which is now routinely included in the various assessments of economic performance produced by the government (Ministry of Finance and Development Planning, 1994). This measure, which, following Salkin (1994), has been labelled by commentators the Sustainable Budget Index (SBI), is simply the ratio of non-investment spending to recurrent revenues.

$$SBI = \frac{Spending_{non-investment}}{Revenue_{recurrent}} \quad (9)$$

An SBI value of 1.0 or less has been interpreted to mean that current government consumption is sustainable because it is financed entirely out of revenues other than from minerals, and that all the revenue from minerals is used for public investment. An SBI value greater than 1.0 means that consumption relies in part on the mineral revenues, which is fiscally unsustainable.

To calculate the SBI, the government expands the definition of public sector investment so that it includes not only the capital budget (referred to in the public finance data as 'development expenditure'), but also a portion of the recurrent budget interpreted as investment in human capital. Government has assumed that 30 percent of the recurrent budget is investment in human capital. While this is a rule of thumb rather than derived from a detailed identification of specific expenditures, the 30 percent approximates the combined share of health and education in the recurrent budget over the past 20 years. Thus, non-investment spending in the SBI is equal to 70 percent of the recurrent budget.

Such a rule has the obvious advantage that it is clear and easy to understand. Moreover it is very similar to the budgetary rules of thumb that have been adopted by governments elsewhere[7]. On the other hand, as a policy rule, the SBI has an inherent problem. It is a rule that dictates an action to be taken—effectively, reinvesting all mineral revenue in public sector and human capital—but without any objective against which to assess the usefulness of the action. It provides no guidance for how much needs to be reinvested for future generations or used for current consumption, nor for the distribution of public assets among, e.g., infrastructure, human capital, or foreign financial investments. This is rather different from an objective-oriented policy rule, such as El Serafy's, which seeks to establish a permanent fund that will generate a constant stream of income.

This problem is exacerbated by several weaknesses identified in Wright (1995, 1997a, 1997b). An obvious problem is the assumption that all development spending is productive investment. Capital spending as defined in public finance statistics should not automatically be treated as '…an indication of the resources devoted to growth…' (IMF, 1986, p86), and the categorisation of spending used in Botswana may exacerbate this[8], issues discussed later in this paper. Also, there is no inter-temporal dimension to the SBI and, as such,

[7] For example, the self-styled 'Golden Rule' used by the UK government since 1997 is that recurrent spending should not be financed by borrowing. This, although in a different context, is essentially equivalent to the SBI.
[8] Funds used for drought relief programmes are often included in the development budget. Also included, contrary to IMF guidelines, is the capital component of military expenditure.

there are ways in which mineral revenues not invested immediately can subsequently be used to fund recurrent spending[9].

While it has been subject to extensive examination from both a practical and theoretical perspective, the precise theoretical derivation from principles of sustainability remains an issue. Wright (1997b) argues that the SBI is the optimal rule where a maximin approach to risk assessment is adopted, and that this is an appropriate strategy for a government concerned with safeguarding the interests of future generations. But outside this framework, the view that a rule that insists on reinvestment of 100 percent of asset sales is 'super-cautious' (Auty, 1996) gains credence.

While necessary, one consequence of moving away from the notion of sustainability as non-declining capital is that it introduces questions of inter-generational equity. By maintaining the overall capital stock as a mineral stock is depleted, all generations are treated equally, a neutrality that avoids raising potentially difficult questions. Just as a country may have the opportunity to use its resource endowment as a means to rapid development, so too could the circumstances of the current generation be improved by allowing a greater degree of consumption. Again this is seen very clearly in Botswana where there are persistent calls for the reserves of financial assets to be used now to alleviate poverty and raise standards of living more generally.

[9] One such mechanism is through the payments made by the central bank (the Bank of Botswana) to the government. These result principally from the investment of unspent mineral revenues, but are not limited to the real return on these investments.

3. Natural capital and total wealth in Botswana

This section reviews the level and composition of Botswana's wealth over the past 20 years. The wealth accounts are assessed to determine whether Botswana is using its mineral wealth in a manner that promotes sustainability, i.e., whether per capita wealth is non-decreasing, and whether depletion of mineral wealth is compensated for by an increase in other forms of wealth.

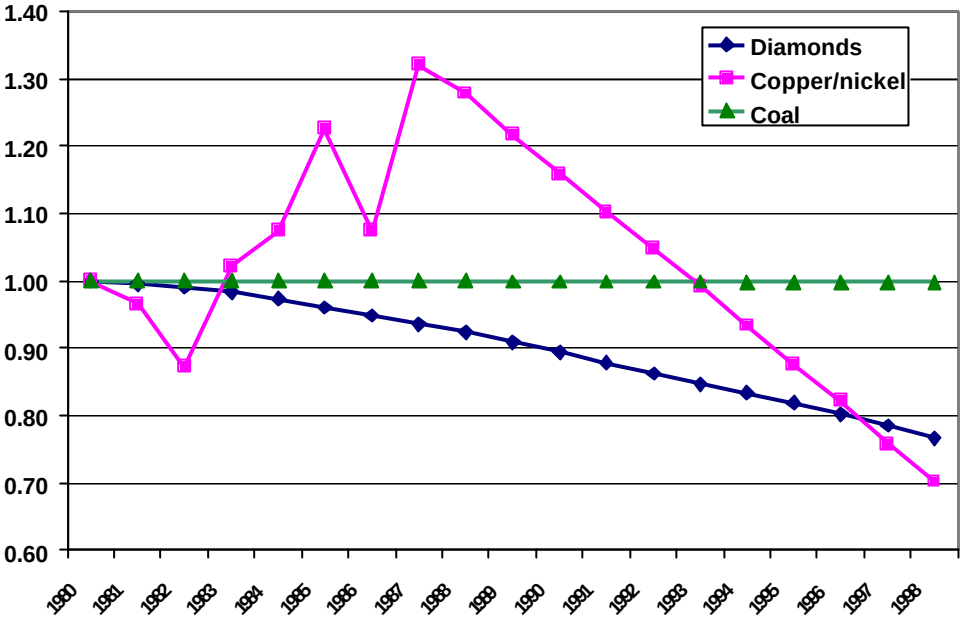
3.1 Physical and monetary accounts for minerals

The indices of physical mineral reserves are shown in Figure 1. (Detailed physical and monetary accounts are shown in the Appendix.) Over the past 20 years, less than 25% of known diamond reserves have been extracted. The extraction of copper/nickel has been offset, in the past, by new discoveries and reclassification of reserves, but by 1998, about 30% of copper/nickel reserves had been extracted. Less than 1% of the known coal reserves have been extracted. The quality of the coal is low, so it is not economically feasible to export coal and it is only used domestically, mainly for power production.[10]

The monetary accounts (Table 1) indicate that diamonds clearly constitute Botswana's main form of mineral wealth—in constant prices, diamonds accounted for at least 95% of the total. Despite the physical depletion, the value of total mineral wealth, in constant prices, has been increasing over time. This is due entirely to the increasing volume of extraction of diamonds over time. Since mineral wealth is calculated as the discounted value of future rents, an increase in extraction results in rents being received sooner and being discounted less, hence, a higher present value.

[10] Even the economic basis for this has been questioned, and since the mid 1990s the growing demand for electricity has been met through increased imports

Figure 1. Index of mineral reserves, 1980 to 1998
(1980 = 1.00)



Source: Based on Table A1

Table 1. Mineral wealth in constant 1993/1994 prices

	Diamonds	Copper-nickel	Coal	Total mineral wealth	Diamonds as % of total
1980/81	7,896	386	42	8,323	94.9%
1981/82	7,677	358	43	8,078	95.0%
1982/83	12,024	378	46	12,448	96.6%
1983/84	16,608	424	44	17,076	97.3%
1984/85	19,928	458	44	20,431	97.5%
1985/86	19,545	452	49	20,046	97.5%
1986/87	20,261	482	56	20,799	97.4%
1987/88	20,452	480	65	20,996	97.4%
1988/89	23,513	471	68	24,053	97.8%
1989/90	23,542	450	74	24,067	97.8%
1990/91	26,690	428	89	27,207	98.1%
1991/92	25,414	420	88	25,921	98.0%
1992/93	24,563	409	101	25,073	98.0%
1993/94	22,722	414	99	23,236	97.8%
1994/95	23,947	403	101	24,451	97.9%
1995/96	25,792	375	100	26,267	98.2%
1996/97	27,089	391	85	27,566	98.3%
1997/98	30,451	354	87	30,892	98.6%

Notes: Constant price values calculated using the unit rent for 1993/94. Value of Closing Stock reported.
Source: Based on figures in Lange 2001.

3.2 Total national wealth

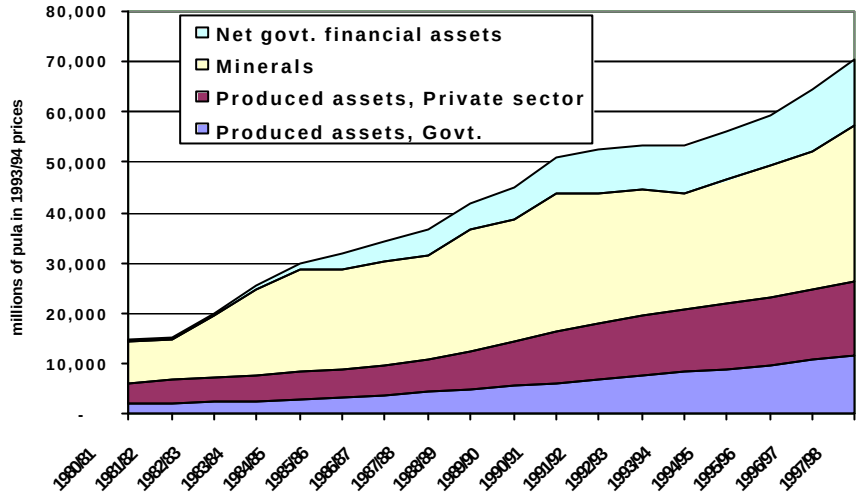
Figure 2 reports total national wealth: produced assets, mineral assets, and government's net foreign financial assets. Foreign financial assets are especially important in the wealth of a country like Botswana because limited domestic investment opportunities require that at least some of the revenue from minerals be invested overseas.

Manufactured capital can be further disaggregated into two components: private sector capital and public sector capital. Private sector capital consists of buildings, machinery and equipment used in production by private industry as well as residential dwellings. Government capital consists largely of infrastructure such as public buildings (schools, clinics, buildings for public administration) and major construction works such as roads, as well as the buildings machinery and equipment needed to operate government offices. This distinction is important because the private sector faces pressure, through competition among producers, to ensure that its investments are productive, and the assumption that the cost of capital approximates the value of capital is fairly reasonable. Government does not face competition in most of its activities and, hence, does not face the same pressure to ensure productivity of its investment spending. Government may accumulate a great deal of capital, but it may not be productive.

Over time, the combined value of all types of capital has increased from almost 15 billion pula in 1980 to over 70 billion in 1997, measured in constant 1993/94 prices. During this time, the composition of national wealth has changed, especially since the mid-1980s. As the share of mineral wealth declined from 57% to 44% between 1980 and 1997, net foreign financial assets increased from 2% to 19% (Figure 3). The share of produced capital declined slightly, from 42% to 38%. However, the share of private sector capital declined significantly, 29% to 22%, while the share of public capital grew, 13% to 16%. The depletion of mineral assets is being offset by investment in other assets, mainly financial assets and public sector investment. However, the economy is still dominated by mining, measured by mining's share of GDP and exports, and the declining share of private capital reflects slow progress in achieving government's objective of economic diversification.

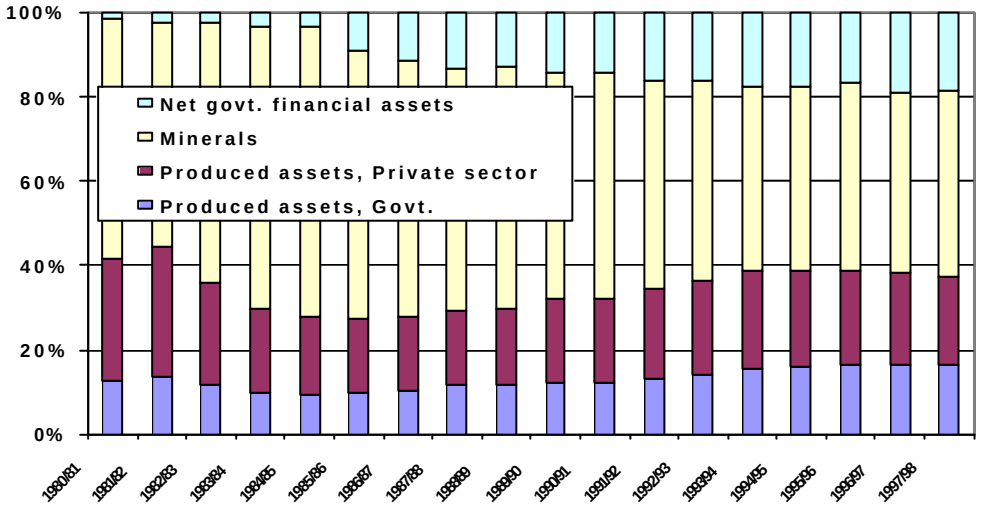
More important than the total value of capital stock is the *per capita* value of capital stock. Capital stock must grow at least as fast as population in order to maintain living standards, but to improve living standards, capital stock must grow more quickly. *Per capita* assets have been growing (Table 2), but more slowly than total assets reported in Figure 2. Per capita assets almost tripled between 1980 and 1997, increasing from about P16,000 to P46,000 in 1993/94 constant prices.

Figure 2. Value of assets by type of asset, 1980 to 1997 (constant 1993/94 prices)



Note: net government financial assets converted to constant prices using the GDP deflator.
Source: Based on Lange, 2000.

Figure 3. Shares of manufactured assets, mineral assets, and net foreign financial assets in Botswana, 1985 to 1997 (constant 1993-94 prices)



Source: Figure 1.

Table 2. Per capita assets in Botswana, 1980 to 1997

	pula per person in 1993/1994 prices
1980/81	16,184
1981/82	16,177
1982/83	20,536
1983/84	25,124
1984/85	28,368
1985/86	29,168
1986/87	30,255
1987/88	31,233
1988/89	34,576
1989/90	35,728
1990/91	39,068
1991/92	39,529
1992/93	39,134
1993/94	38,221
1994/95	39,436
1995/96	40,742
1996/97	43,131
1997/98	45,890

Source: Based on Lange, 2001.

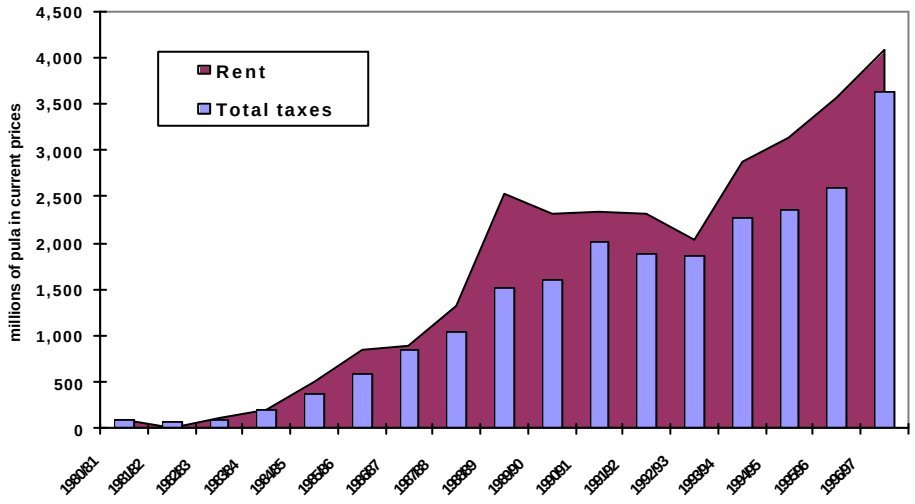
4. Transforming mineral wealth into other forms of capital

This section addresses the process of transforming mineral revenues into other forms of capital. First, the amount of rent generated by mining and the share recovered by the government is reported. Then the way government has used mineral rents is assessed in terms of the SBI. The investments made by government from mineral revenues are examined in detail and some adjustments are made to the measure of public sector investment so that it more accurately reflects the productivity of public sector investment. The SBI is also adjusted to reflect this more accurate assessment of productive investment.

4.1 Resource rent: recovery and re-investment by government

The previous section indicates that replacement of mineral wealth by other forms of wealth has, indeed, been occurring. Examination of the collection of resource rent by government and the use for investment provides a clearer picture of the process by which this has happened. Most countries, including Botswana, levy special taxes and royalties on minerals to capture resource rent. The government has, in fact, been successful in recovering the resource rent generated by mining in all years (Figure 4), with the recovery rate averaging 75% of rent. Because of the large role of diamond mining in the economy, the government is very dependent on revenues from diamonds. In many years, mineral revenues accounted for more than half of total government revenue.

Figure 4. Resource rent and taxes from mining in Botswana, 1980 to 1997

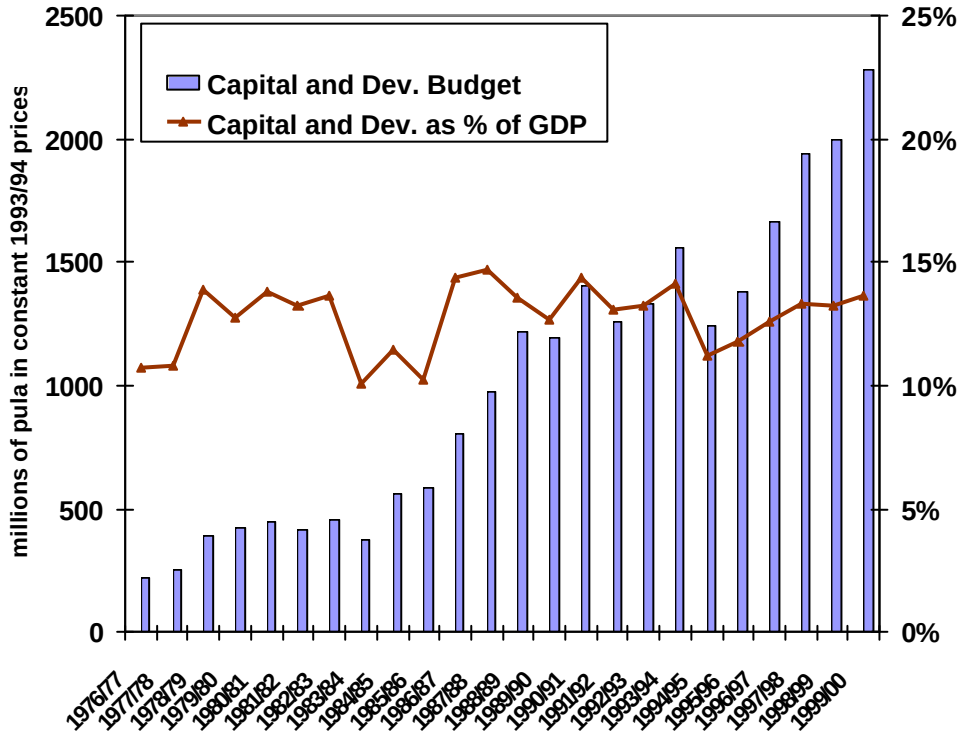


Note: Rent calculations assumed a 10% return to fixed capital.
Source: Based on Lange 2001.

Over most of the period, all mineral revenues have been reinvested in public capital. The capital and development budget, what is narrowly defined as public sector investment, constitutes a large share of both government budget and GDP, averaging 38% of the total government budget ad 13% of GDP over the past 25 years (Figure 5). The SBI, which includes the capital and development budget, as well as investment in human capital from the recurrent budget, has remained well under 1.00 until the 1990s (Figure 6). It first passed 1.00 in 1994, and has now been over 1.00 for 2000 and 2001.[11]

Human capital is an especially important component of public investment and the SBI. Figure 6 also shows the effect of adding recurrent expenditures for education and health to conventionally defined public sector investment. If they hadn't been included as part of investment but instead had been included as part of recurrent spending, the SBI would have averaged 1.07 from 1976 to 2001, which is over the sustainability rule.

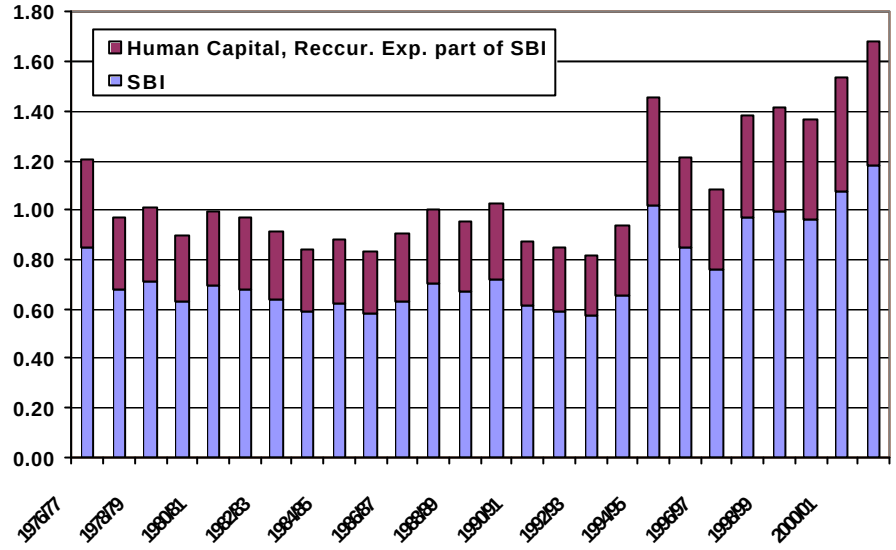
Figure 5. Public sector investment as share of GDP (in constant 1993/1994 prices)



Source: Authors' calculations based on CSO (various years) and Government of Botswana (various years).

[11] Note that the apparent rapid acceleration of the SBI above 1.00 in 2001 is likely to be misleading. The measure for this year is based on budgeted expenditure, which in practice has tended to overstate what is actually spent.

Figure 6. Sustainable Budget Index, 1976 to 2001



Notes: The human capital component shown in the graph is measured as 30% of the recurrent budget, which approximates recurrent expenditures for health and education.
Figures for 2001 are based on the budget published at the start of the year.
Source: Authors' calculations based on Government of Botswana (various years).

4.2 Productivity of government investment

Public sector investment dominates capital formation in Botswana. Since the mid 1970s it has never been less than 30% of total gross fixed capital formation and has at times approached 50% (Wright, 1999). As the primary means for replacing mineral assets, the productivity of this component of national wealth is critical for the long-term sustainability of the Botswana economy. There are two very different components of public sector assets: manufactured capital and foreign financial assets.

In the early 1980s, foreign financial assets were relatively small (Figure 3), and these assets were held primarily to provide a foreign exchange reserve for imports. As diamond revenues grew, these assets increased rapidly. The objective of a risk-weighted financial return is the sole determinant of this portfolio. In recent years, foreign financial assets became the second or third largest source of government revenue after mineral revenues, more or less equal in importance to customs and excise revenues.

Conceptually, economics defines the value of any asset as the discounted value of net incomes it will generate over its lifetime. Foreign financial investments generate income that can be directly observed. The value of foreign financial assets is continuously revised by the Bank of Botswana to reflect changing market conditions, so that the reported value reflects the best current assessment of their true underlying value, that is, their capacity to generate income. The same certainty cannot be assumed for valuation of the other component

of government investment, manufactured capital and human capital, because these forms of capital do not generate incomes that can be directly and solely attributed to them, as financial investments do.

In the national accounts, the value of investment and capital stock is measured by the cost of an investment. This is reasonable for private sector investment because, in theory, competitive markets assure that the cost of private sector investments is equal to the income they generate. In addition, the profitability of an industry provides a means for measuring the value of its investments, and for assessing whether the cost of an investment is, in fact, equal to its income-generating capacity. However, this is not the case for public sector investments which are insulated from competitive pressures and where investment decisions, for a variety of reasons, have not always been based on the expected economic returns (at least narrowly defined or where the returns are easily quantified financially). These reasons range from the use of wider, non-economic criteria to assess the desirability of spending, a lack of rigor in undertaking cost benefit analyses, and a lack of control in project implementation leading to changes in scope and/or costs that may undermine such analyses. Despite a well-deserved reputation for careful planning at both the macro and micro levels, all these problems exist to some extent in Botswana, possibly exacerbated by the large inflows of public revenues which have weakened the overall budget constraint. Thus, use of the national accounts' valuation of the stock of public capital as an indicator of its underlying investment value must be treated very cautiously.

Even if considered to be of good enough quality, consistent national accounts data exist only for the period since 1974. This inevitably constrains productivity analysis, especially for government investments, which are likely to be long term in nature. (Simple productivity calculations which look for an impact of investment in t on output in $t+1$ are unlikely to be appropriate for many public sector investments, while allowing a longer time lag to cover the investment's gestation period reduces the number of data observations.) However, a start can be made in assessing the productivity of the government's investment programme by examining the structure of investment.

Such an examination must be seen in the context of the literature on the sources of economic growth, which has burgeoned in recent years, as economists have made use of the increased technical capability to examine extensive multi-country databases.[12] This has yet to yield much by way of clear-cut conclusions as work has not only focussed on the potential sources of growth, but has raised important questions about the comparability and quality of data, appropriate forms of hypothesis testing and the interpretation of results. In

[12] A good entry point to this subject is the 'Economic Growth Resources Website' (www.bris.ac.uk/Depts/Economics/Growth). Alternatively, Temple (1998) is one of several good overviews.

response, some authors have called for the multi-country analysis to be supplemented by individual case studies at the country level (see Solow, 1994; Collier and Gunning, 1997).

In the case of Botswana, some attempt has been made to examine growth within a total factor productivity framework, and reached the tentative conclusion that a slowdown in productivity growth could be attributed to a declining quality of government investment (Bank of Botswana, 1994; Leith 1997). However, this did not focus on the composition of public sector investment, and the robustness of the conclusion can be questioned in the light of problems with the data (Wright 1999).

The review of government's investment programme will identify which components of government's capital budget, if any, are clearly not productive, i.e., not generating income at least equal to the cost of investment. While this is not sufficient to allow revisions of the time series of public sector capital stock, it does allow revision of indictors of SBI, the index of sustainability. These revisions will provide a more accurate assessment of economic performance and changes in national wealth. Furthermore, this assessment may indicate how to improve the allocation of public sector investment, both between foreign financial assets and fixed capital investments, as well as among different categories within the capital budget.

Taken as a whole, the aggregate total of public investment does not seem to have exceeded levels at which additional such investment is detrimental to growth. Isham and Kaufman (1999) estimate this level at around 10% of GDP. While this is close to the average figure recorded by Botswana over the past two decades, it has been suggested that a higher indicative ceiling might be relevant in the context of a relatively undistorted policy environment, general efficacy of government planning, and the ready availability of financial resources (Wright, 1999).

Within this total, the initial observation by most experts about public spending is that the profile over time is broadly in line with what might be seen as good for growth (Leith, 2001). Public spending has emphasised public infrastructure: shares of the capital budget going for roads, expansion of water and electricity connections, and communications have averaged 12%, 11%, and 8%, respectively, between 1976 and 2000 (Table 3). More recently, there has been an increasing emphasis on investment in education and health in the capital budget, averaging 19% of the capital budget over the entire period, and 24% over the last five years, in addition to the 30% of the recurrent budget spent on human capital. However, the shares within the capital and development budget only tell part of the story; there are two major qualifications to this favourable picture. First, examination at the sectoral level reveals clear cases where budget items are not productive. Three

examples of these deficiencies are identified here in the sectors of defence, community and social services, and agriculture. Together these averaged nearly one-quarter of public investment over the past 25 years.

Defence has accounted for an average of 11% of the capital budget from 1976 to 2000. According to IMF guidelines no spending on defence should be regarded as an investment. This said, the Botswana government's justification of the rapid build up in defence spending as being necessary to establish the Botswana Defence Force (BDF) from scratch is not without merit. At independence, Botswana had no armed forces and, as a front-line state during the apartheid era of South Africa (and in a region where significant social and political instability still exists), it had a real need to build up a defence capacity. However, there is widespread concern that the force's budget is not subject to serious scrutiny or control. The budgetary ceiling agreed for the NDPs have been revised upwards on a regular basis, and, clearly, not always based on emerging priorities: as a micro example, in the 2000 budget the additional allocation was in part justified by the need to purchase a VIP helicopter (Government of Botswana, 2001). At the end of 2001 a total of 1377 million had been approved for the BDF capital budget during NDP 8; originally only P177 million had been budgeted for the six-year plan period.

Table 3. Development Budget of Botswana, 1976-2000

	1976-1980	1980-1985	1986-1990	1991-1995	1996-2000	All years
Defence	9%	7%	15%	15%	8%	11%
Education & Health	19%	16%	19%	18%	24%	19%
Economic services, of which:	55%	55%	46%	41%	41%	47%
Agriculture	8%	9%	11%	4%	5%	7%
Mining	7%	5%	4%	7%	3%	5%
Water and Electricity	8%	11%	9%	9%	15%	11%
Roads	22%	14%	7%	10%	11%	12%
Other Transportation & Communications	6%	12%	11%	7%	4%	8%
Other Economic Services	4%	4%	5%	3%	4%	4%
Other development spending, of which:	17%	23%	19%	26%	28%	23%
General Administration, Housing, Urban and Regional Development	15%	16%	15%	20%	22%	18%
Food, Social Welfare & Other Community Services	2%	6%	4%	6%	6%	5%
Total	100%	100%	100%	100%	100%	100%
Government Development Budget as Share of:						
Total government budget	41%	38%	44%	35%	33%	38%
GDP	12%	13%	13%	13%	12%	13%

Source: Authors' calculations based on (Government of Botswana, 2001).

Food, Social Welfare, and Other Community and Social Services have accounted for an average of 5% of government's capital budget, rising from a low of 2% over the period 1976-1980 to 6% in the past decade. A substantial part of this development budget category is actually transfer payments related to drought relief, which is clearly not an investment. Such spending has been included in the development budget in part to help attract donor funding, who look more favourably on cooperating on one-off rather than recurrent expenditures.

Traditionally a pastoral society, agriculture continues to play a major social and cultural role in Botswana and an average of 7% of the development budget has gone to agriculture. But despite heavy government investment, agriculture's contribution to GDP has declined over the past 25 years and is now less than 4%. Over the period 1973 to 1996, public sector expenditure in support of agriculture averaged more than 40% of agricultural GDP. According to Oxford Policy Management (2000) this is about ten times what might be considered normal. Moreover, the spending is unbalanced in favour of crops where the spending appears to have well exceeded the value of output, in which case no conventional calculation can yield a positive return. Possibly recognising this, the government has undertaken to review the effectiveness of its various agricultural assistance programmes. Like defence spending, however, public investment in agriculture is declining, averaging only 4-5% of the capital budget over the past five years (Table 3).

The high share of the capital budget that has been used for non-investment items or items that do not increase the productivity of the economy is disturbing. Another disturbing trend is an increasing tendency for development spending to be in the form of 'monuments', although this is not a phenomenon that can be easily quantified. Acquiring a new headquarters building seems to be a major objective of government ministries, their departments, and the various bodies that they support. At the same time, evidence that the public service is becoming increasingly productive as a result of this is thin on the ground. With the attention focussed on new construction, maintenance of the existing infrastructure has been given less priority. Recognising this, in November 2001 a total of P670 million was approved for the remainder of NDP 8 (i.e. until March 2003) to help clear the backlog of maintenance of government buildings; however this was included in the development budget and as such will also be classified as investment.

The second qualification about Botswana's capital budget concerns the clear potential for diminishing returns to set in as the stock of public infrastructure expands. Public sector investment has grown at an average annual rate of over 11% since 1980, which is very rapid indeed. Over the same period, private sector capital has grown more than 7% annually. This possibility has been examined although conclusions are very tentative

given problems of data adequacy. Leith (1997) has argued that continuing dominance of government investment has contributed to a slowdown in total factor productivity growth. However, such a conclusion is far form certain: Wright (1999) discusses various weaknesses in both the data and the underlying productivity calculations.

Certainly, some tendency to over-invest with public spending can be expected because users rarely face the full costs, as their counterparts in the private sector do. This tendency is likely to be pronounced in Botswana where the budget constraint is particularly soft: the costs of the development programme being met from mineral asset sales and increasingly, from interest earned on foreign financial investments. That said, as has already been noted earlier in this paper, there may also be reasons why, in Botswana, high levels of government investment might be more productive than elsewhere (see also Wright, 1999).

The process of designing and implementing the capital budget adds to the concerns about low productivity. In the Mid-Term Review of NDP 8 (Government of Botswana, 2000), government expressed concern that development projects are not subject to sufficiently rigorous economic analysis before they are agreed as part of the development programme. To compound this problem proper attention to sequencing of project implementation has not been applied, again due in part to the surplus of financial resources. This was clearly seen in the first part of NDP 8 (1997-2002), where government attempted to front-load the development programme. The stated intention was to make up for previous delays, which had seen projects carried over from earlier development plans due to limited capacity to implement development projects. However, a principal effect was a combination of higher costs and lower work quality, both of which must result in a lower net present value of assets.

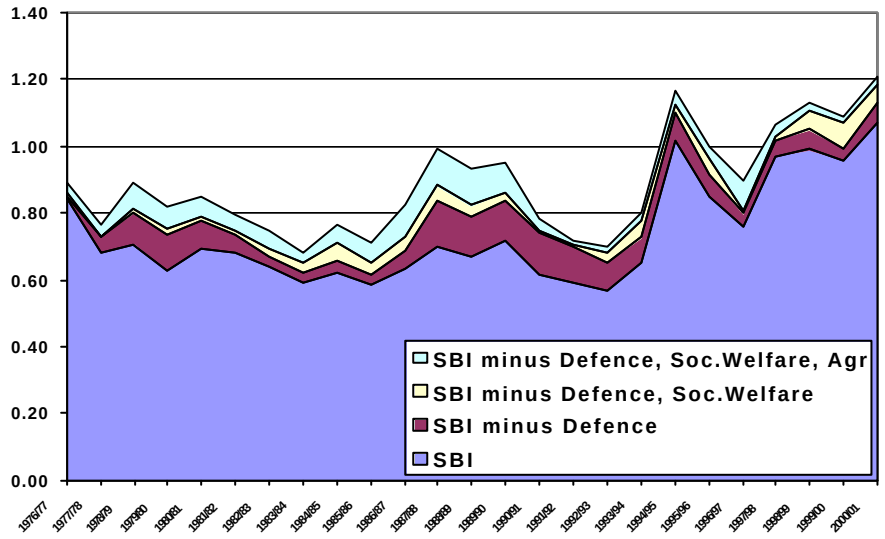
While these problems are recognised by government officials, whether it can be addressed remains to be seen. The original version of the Mid-Term Review tried to rein in spending in the latter part of the plan, but this was rejected by parliament, where politicians refused to countenance delays in 'their' projects. The consequence has been that front loading has become heavy loading all through the plan.

Weakness of public investment processes is a problem common to all countries and we do not mean to suggest that Botswana's problem is very serious. On the contrary, Botswana's long-lasting economic success and political stability attest to the strength of its processes. However, these common weaknesses, even in one of the most successful countries, suggest that rules for managing revenues from minerals, such as the SBI, need to be examined carefully, if they are truly to provide a guide for sustainable management of resource rent. A more

conservative and realistic adjustment of the SBI would take out of the capital budget and add back into the recurrent budget only those categories that are 1) clearly transfer payments rather than true investments (e.g., Food and Social Services) and 2) clearly non-productive investments (e.g., Defence and Agriculture).

These adjustments provide a somewhat different picture of the transformation of minerals into other forms of wealth. If capital expenditures for defence or removed from the public investment budget, as IMF guidelines recommend, the SBI still remains under the 1.00 point until 1994, at which point it surpasses it by 10%, and remains above 1.00 for all years after 1997. Spending for food, social welfare, and community programmes is a small part of the capital and development budget and concentrated at particular times, especially times of severe drought, notably 1984-1986 and 1993-1995. This category of spending has grown rapidly since 1998, and a revised SBI would reach a value of 1.19 in 2001 if these expenditures were also excluded. Finally, considering agriculture as non-productive investment would further erode the sustainability index, which would reach 1.21 by 2001.

Figure 7. Sustainable Budget Index revised for unproductive capital expenditures



Source: Authors' calculations based on method described in text and (Government of Botswana, various years).

5. Conclusions and policy implications

One of the world's poorest countries at independence in 1966, Botswana has done remarkably well in using its mineral wealth to transform the economy, joining the World Bank's category of Upper-middle-income countries in the 1990s. Botswana is an excellent model for resource-rich economies, escaping the 'resource curse' through prudent macroeconomic management. It devised its own rule-of-thumb for reinvestment of mineral revenues to offset depletion, the Sustainable Budget Index, which requires that all mineral revenues be reinvested. In the process Botswana has achieved remarkable improvements in infrastructure, human capital, and the basic services supplied to its population, for example:

- paved roads: 23 km in 1970, increased to 2,311 km by 1990
- safe drinking water: 29% of the population in 1970, increased to 90% by 1990
- telephones: 5,000 connections in 1970, increased to 136,000 by 2001
- female literacy: 77% by 1997

Source: (World Bank, 1994, Tables A1 and A2; World Bank, 2000, Table 2)

Despite its economic transformation, per capita income in 2000 was around US$ 3500 and the most recent available data indicates that in the mid-1990s 38 percent of households (equivalent to 47 percent of the population) still lived in poverty (Jefferis, 1997). Botswana naturally aspires to a higher standard of living and reduced poverty; increasing per capita wealth is part of the solution. In Botswana, rapid economic growth has consistently been reaffirmed as a development objective in both the series of NDP and, more recently, *Vision 2016*, which includes the goal of trebling per capita incomes over a twenty-year period. Given the overwhelming importance of mineral wealth in Botswana, re-investment of much of the mineral rent is clearly the key to meeting this ambitious target.

The SBI, with its strong bias toward reinvestment, has served Botswana well in the past, but may be less useful for the future. There is evidence that not all of public sector investment has been productive, and that a better allocation of mineral revenues might improve the sustainability of the economy. In section 2, it was pointed out that the policy rule for reinvestment of Botswana's mineral revenues was not based on an objective with a well-defined target, such as a given percentage increase in per capita GDP, against which the action could be measured. Consequently, there are no criteria for allocation of mineral revenues, or evaluating a given allocation.

Government can use mineral revenues in a combination of four ways:

1. Invest in foreign financial assets
2. Invest in infrastructure and human capital
3. Fund public consumption
4. Fund private consumption by returning some of the revenues to citizens

Until recently, government has used revenues only for the first two purposes, both forms of investment. In recent years, however, an increasing part of the revenues has been used for the third purpose, funding public consumption. A closer examination reveals that less of the revenues have been used for productive investment than the SBI would indicate. Some capital account spending does not add to productive capacity (defence, agriculture, and social services). Though not quantifiable, there is a tendency toward 'monuments,' which are not productive. Some of the investments may even be harmful, leading to the depletion of other natural capital. For example, over-investment in water supply infrastructure, for which the user is not charged, encourages depletion of fossil groundwater. The process of approving development projects is not subject to close economic scrutiny. Even if all investments were potentially productive, the inability to spend all the allocated capital budget indicates a lack of capacity to implement all of them, which further reduces the likelihood that projects will be carried out and perform in an efficient manner.

HIV/AIDS has further complicated the problem of efficiently allocating public investment funds. The ex-post impact of HIV/AIDS has been to lower the productivity of a significant amount of public infrastructure. Much of the volume and composition of infrastructure for each village such as schools, clinics, water supply, roads, etc. was based on past projections of village populations, which have now radically changed due to HIV/AIDS. Government's spending on health will increase dramatically to address this epidemic, as government has agreed to make anti-AIDS medications available to all (BIDPA, 2000). While health expenditures, current and capital, were viewed as investment in human capital, HIV/AIDS has dramatically increased the maintenance costs of human capital and reduced the productivity of health expenditures relative to the past.

One alternative would be to reduce the capital and development budget and to put more revenues into foreign financial assets. Another alternative would be to remit part of it to citizens to fund private consumption or investment. The question of inter-generational equity has not been explicitly addressed in government policy. The rule of maintaining constant levels of per capita wealth treats all generations equally, a neutrality that

avoids raising potentially difficult questions. But just as a country may have the opportunity to use its resource endowment as a means to rapid development, so, too, could the circumstances of the current generation be improved by allowing a greater degree of consumption. Reflecting this, in Botswana the emphasis on saving resources for investment in the future has been questioned at a time when so many currently live in conditions of poverty.

An intriguing comparison of two different approaches to managing rent from oil and natural gas in Alaska (USA) and Alberta (Canada) by Warrack and Keddie (2000) provides important lessons that may be relevant to Botswana. Both Alaska and Alberta are sparsely populated, relatively undeveloped parts of their respective countries, heavily dependent on natural resources. In 1976 the Alaska Permanent Fund (APF) and the Alberta Heritage Trust Fund (AHTF) were established to manage part of government revenues from the exploitation of oil and natural gas. Both funds were established as mechanisms to transform mineral assets into other forms of capital.

Before 1976, revenues from Alaskan oil were used to improve basic infrastructure in Alaska, much like the objectives of the AHTF. Public dissatisfaction with the results led to the establishment of the APF. Each year, 50% of oil royalties go directly to the state's general revenues and the other 50% goes to the APF. In contrast to the AHTF, the APF was established as an independent corporation mandated to manage its funds much like an endowment on behalf of the citizens of Alaska. Funds are commercially invested with a specific objective (a 4% real rate of return over time with below-average risk investments) and are not earmarked for specific social objectives. The proceeds, after an adjustment for inflation to maintain the real value of the principal, are distributed directly to the citizens.

The experience of exclusively government-directed investment in Alberta has had limited success. After basic infrastructure is provided, it is difficult for government to directly undertake productive investment. Furthermore, in the absence of clear guidelines and accountability, it is all too easy for government to succumb to pressure to use funds for current consumption and projects that do not yield strong returns. In Alaska, half of the mineral revenues go into a trust fund, the proceeds of which are distributed to citizens under the philosophy that economic development and the decision to invest or consume are best directed by the private sector.

As the productivity of public investments in Botswana diminishes, it may consider establishing a permanent fund to invest part of the mineral revenues and distribute the proceeds directly to citizens. In addition to directly assisting citizens and addressing poverty, diversion of a portion of the mineral revenues into such a fund would

reduce the money available for government, thereby creating an incentive for a more productive capital budget, hopefully based on greater scrutiny the economic costs and benefits. As the comparison of Alberta and Alaska indicates, such a fund is best established by an independent corporation that can resist the demands of government.

Whatever policy Botswana decides upon regarding reinvestment of rent, it needs to be based on an objective with a well-defined target, such as a given percentage increase in per capita GDP, which can be used for optimising allocation of mineral revenues among alternative investments, and between current and future consumption. A major problem with the SBI is that it is not based on such an objective against which the action could be measured. Consequently, there are no criteria for optimizing the allocation of mineral revenues among alternative investments, or between current and future consumption. It seems clear that this is an issue that needs to be revisited.

Botswana's 6-year National Development Plans address medium-term, but not long term, objectives. Government has recently engaged in longer term strategic planning exercises, such as Vision 2016 (Presidential Task Group, 1996 and 1997), which are more appropriate for designing an optimal long-term investment strategy. Vision 2016 has identified long-term goals for GDP growth, poverty alleviation, and other objectives, but these objectives have not been related to utilisation of Botswana's most important source of finance: mineral rents. Clearly, to make the longer-term strategic panning more effective, and to ensure sustainable development, Botswana would benefit from paying closer attention to the transformation of mineral wealth into other forms of wealth, starting with an assessment of the long-term objectives that the SBI is intended to achieve.

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Appendix

Table 1. Asset accounts for diamonds, copper/nickel and coal, 1980 to 1997

A. Physical accounts

	Diamonds (millions of carats)		Copper/Nickel (thousand tons of cu/ni content)		Coal (thousand tons)	
	Extraction	**Closing stocks**	**Extraction**	**Closing stocks**	**Extraction**	**Closing stocks**
1980/81	5.1	1,048	44	842	371	7,188,273
1981/82	5.0	1,043	42	762	381	7,187,893
1982/83	7.8	1,035	42	892	415	7,187,478
1983/84	10.7	1,024	48	938	395	7,187,083
1984/85	12.9	1,012	51	1,069	393	7,186,690
1985/86	12.6	999	54	938	437	7,186,253
1986/87	13.1	986	53	1,153	499	7,185,754
1987/88	13.2	973	53	1,115	579	7,185,174
1988/89	15.2	957	53	1,062	613	7,184,561
1989/90	15.3	942	51	1,011	663	7,183,898
1990/91	17.4	925	49	962	794	7,183,104
1991/92	16.5	908	48	914	784	7,182,320
1992/93	15.9	892	48	866	901	7,181,419
1993/94	14.7	878	51	815	890	7,180,529
1994/95	15.6	862	51	764	900	7,179,629
1995/96	16.8	845	47	717	898	7,178,730
1996/97	17.7	828	55	662	763	7,177,967
1997/98	20.1	807	49	613	777	7,177,190
1998/99	19.8	788	55	558	928	7,176,262
1999/00	20.7	767	na	na	na	Na

B. Monetary accounts
(millions of pula in current prices)

	Diamonds	Copper-nickel	Coal
1980/81	1,367	67	7
1981/82	1,137	-	8
1982/83	1,897	-	8
1983/84	2,719	-	8
1984/85	3,548	-	7
1985/86	4,681	-	5
1986/87	6,437	-	3
1987/88	8,314	46	3
1988/89	13,045	718	2
1989/90	16,045	1,108	12
1990/91	20,539	1,114	45
1991/92	21,820	1,157	80
1992/93	22,608	932	96
1993/94	22,722	414	99
1994/95	25,534	241	84
1995/96	29,916	523	50
1996/97	35,926	1,117	12
1997/98	46,481	1,576	15

'-' indicates a zero value. In such years the resource rent was negative.

Notes: Value of Closing Stock reported.

Source: Based on figures in Lange 2001.