The Role of Government in Growth and Income Distribution: The Case of Botswana

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Preface

This report is part of a study on public sector performance, the role of the public sector and public sector reform in Botswana. The study was commissioned by the Royal Norwegian Ministry of Foreign Affairs. All opinions and conclusions presented in the paper are the author's own.

1 Introduction[1]

This paper analyzes the optimal scale of the Botswana government, given a policy objective of high long-run growth with a reasonably equal income distribution. The development debate has often reflected a view that there is a trade-off between these two objectives.[2] More recent empirical and theoretical research indicates, however, that an equal distribution of income promotes growth by raising the average level of human capital in the economy.[3] In addition, equity is associated with political stability and social harmony, which are positively related to growth. Finally, the World Economic Forum (1998) finds that there is a positive correlation between their competitiveness index and the UNDP's human development index. Thus, it appears that a competitive economy does not harm social development.

Mineral rich countries have experienced development problems that stem from the industrial and institutional structures typical for mineral-led growth. Mineral-rich countries tend to have both big government and an unequal distribution of income. This is because the mineral sector is usually capital-intensive, large-scale and dominated by some of the largest multinational companies in the world. Consequently, mineral-led growth is often based on a narrow industrial base, and the income it generates accrues to multinational mineral companies and the government in the host country. Long-run growth and distribution of income therefore depends crucially on how government spends and invests the mineral revenue, and to what extent it creates space for other economic activities with a growth potential in a competitive environment.

In a well-managed mineral-led economy, the problems with inequality are of a temporary nature. Social development simply takes more time than it takes to achieve a middle income level based on exports of vast mineral resources. It also takes time to accumulate the human capital on which sustained long-run growth is founded. Therefore, social development typically lags behind the level of income per capita in mineral-rich developing countries during the investment and development phase of the mineral sector, while social development catches up during the harvesting phase if resources are spent well.[4]

Botswana has experienced an unusually long-lived diamond sector boom from the early 1980s. The world diamond market is dominated by De Beers. Its trading arm, the Central Selling Organization (CSO) has close to a monopoly on world sales of gem quality diamonds. In Botswana diamonds are produced by Debswana, a joint venture between the Botswana government and De Beers. The peak of the mineral boom was probably reached with the extension of the Orapa mine that came on stream in 1999 and operates at full capacity from early 2000. The mineral sector is thus maturing in Botswana, and a continued mineral-boom is unlikely. The Botswana government is currently in a process of reassessing its role in the economy. Based on

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[2] E.g., the Kuznets curve (Kuznets 1955).
[3] See for example Galor and Zeira (1993).
[4] Social development tends to lag behind economic development in all countries (Easterly 1999), but more so in resource-rich countries because a mineral boom is less human capital-intensive than growth driven by productivity improvements in agriculture, manufacturing and services.

the assumption that the mineral boom is over, it is realized that government's share of total GDP can not be sustained without running into serious deficit problems (Jeffris 1999).

The rest of the paper is organized as follows. Section two briefly reviews the mineral- and government-led development that has taken place in Botswana during the last couple of decades. Section 3 discusses the division of labor between the government and the private sector regarding the provision of private goods and services. The issue of efficiency versus distribution is discussed in section 4. We emphasize that an equal distribution of income is good for growth, but some measures to achieve equality may create distortions and efficiency losses. Section 5 discusses the role of government in economic growth. Finally, section 6 draws some conclusions about the role of government in enhancing growth in Botswana during a critical period of transformation from a mineral-led economy to an industrialized economy. Industrialization is interpreted in a broad sense meaning the introduction of modern industrial technology in the production of goods and services.

2   The mineral sector and the government
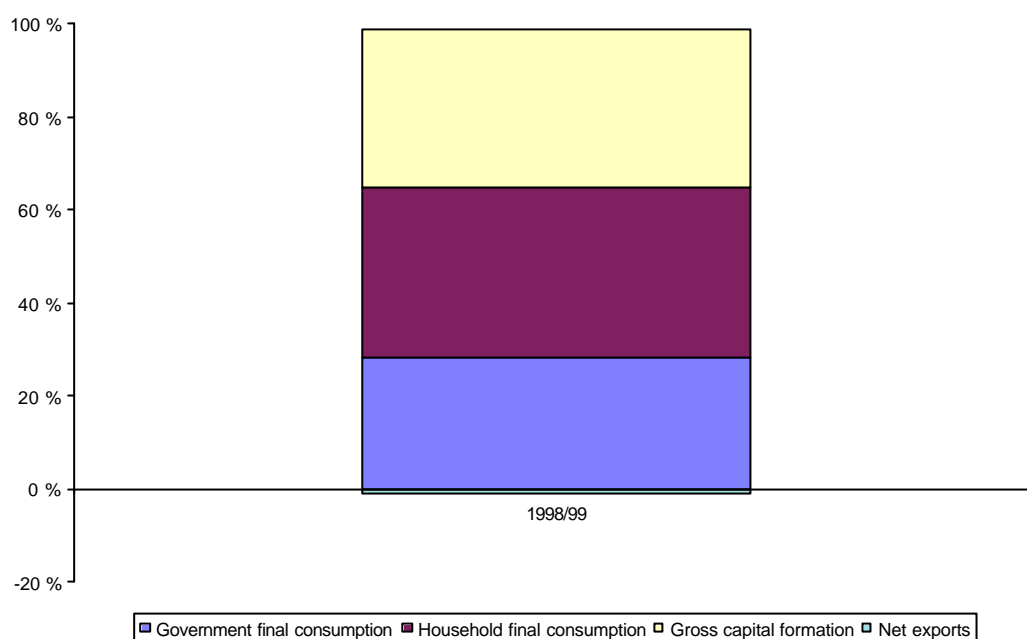
2.1   *The scale of government*

The Botswana economy is dominated by the mineral sector on the production side and by the government on the expenditure side of GDP. Figures 2.1 and 2.2 show GDP by sector of origin and GDP by expenditure category respectively. The mining sector constituted more than a third of GDP in 1998/99, while general government provision of services accounted for more than a sixth of GDP. The two sectors combined produce slightly more than half of the country's value added, or GDP.

Figure 2.1. GDP by sector 1998/99

Source: Central Statistics Office

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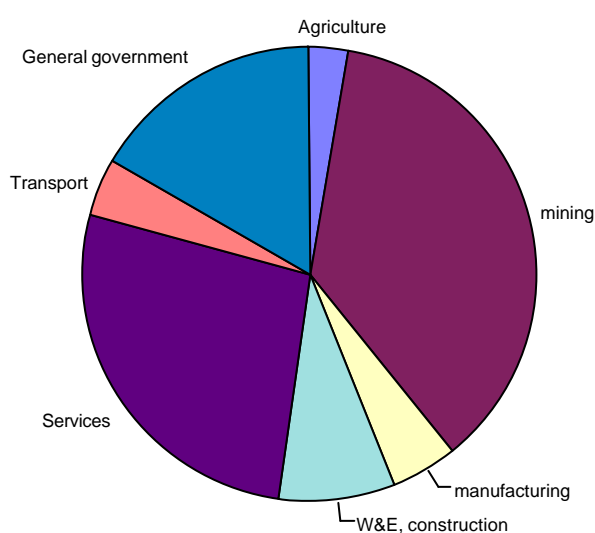
Figure 2.2. GDP by expenditure 1998/99

Legend: Government final consumption ■ Household final consumption □ Gross capital formation □ Net exports
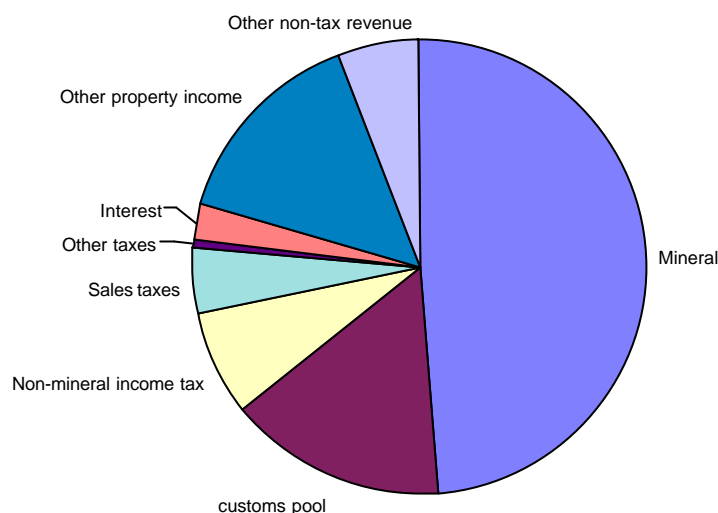
Source: Central Statistics Office

Turning to the expenditure side, government consumption accounted for almost 29 percent of total GDP in 1998/99, while government development expenditure accounted for about half of gross fixed capital formation.[5] The year 1998/99 is exceptional in the sense that there is a negative net exports, following the Asian financial crisis. This was the first year since 1983/84 that there has been a trade deficit and the country probably returned to a surplus in 1999/2000 and 2000/01. Although the deficit in 1998/99 is not representative for Botswana's current account position during the past two decades, it shows how vulnerable the economy is to ups and downs in the diamond market. Government consumption as a share of GDP is high in international comparison. The world average was 15 percent in 1999, while the average for middle income countries was 12 percent – less than half the share in Botswana (World Bank 2000).

The interrelationship between the scale of government activities and the mineral sector is illustrated in figure 2.3, which shows the composition of government revenue.

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[5] Government development expenditure is not entirely on investment or fixed capital formation, but most of it is, and development expenditure can thus be taken as a good proxy for government investment.

**Figure 2.3. Composition of government revenue 1998/99**

Source: Central Statistics Office

Taxes on the mineral sector accounted for 49 percent of total revenue in 1998/99. In addition, other property income, which entails royalties from the mineral sector and Bank of Botswana's earnings on international reserves, accounted for 15 percent. Finally, interest income, mainly on accumulated mineral revenue, accounted for another 3 percent. The mineral sector therefore accounted for close to two thirds of total government revenue, directly and indirectly, this year.

Finally, figure 2.4 shows the role of government as an employer. Central Government accounts for 34 percent of formal sector employment, while local government adds another 8 percent. Total public sector employment, including the parastatals, accounts for about 48 percent of total employment. Looking at recent trends, the share of central government in total employment increased from 25 to 34 percent during the 6-year period 1992-98, while local government employment increased from 6 to 8 percent of the total. There has in other words been a substantial increase in the government share of total employment, as well as an increase in the absolute number of government employees. This has happened during a period of slow growth in overall employment. Thus, total employment increased by only 4.7 percent from 1992 to 1998, while central government employment increased by 40 percent during the same period.

Figure 2.4. Employment by sector 1998
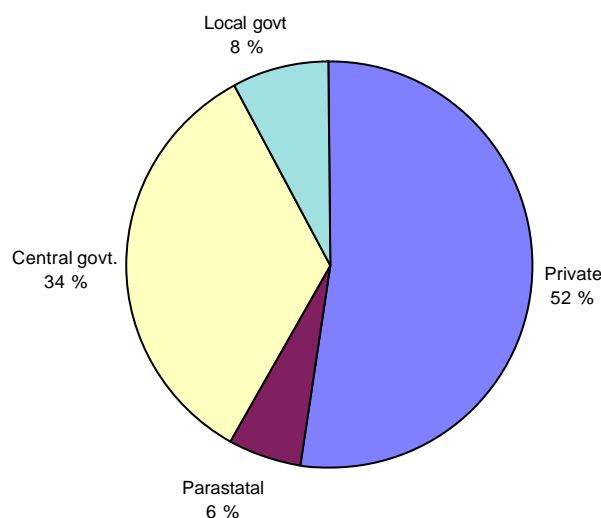
Source: Central Statistics Office

In order to fully assess the government's role in the economy, it is important to look at the allocation of different categories of labor between the main sectors of the economy. Table 2.1 shows the skill composition of employees in each major sector, taken from the latest labor force survey in 1995/96.

Table 2.1: Composition of labor force according to training by sector

	Central government	Local government	Parastatals	Traditional agriculture	Informal sector	Private sector
No training	47.8	78.6	59.2	98	90.7	72.7
Humanity	22.0	0.9	2.5	0.2	0.5	2.0
Social science	8.1	9.3	16.4	0.2	1.4	9.3
Natural science	6.2	2.3	1.4	0	0.3	2.3
Craft and industry	4.1	5.0	13.4	0.8	4.8	7.4
Engineering and other technical	3.8	1.0	3.4	0.1	0.5	2.8
Service trades	7.9	2.3	3.3	0.6	1.7	3.2
Other	0.1	0.5	0.4	0	0	0.3
Total	100	100	100	100	100	100

Source: Republic of Botswana

Clearly, the Central Government is the most skill-intensive sector in the economy. The second most skill-intensive sector is the parastatal sector. Unsurprisingly, traditional agriculture and the informal sector are the sectors that are the least skill-intensive. Note, however, the large share of the labor force employed in the private sector that has no training. Table 2.2 shows how the various skill categories in the Botswana economy are distributed on sectors.

Table 2.2. Distribution of skill categories among sectors

	Central govt	Local govt	Parastatals	Traditional agriculture	Informal sector	Private sector	Total
No training	14.1	12.3	2.8	18.6	20.3	31.8	100
Humanity	83.1	1.9	1.5	0.6	1.6	11.4	100
Social science	26.5	16.0	8.6	0.5	3.4	45.1	100
Natural science	55.1	11.0	2.0	0.2	1.9	29.9	100
Craft and industry	16.9	11.0	8.9	2.3	15.2	45.6	100
Engineering and other technical	39.7	5.8	5.7	0.9	4.2	43.7	100
Service Trades	49.0	7.6	3.4	2.2	8.1	29.7	100
Other	15.1	28.9	7.1	0	0	49	100

Source: Republic of Botswana

The two biggest employers in the economy are the central government and the private sector, while parastatals and the local government are relatively small. Further, government is by far the biggest employer of people with training in humanity sciences. A large share of these is school teachers. But also natural sciences and service trades are dominated by government. Only in engineering and craft and industry is the private sector more important as an employer of skilled labor than the government. We will discuss in section 5 to what extent this allocation of skilled labor is the most conducive for growth and overall employment.

2.2   *Mineral-led development*

Botswana has the industrial structure and the dominance of the government in common with several other mineral-rich countries. Botswana is a maturing mineral-exporting country facing the challenges of a transformation from mineral-led growth to diversification and the establishment of new engines of growth. The transformation in successful mineral-rich countries can be represented by the following five stages:

1. Rapid economic growth driven by investment in large-scale mineral projects and the coming on stream of production from these projects;
2. Injection of the mineral rents into the local economy in the form of investment in infrastructure, health and education. Rapid expansion of the public sector;
3. Establishment of resource intensive downstream industries through local and foreign investments;
4. The establishment of service industries both within the public and private sectors;
5. Continued growth based on private investments in more skill-intensive industries. The private sector grows faster than the public sector.

Note that labor-intensive industrialization is absent from this development path. This is because the dominance of the mineral and government sectors drives costs and thereby typically renders labor-intensive industries uncompetitive. Therefore, large-scale resource-intensive industries and skill-intensive industries are more commonly found in natural resource-rich countries. Botswana has successfully gone through the first two phases of this development path (see Nordås et. al. 1998). Since Botswana's

major mineral resource, diamonds, are not subject to large-scale downstream processing, the development will probably leapfrog the third stage. The challenge the country faces now is to move on to stage 4 and 5.

3 Government provision of private goods

Governments provide private goods and services because of market imperfections such as externalities, imperfect financial markets and natural monopolies. The rationale for government provision of social services such as health and education, for example, is both redistribution and correction of imperfect credit markets and externalities in the accumulation of human capital. Nevertheless, it has been recognized that governments are not always able to introduce measures that rectify market failures. Indeed, governments may have insufficient information to know exactly what to do, while policy measures are subject to administrative costs and some times unintended side-effects. In addition market failures appear to have been reduced significantly over time, mainly due to technological change. One example is technological developments that have substantially reduced the minimum efficient scale of electricity supply and communication services, and thereby increased the scope for competition in those sectors. Further, communication technology has reduced transport costs and globalized markets to the extent that government policies need to take into account the impact its policy has on local agents in an international context. Privatization of telecommunications, electricity supply and other utilities has proliferated around the world as a result.

The government faces two major challenges during the transition from stage 2 to stage 5 in the development path sketched above. First, it must find the balance of providing growth-promoting services without crowding out the private sector. Second, given the country's highly unequal distribution of income and high incidence of poverty, it must redistribute income and assets without adversely affecting incentives to invest and participate in economic activities. The balancing of these considerations is the focus of our analysis.[6] We first assess the cost of government service provision compared to the private sector. Second, we discuss the division of labor between the private sector and the government in the provision of private goods. Examples of such goods are curative health services, economic services, housing, transport and utilities.

3.1 The relative cost of goods and services provided by government

It has long been a concern that the public sector tends to expand more than proportionally to the national income in most countries of the world. One reason for this is that the cost of government services tends to grow faster than the costs of producing goods and services in the private sector. This means that even if the level of real resources devoted to the public sector (e.g., the share of total employment) remains constant and the real cost of the service declines, the *relative* cost of public services still increases if productivity development is slower in the public sector than in the private sector. We illustrate this point by an example:[7]

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[6] A study reported in Harberger (1998) finds that there are two major roads out of poverty for the individual. These are setting up a small business or obtain a formal sector job. The first requires access to credit, the second or possibly both require skills. The study was undertaken in El Salvador.
[7] The example is borrowed from Ferris and West (1996).

If productivity in the public sector grows by 1 percent per year, and productivity in the private sector grows by 2 percent per year, the cost of public services in terms of foregone production in the private sector develops as shown in figure 3.1. We take as the point of departure a base year and choose units of measurement such that the relative cost of public services in terms of private goods and services is unity in the base year. Relative costs will then develop as indicated by figure 3.1 over time.

Figure 3.1. Relative cost of government /private production
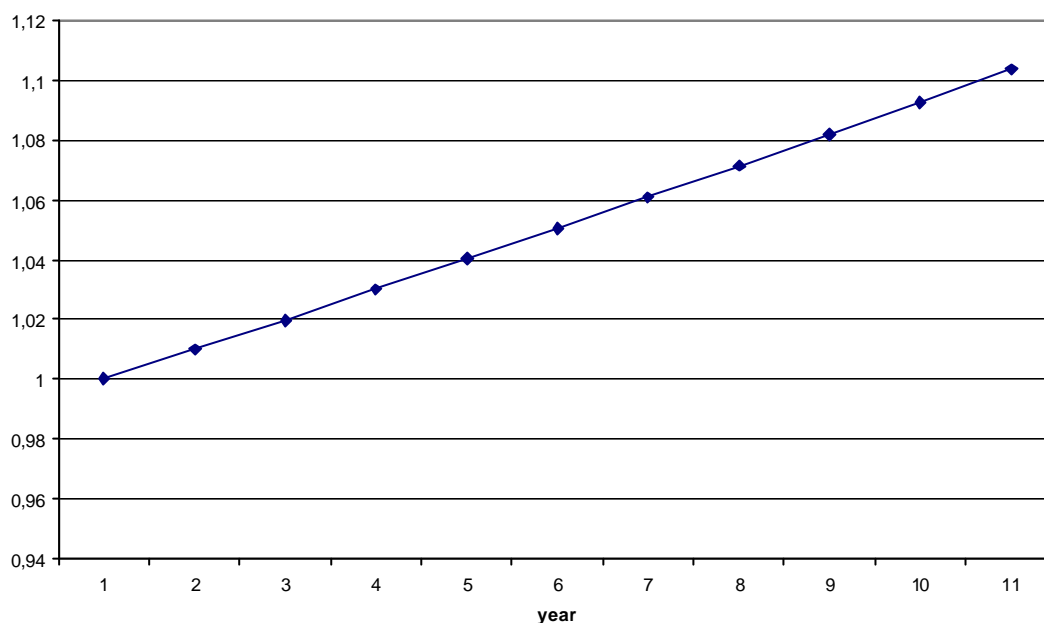
With this difference in productivity growth, the economy has to forego an ever increasing amount of private goods and services in order to sustain production of government services. This is a stylized example, but it reflects the development in a wide range of countries, and has been seen as a problem in the OECD area. Given the substantial expansion of the public sector in Botswana over the past two decades, we would expect to see a development similar to figure 3.1 there.

In practice, productivity growth in the public sector is very difficult to measure. We use the GDP deflator for the general government sector divided by the GDP deflator for the private sector as a proxy for relative productivity. Figure 3.2 depicts this measure of relative cost development of general government relative to the non-mining private sector, the manufacturing sector and private services respectively.[8] If the index is increasing, the cost of producing government goods and services rises at a faster speed than the cost of producing goods and services in the private sector. We first notice that the manufacturing sector is the sector with the largest changes in relative costs both relative to the central government sector and relative to the rest of the non-mining private sector. We also note that the direction of change is the same for all private sector measures introduced. The cost of central government production improved during the period 1984/85-1986/87 relative to manufacturing and for the second half of the period also for the entire private non-mining sector and private

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[8] The indices are derived by dividing GDP at current prices by GDP at constant prices for each sector. It is not a perfect measure of relative productivity, but in the absence of productivity figures for the public sector, it is probably the best available approximation.

services. After a sharp increase in the relative cost of central government during the period 1986/87-1990/91, the relative cost of government improved again until 1997/98. Over the 15-year period as a whole, the relative cost of central government has deteriorated by about 8 percent relative to the non-mining private sector.[9] Compared to figure 3.1, which is representative for OECD countries such as the US (Baumol 1993, Ferris and West 1996), Botswana's public sector performance appears to be remarkable.

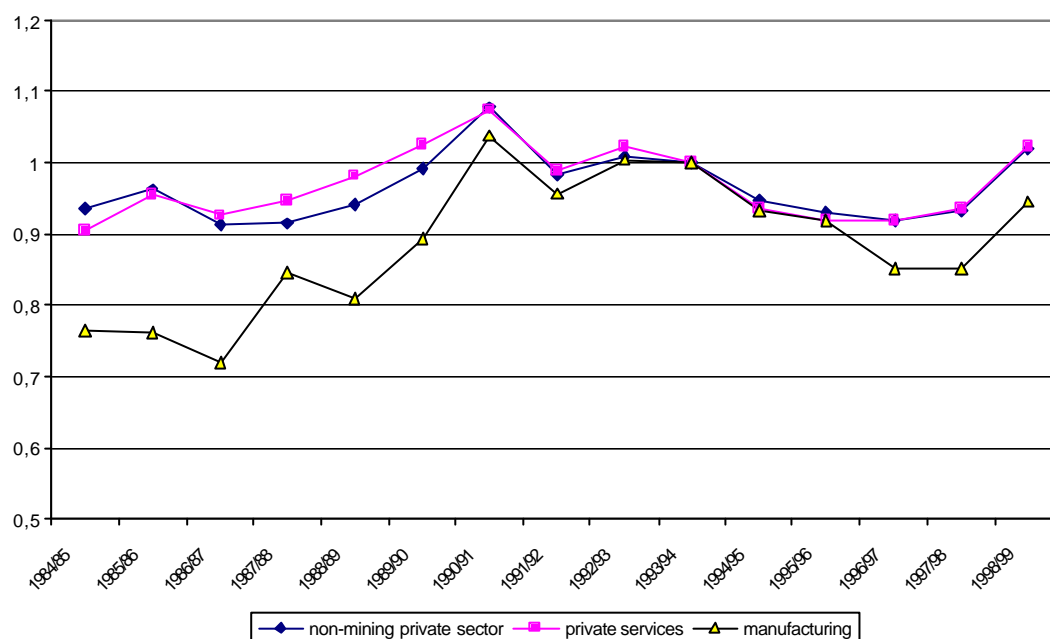**Figure 3.2. Relative cost of central government**

Figure 3.2 suggests that the cost and productivity problems Botswana may have, is not a public sector cost problem per see. In fact, our findings support a study by Mandlebe (1997), who finds that productivity development in the government sector has been better than in the non-mineral private sector on average during the period 1974 – 1994. However, Hagen (1999) finds that education indicators in Botswana lag far behind what one should expect compared to the country's expenditure on education and the level of income in the country, suggesting that the education sector is not very effective and productive in an international comparison. A relatively good performance of the public sector relative to the *local* private sector may therefore well indicate that both the private and the public sector have a productivity problem in international comparison. The reform process underway therefore needs to critically assess the impact of government labor market policy, industrial policy and use of resources on cost developments and productivity in the private sector.

To our knowledge there are no studies of the impact of government industrial policy on productivity and competitiveness of the private sector in Botswana. There is, however, a comprehensive study of the impact of government interventions such as

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[9] Costs rose faster in central government during the period 1979-82 also, but the relative costs improved again between 1982 and 1984. Figures during this period are, however given at 1985/96 prices and are not compatible with the figures depicted in figure 3.2.

tariff protection, import restrictions, credit allocation and tax incentives on productivity in South Korean industries (Lee 1996). The study concludes that tariffs and import restrictions decrease productivity growth, while subsidized credits and tax incentives had no effect on productivity in the favored industries. These results suggest that industrial policy that limits competition and exposure to international best practices is bad for productivity, while measures that reduce investment costs are not harmful for productivity. Botswana's industrial policy has been dominated by measures such as subsidized credits and tax incentives. Although this should not be harmful to productivity in a competitive market, Botswana's market is far less competitive than the Korean market, and in some cases the cost of capital is so low that over-investment and a low social return to capital may well have resulted.[10] In addition mineral - and government-led growth has probably contributed to a high cost level in the economy as a whole, and thus high costs of other inputs than capital in the production process.

3.2 Division of labor between government and the private sector in provision of private goods

Government expenditure on private services accounts for about 28 percent of total recurrent expenditure and almost 8 percent of GDP in Botswana. Figure 3.4 shows the composition of this expenditure category in 1998/99.[11] The share of total expenditure going to services that are private in nature and could be provided by the market is not particularly high in international comparison, but government provision of private goods and services as a share of GDP is high.

Figure 3.4. Composition of government provision of private services 1998/99
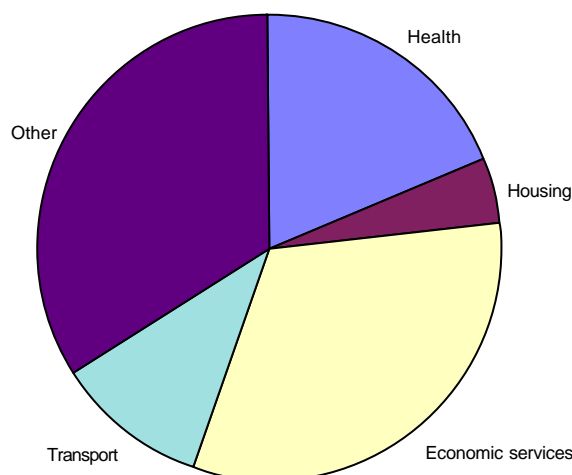
Source: Central Statistics Office

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[10] If that is the case, the likely adjustment after the mineral boom is a convergence towards steady state from above, as shown by Rodriguez and Sachs (1999). See also section 5.

[11] Other services are food and social welfare, local and regional development not elsewhere classified, urban infrastructure, cultural recreation, broadcasting and press.

In Botswana, it is often argued that the government has to provide a number of private services because there is no private supply of such services. However, if consumers consider the service or good the same or almost the same whether provided by government or the private sector, government provision of goods and services over and above a certain level may well completely crowd out the private sector. Government provision is defined as what households get from the government free of charge and the subsidy element in cases where households pay for government services. If the private sector produces such services more efficiently than the government, then there will be an improvement in welfare from privatizing the services or scale back government provision and leave the market open for private investors. If the private sector is not more efficient than the government, as figure 3.2 suggests, gains from privatization would materialize only if privatization is combined with measures that ensure enhanced competition and incentives for improving productivity in the private sector. In any case, if government agencies provide private goods, it is an acknowledged principle that private and government providers should be subject to the same conditions. Finally, the borderline between the public and private sectors should be clear and well defined (Harberger 1998).

4 Government provision of services for redistributive purposes

Botswana has an unequal distribution of income. The Gini-coefficient is estimated at 0.56 in 1993/94 (Ditlhong 1997), which is among the highest in the world.[12] Another indicator of uneven income distribution is the difference between the ranking according to GDP per capita and the ranking according to UNDP's human development index (HDI). The difference was –57 for Botswana in 1998, the second largest in the world (UNDP 2000).[13] Finally, the share of total households below the poverty line provides additional information on income distribution. The share was 38 percent in 1993/94 (Government of Botswana/UNDP 1998). This is an improvement from earlier estimates during the 1980s, but it is still high, given Botswana's relatively high per capita income, and given the period of time Botswana has been a middle-income country.

A more equal distribution of income is probably a precondition for the transition of the economy to a diversified economy and growth based on private sector business activities. This is because the cost level in Botswana is such that a relatively high productivity level is necessary in order to sustain present income and exchange rate levels in a competitive environment. High productivity in turn can only be achieved in an environment of skilled and motivated workers and an effective infrastructure - conditions that are usually not found in an environment of widespread poverty.

It has often been argued that there is a trade-off between a more equal distribution of income on the one hand and efficiency and growth in the economy on the other hand. The reasoning behind this is that redistribution requires relatively high taxes that in turn create distortions and disincentives. In addition, it is argued that high-income groups save more than poor people, and that redistribution of income would lead to

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[12] The Gini coefficient has a value between 0 and 1. The higher the value, the more unequal the income distribution.

[13] Gabon has the highest difference with –60.

lower savings and investment and thereby slower growth. Finally, it is argued that when there is indivisibility in investment combined with imperfect credit markets, wealth needs to be concentrated in order ensure large-scale investments. While the first argument is widely accepted, the others are highly controversial. First, it has been shown that when imperfect credit markets are combined with diminishing returns to capital at an individual or project level, there will be more investment and growth when income is equally distributed (Benabou 1996). Second, it has been shown that if talent and ideas are distributed randomly in the population, talent and ideas are underutilized in an economy with a highly unequal income distribution. Third, it has been shown that if the poor can indeed borrow and realize their ideas, the terms are often such that the lender will reap a large share of the benefit from the borrower's effort. The more own resources the borrower can contribute, the more of the benefits from his/her efforts will accrue to him/her, and the more effort he/she will exert. Which effects dominate in the real world is an empirical question and most recent studies find a negative and significant correlation between inequality and economic growth and/or the investment rate.[14]

Finally we note that there are other ways of achieving a more equal distribution of income than redistribution by means of taxes and subsidies. A redistribution of *assets*, through land reform or privatization of state enterprises, and/or creating equal *opportunities* through equal access to education are thought to be less distortive ways of achieving equality.[15] In the two next sections we discuss two approaches, equality of *outcome* and equality of *opportunity,* to income distribution and their impact on efficiency and growth. Policy measures aiming at equal outcome usually revolve around progressive taxation and government provision of goods and services, while policy measures aiming at equal opportunity largely relate to access to secondary and tertiary education, access to credit and programs of rural development. Policies related to equality of outcome are usually analyzed in a context of public economics and welfare analysis while policy measures directed at equal opportunity are usually analyzed in a dynamic context. We will follow that pattern in the analysis here.

4.1 Equal outcome
Public economics addresses the redistribution versus efficiency problem when redistribution involves taxes which distort the workings of the market and create deadweight losses. The main conclusions from the literature on income distribution through taxation and subsidies suggest that there are limits to what can be achieved from such measures. Harberger (1998) demonstrates through a very simple example that even a very progressive tax system does not change income distribution much. We copy his table, but with income distribution data for Botswana to illustrate his point.

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[14] See Benabou (1996) for an overview.

[15] Privatization leads to a more equal distribution of assets if it is done through voucher schemes or similar methods as applied in several of the former East European economies.

Table 4.1 Income distribution and tax and benefits[16]

Income group (quintile)	Income and distribution before tax	Tax	Income after tax	After tax distribution	Benefits	Income after tax and benefits	After tax and benefit distribution
	(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)=(3)+(5)	(7)
First	4.5	0	4.5	6.33	2.89	7.40	8.65
Second	7.9	1.2	6.7	9.45	2.89	9.62	11.23
Third	9.3	1.9	7.4	10.47	2.89	10.34	12.08
Fourth	21.5	6.0	15.5	21.79	2.89	18.37	21.48
Fifth	56.8	19.9	36.9	51.95	2.89	39.82	46.55
Total	100	28.9	71.0	100	14.45	85.55	100

For illustrative purposes we have introduced a progressive tax system with the *average* tax rate increasing from zero in the first quintile to 35 percent in the fifth quintile. Distribution is presented as the share of total income earned by each quintile in columns (1), (4) and (7). We follow Harberger in assuming that half of tax receipts is spent on services or benefits to which every household has equal access or receives the same amount. The after tax distribution of income in terms of percentages received by each quintile is better after tax than before tax, as can be seen from comparing the distribution figures in columns (1) and (4). However, the improvement is much better still after an equal amount of benefits have been distributed among households as can be seen from column (7) compared to columns (1) and (4) in table. The poorest quintile improves its relative position from earning 4.5 percentage of total income before taxes and benefits to 6.33 percent after tax, and further to 8.65 percent after tax and benefits. Furthermore, although progressive taxes alone improve the relative position of the four poorest quintiles, it is only after the expenditure scheme has been introduced that the *absolute position* of the three poorest quintiles improves as well.

A number of papers discuss the optimal policy mix of government expenditure and progressive taxation in order to achieve a more equal distribution of income with as little efficiency loss as possible. Crucial to this discussion is the assumptions made about to what extent the government can target expenditure to particular groups and to what extent it can identify households in a way that makes redistribution through the tax system work as intended. These studies find that if the government can indeed identify the characteristics of households such that redistribution through taxes and transfers is possible, then such a system is preferable to public expenditure as a measure of obtaining a more equal distribution of income. This is because people can choose the level of consumption of services themselves in that case. However, it has proven very difficult in practice to design a cost-effective taxation and transfer system that actually benefits the target group as intended. For practical purposes, therefore, public expenditure may be a better alternative.

The expenditure categories that potentially have the largest distributional effects are primary education, primary health care and services such as safe water and sewage systems. However, these expenditure categories are often regressive in developing as well as developed countries. Primary schools and health services are quite often of

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[16] The figures on income distribution are taken from the 1993/94 survey which is the latest survey undertaken.

much better quality in affluent areas than in poor urban slums or poor rural areas. Moreover, secondary and tertiary education is often more subsidized than primary education and it is still the case that a larger proportion of relatively well-off children and youngsters attend higher level education. According to Harberger (1998) it would be a great step forward merely to ensure that poor people have access to the same quality public services as their better off fellow citizens have. In Botswana, provision of services such as education appears to be regressive. Table 4.2 shows education level by income group.

Table 4.2. Education level by income group, percentage of total

Income group	No education	Primary only	Secondary	Tertiary
Very low economic resources	36.9	48.55	14.41	0.13
Low economic resources	24.06	55.53	20.37	0.05
Better off	15.99	50.33	30.17	3.51

Source: Republic of Botswana 1996

The table refers to persons aged 5 and over in 1993/94. It does not fully capture the relation between household income and access to education, since a low income can be a *result* of a low level of education rather than a cause. With this qualification in mind, the table shows that only half the share of very low economic resource households has obtained secondary education compared to better off households. It is, however worth noticing that as much as 16 percent of persons from well-off households have no education. They probably represent the older generation in well-off farm and cattle raising households. Harberger's findings applied to the Botswana context suggests that improving the quality of primary and secondary education in poor areas should be a priority both for redistributive reasons and, as will be further discussed below, reasons of sustained economic growth. Further discussion of education is left to section 4.2 where equal opportunities are analyzed.

We have argued that the evidence points in the direction that benefits are more effective instruments of income redistribution than progressive taxes. Further, we have argued that benefits provided in an equal amount to all households significantly improve income distribution and represent a notable improvement to the present situation in most countries, including Botswana. Besides, an equal amount to all households is easier to administer than a more complex system.

4.1.1   Taxes and benefits versus markets
We now turn to the issue of to what extent benefits should be given in the form of income transfers or through public provision of services in more detail. The government has the choice whether to produce services itself, or alternatively pay poor households a transfer such that the household can purchase the good or service in question in the market. It has been argued in the literature (Arrow 1971) that the latter solution is better because the government does not know household preferences.

In the following we will assume that services of a private nature, e.g., services that can in principle be produced and sold in a market, can be produced either by government or the private sector and the two sectors produce close substitutes. Further we assume that households' demand for the service in question is positive and depends on household income and the price of the service. If the service is sold in the market, its distribution among households depends on the income distribution in the economy, which is highly unequal as we have already seen. If government decides to

improve distribution through an income transfer, the distribution of the service will still be determined by the income distribution, this time the after transfer income distribution. If the poor still consumes less than what is considered appropriate from a welfare point of view, government provision of the service may be a solution. These arguments usually apply to merit goods and goods and services that cater for basic needs. It is worth noticing that government provision does not necessarily mean government *production* of the service. It could also mean paying a private company for providing a service to all households in a geographical area at subsidized prices or for free.

We will now make a rough estimate of a reasonable level of government expenditure on private goods and services for reasons of income distribution. We take as a point of departure Harberger's argument that an equal amount of the service to all households is a substantial improvement compared to existing practices and that it makes sense from efficiency reasons. Further, we will assume that the service is financed by a proportional income tax. Since poor households pay a lower tax in absolute terms, but receive the same service as rich households, such a policy will have a redistributional effect.

At very low levels of government provision, most households will purchase some of the service in question in the private markets. As the service provision from government increases, the lowest income households will switch to government provided services and withdraw from the market. As has been argued in the literature (Boadway and Marhand 1995, Epple and Romano 1996) government provision from an income distribution point of view should not exceed the level that would make the targeted group withdraw from the market. An optimally designed expenditure scheme would be such that everybody in the target group switches from the market to the government and nobody in the non-targeted groups withdraw from the market.

We assume that the targeted group in Botswana is the households that fall below the poverty line. These constitute 38 percent of all households and thus approximately the two poorest quintiles of the population who earned about 12 percent of total household income in Botswana in 1993/94. We consider private goods and services represented in figure 3.1 above only. In order to estimate what government expenditure on these services for redistribution purposes should be, we need data on household preferences. These are not easily observable, and a commonly used proxy is the share of total income that households actually spend on these items. In the Botswana case we have household expenditure data only on broad categories of services. Because of lack of data, we resolve to present the amount of government expenditure on services that are private in nature and that would exactly crowd out the two poorest quintiles from the market as a function of the share of income that these households would spend on similar private goods in a market in figure 4.1.[17]

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[17] See the appendix for derivation of the figure.

Figure 4.1. Government expenditure for redistributive purposes
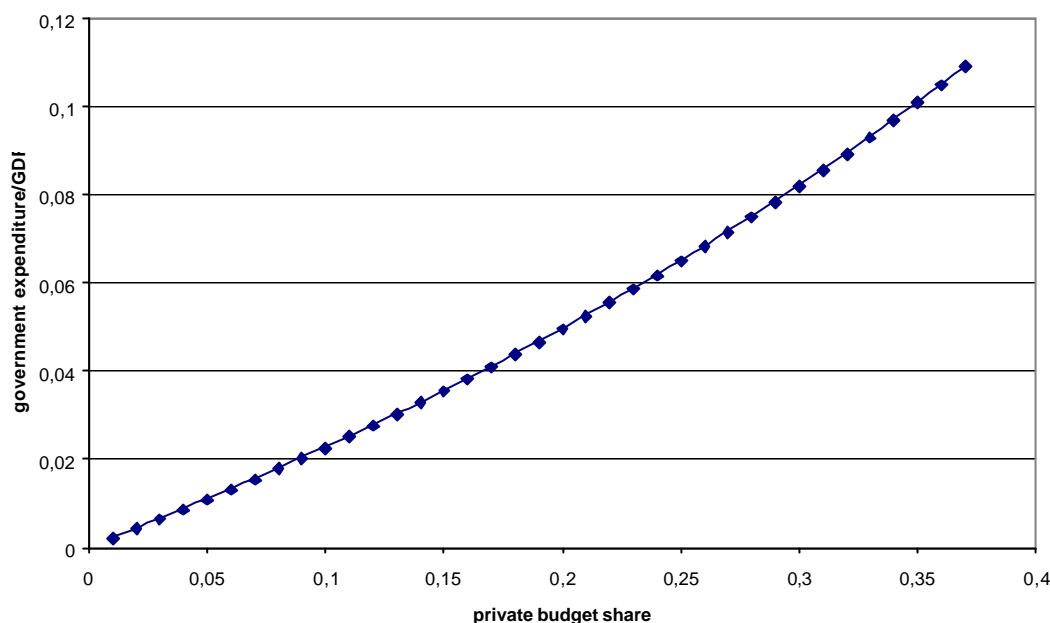
The figure shows that if poor households' preferences are such that they would spend about 20 percent of their income on services such as health, housing and other economic services, government should spend at most about 5 percent of GDP on such services. The Botswana government spends about 8 percent of GDP on health, housing and economic services, which appears to be on the high side for a reasonable range of preferences.

4.2 Equal opportunities

We now turn to government provision of services, which are important for economic opportunities. Access to education of reasonable quality is crucial for economic opportunity, while a high skill premium potentially creates a situation of high inequality. The skill premium in turn is partly a result of skill-biased technological change, outside the scope of government policy intervention. But it may also be a result of a combination of subsidized capital and minimum wages set above the market-clearing rate. This combination tilts relative prices in favor of capital, which in turn often is complementary to skilled labor while replacing unskilled labor. Botswana has to some extent been characterized by such a policy mix, and unskilled people largely have to fend for themselves in the informal sector.

Access to education and establishment of small-scale or micro businesses for poor people often depends on access to credit. Credit is, however, not always readily available to people who can only offer prospects for future earnings as a "collateral". Therefore, due to imperfect credit markets, income inequality tends to persist over time as poor households have limited access to education or business opportunities that would provide their children with a ticket to a better life. Note that there is a fine line here between subsidizing capital at the expense of the employment of unskilled labor and rectifying market failures in the credit market. The former is detrimental to growth with redistribution, the latter is good for growth with redistribution.

An interesting study of the evolution of growth and income distribution driven by accumulation of human capital is provided by Galor and Zeira (1993). They combine imperfect credit markets and indivisible investment in human capital in a dynamic framework. The indivisibility of human capital investment relates to the fact that the investment results in a skill only after an exam is passed or a certificate obtained. In the absence of comprehensive credit markets, parents transfer income to their children in order to pay for education. In addition, students can borrow money, but the market for student loans is rationed such that not everyone with the ability to acquire the skill in question has access to the necessary funding. The children of rich parents will inherit more than they need for financing education, and will leave more to their children than they received from their parents. Over some generations these families will converge towards a high income level where all the family members are employed as skilled personnel in the formal economy. Poor families consist of unskilled workers often in the informal sector, and they will remain there generation after generation. Neither of these two groups will borrow money, and their relative position will remain stable. The most dynamic group is a middle income group who is rich enough to leave a sufficient amount of money to their children to give them access to education partly funded by borrowing. Within this group, those who start above a critical level will leave more for their children than they received from their parents, and after some generations they will converge towards the rich group. In contrast, those who started below this critical level will borrow so much that they leave less for their children than they received from their parents. This group will converge towards the poor, unskilled group after some generations. The more unequal distribution of income, the larger is the proportion of total households that falls into the two lowest income groups. Therefore, a country with a highly unequal distribution of income runs the risk of stagnation and even decline over time if equal opportunity is not secured, and talent and ideas remain unexploited. One implication of Galor and Zeira's analysis is that it is important to have a sufficiently large middle class for economic growth.

Lee and Roemer (1998) add the government sector to Galor and Zeira's framework. Government provides compulsory, primary education financed by a proportional tax, and the individuals invest in further education if they have the necessary means to do so. This captures many of the complex issues of distribution, redistribution measures and growth. First, higher taxes are needed when inequality is large. Higher taxation has a negative impact on private investment, which in turn is negative for growth. Second, there is a threshold effect. People below a critical level of income will not invest at all and if a small transfer is made to this group, they will still not invest at all, possibly resulting in lower total investment in human capital. Only if transfers reduce the *number* of people in the poor group will it have a growth effect.

The two studies discussed above agree that the higher the incidence of poverty, the slower the growth rate. The second study takes into account the distortive effects of redistribution measures and poor households' supposedly low propensity to save and thereby opens the possibility that redistribution does not always improve growth performance. Bearing in mind the qualifications from Lee and Roemer's study, it is still very much likely that Botswana's growth performance as the mineral sector levels off would improve if income distribution were more equal. With close to 40 percent of the households below the poverty line, Botswana has a high incidence of poverty

and it does not have a large middle class. The challenge is to redistribute without creating too much distortions and disincentives for entrepreneurs.

Chile is an example of a mineral-exporting country that has experienced a successful transition towards stage 4 and 5 in the development path sketched in section 2. Over the past decade and a half, GDP per capita has grown by 3.2 percent per year on average, while the Gini coefficient fell from 0.54 to 0.47 and the economy became more diversified (Iglesias 1998). According to this study, Chile reduced unemployment among unskilled labor by narrowing the gap between supply and demand from both sides. Better access to education reduced the supply of unskilled workers. Rapid growth and deregulation increased demand for unskilled labor while deregulation also led to an increase in the relative size of the formal economy compared to the informal economy. In the Botswana case it is probably the demand side that most urgently needs to be addressed through deregulation. The country already spends more than most countries on education, so it appears that the problem now lies with the quality of education and the net benefit of investing in education from the individual's point of view.

## 5   Government expenditure and economic growth

Barro (1990) analyzed the role of government for economic growth in a purely theoretical setting. His main prediction is that the relation between government expenditure and economic growth is inverted u-shaped. His basic assumption is that government expenditure is confined to areas where markets are imperfect due to externalities, information problems and lack of markets. Such expenditure improves productivity in the economy as a whole. However, in order to finance its activity, government imposes taxes on the private sector and it diverts resources away from the private sector, and thus reduces investment and output in the private sector. At low levels of government expenditure and taxation, the productivity effect is stronger than the resource diversion effect, and growth increases with government expenditure. As government expenditure increases, a peak is reached on the inverted u-shaped curve, and the resource diversion effect dominates the productivity effect thereafter.

Dowrick (1996) tested Barro's model empirically. His results support Barro's finding that growth is a non-monothonic function of government consumption, e.g., there is an optimal size of government that maximizes long-run growth. However, the optimal size varies across countries and over time. Dowrick (1996) ran a regression that included 116 countries, among them Botswana, and found that the optimal size of government in terms of government consumption as a share of GDP ranges between 10 and 18 percent. Among the 116 countries included in the regression, Botswana ranked as number 107 according to government consumption/GDP starting with the country with the lowest share, e.g., only 9 countries have a higher government consumption/GDP than Botswana. In Dowrick's data set government consumption/GDP was 21.2 percent measured in recurrent domestic prices and 25.5 percent measured at constant international prices. Whichever measure is used, government consumption is well outside the range of optimal expenditure rates according to Dowrick's study.

So far we have implicitly assumed that government expenditure is funded by taxes, and ignored Botswana's substantial income due to mineral rents. However, the Botswana government is able to sustain a given expenditure level with lower taxes

than most countries because of its mineral revenue. In the appendix we show analytically how the inverted u-shaped curve presented in figure 5.1 below changes when we take mineral rents into account. Here we confine ourselves to presenting the graph with no mineral rents and the graph where mineral rents add 20 percent to government expenditure over and above what is financed by receipts from taxes on income and trade. The graphs show the optimal growth rate of the economy as a function of the tax level, when capital and labor is fully employed.

Figure 5.1. Economic growth and taxes
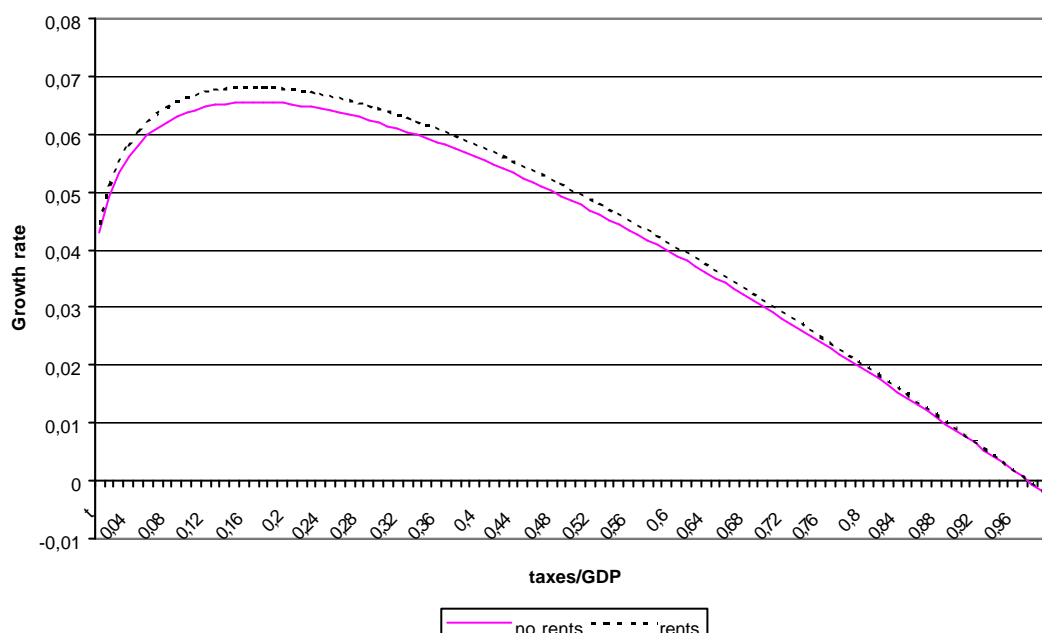
Diamonds are extracted at relatively low costs compared to their sales value, and most if not all the diamonds are exported. Therefore, mineral rents are analytically similar to transfers in a foreign currency. They can be spent on imports, and if so they do not impose extra pressure on local labor and capital markets. As figure 5.1 indicates, the curve with mineral rents lies everywhere above the curve without mineral rents. Thus, a higher growth rate can be achieved at the optimal tax rate, as Botswana's experience indeed testifies to.

If mineral rents lead to additional pressure on domestic scarce resources such as skilled labor, however, the results from the above analysis may change. Thus, the upward shift of the curve as a result of the introduction of mineral rents in figure 5.1 depends crucially on the assumption that mineral rents are spent on imports. Further, it depends on the assumption that government uses scarce resources such as skilled labor and capital in the same proportion as the private sector, and that capital and labor are equally productive at the margin in both sectors. This simplification conceals the possibility that some services can not be imported and that mineral rents in that case would change relative prices in favor of non-importable services.[18] If such non-importable services are also produced by a technology that uses scarce resources such as skilled and professional labor more intensively than importable goods and services, the injection of mineral rents in the economy would introduce

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[18] This is the Dutch disease argument.

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additional pressure on the market for skilled labor and lead to a redistribution of income towards this group with little effects on the growth rate.

In order to capture the effect of shortages of complementary local resources, we extend Barro's model by introducing mineral rents and government sector that produces services according to a more skill-intensive technology than the economy as a whole, as documented in table 2.1 above. Table 5.1 below shows the value of input from various factors of production from the 1992/93 Social Accounting Matrix for Botswana. We have aggregated all industries excluding mining into the first column.

We first notice the net operating surplus in the private non-mining sector. It is only marginally above depreciation, indicating that the return to investments in the private sector is close to zero, at least for this particular year.[19] This underscores our discussion in section 3.1, which concluded that both the private and the public sector have cost and efficiency problems in Botswana.

Table 5.1. Factor payments (P million) from the 1992/93 SAM

Factor of production	Industries	Mining	Central govt.	Local govt.
Professional and technical, citizens	459	34	262	39
Professional and technical, non-citizens	258	31	70	4
Administrative and managerial, citizens	164	2	44	8
Administrative and managerial, non-citizens	165	14	18	1
Clerical, citizens	404	17	219	38
Clerical, non-citizens	5	0	0	0
Skilled manual, citizens	540	182	122	24
Skilled manual, non-citizens	75	24	0	0
Unskilled	413	41	140	25
Informal sector	550	0	0	0
Net operating surplus	1045	2532	0	36
Depreciation	1003	157	489	0
Net taxes and subsidies	-30	1	0	0
Total value added	5052	3034	1363	176

Source: Central Statistics Office, 1996

Table 5.1 gives a more detailed break down of skill levels than table 2.1. Besides, it distinguishes between citizen and non-citizen employees. Note, however, that while table 2.2 and 2.3 report the distribution of *workers* on sectors, table 5.1 reports the distribution of *payments* to each skill category. There are two important features worth noticing in this table. First, as already mentioned, net operating surplus less depreciation of capital stems almost entirely from the mineral sector. Second, although it may be impossible to import some services, it appears that the problem can be overcome to some extent by importing workers. Thus, notice that more than a third of total payments to professional and technical employees, and half of total payment to administrative and managerial employees went to non-citizens in all non-mining industries combined. In the mining sector the share to non-citizen professional, technical, administrative and managerial staff is even larger, reaching more than 85 percent in the administrative and managerial category. The percentage distribution of payment to the factors of production is reported in table 5.2.

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[19] The private return to investment can be positive, however, if tax incentives and other implicit subsidies such as the Financial Assistance Policy (FAP) are sufficiently high.

Table 5.2. Factor shares from the 1992/93 SAM

Factor of production	Industries	Mining	Central govt.	Local govt.
Professional and technical, citizens	9.1	1.1	19.2	22.3
Professional and technical, non-citizens	5.1	1.0	5.1	2.4
Administrative and managerial, citizens	3.2	0.1	3.2	4.8
Administrative and managerial, non-citizens	3.3	0.4	1.3	0.8
Clerical, citizens	8.0	0.6	16.0	21.5
Clerical, non-citizens	0.1	0	0	0
Skilled manual, citizens	10.7	6.0	9.0	13.5
Skilled manual, non-citizens	1.5	0.8	0	0
Unskilled	8.2	1.3	10.3	14.3
Informal sector	10.9	0	0	0
Net operating surplus	20.7	83.4	0	0
Depreciation	19.8	5.2	35.9	20.4
Net taxes and subsidies	0.6	0.1	0	0
Total value added	100	100	100	100

A common interpretation of the figures in table 5.2 is that it takes for example 9.1 + 5.1 units professional and technical labor input to produce 100 units of goods and services in the Botswana business sector. [20]   With this interpretation, the table shows clearly that the mining sector is the most capital-intensive sector, while the government is the most skill-intensive sector. Several studies and policy documents have emphasized skill shortages as a constraint to economic development and diversification away from the mineral sector. This table indicates that although there may be shortages and the government employs a large share of the skilled labor that there is, the private sector can ease the constraint by employing foreign professional and skilled workers. Their salaries and wages are probably higher than the going rate among citizens of the same skill category, however.

We now return to our question about the optimal size of government, taking into account the scarcity of human capital, and the fact that government uses human capital intensively.   Using an extended version of Barro's model and the data presented in tables 5.1 and 5.2, we find that if we define skilled labor as professional and technical, administrative and managerial, the share employed by government should not exceed about 35 percent. If we include clerical employees and skilled manual employees in the human capital stock, the share employed by government should not exceed about 20 percent.[21] In most categories presented in table 2.2 the combined share of central and local government is much higher than that. The share of total employment in government should be below 20 percent since government is less intensive in unskilled labor than the private sector. The present employment share in central government of 34 percent (see figure 2.4) is then more than 10 percentage points above our estimate of the optimal share. This indicates that a reallocation of skilled labor from the public to the private sector would improve the level of income in the short run as well as ensure a higher growth rate in the future.

We conclude this section with a cautionary note. The analysis behind figure 5.1 takes as a point of departure that the government produces services that enhances productivity in the private sector. While primary education, preventional health

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[20] The necessary condition for this interpretation to hold is that factors of production are being paid according to their contribution to value added.

[21] See the appendix for the derivation of the optimal allocation of skills among government and the private sector.

services, enforcement of law and order and contracts clearly have the properties that are assumed for the analysis, other services can hardly be said to oil the wheels of the economy. The productivity enhancing effect of government expenditure may therefore be exaggerated in this model.

6 Conclusions

The role of government has been one of the most central questions in economic theory since Adam Smith. Smith's postulate was that markets provide an efficient allocation of resources, provided that certain basic conditions are satisfied. The government then enters the scene when these circumstances are not satisfied. Economic research sought to identify market failures and design government intervention in order to remedy such failures. Thus, it was believed that when markets are not efficient, well-defined government interventions that would remedy the market failure could be designed. In contrast, more recent research focusing on market failures in the areas of asymmetric information and incomplete markets argues that government can not always correct market failure and that it seldom has sufficient statistical knowledge to know exactly what it should do.[22] Besides, there are government failures too.

Three major conclusions can be drawn from the discussions and findings of this chapter. First, the Botswana government is indeed too big both in relation to its own resources and compared to what is found to be optimal in empirical and theoretical analysis. The latest figures on government consumption relative to GDP suggest that it is around 29 percent of GDP measured at current prices. This is about 10 percentage points above what Dowrick (1996) finds to be the upper limit to what will foster economic growth. On this account, the radical approach to public sector reform taken in the Botswana National Development Plan 8 and other recent official documents is justified. Developments since the development plan was formulated have, however, seen an expansion rather than a reduction in the scale of government. Apparently it is easier to expand than to reduce the scale of government, particularly when the government has the financial resources to expand without running into deficit.

Second, one area where public expenditure could be cut back significantly, is the provision of private goods. We argue that public sector provision of such goods and services crowds out the private sector and thereby probably reduce competition and induce inefficiencies in the economy. Also from a distributional point of view the scale of government provision is on the high side for such services.

Third, the greatest challenge facing the Botswana government is the high incidence of poverty and the skewed income distribution. The country can not sustain the present income level and growth performance without continued injection of mineral rents into the economy if this situation persists. The country will simply not be able to transform itself into a modern dynamic economy with close to 40 percent of the population below the poverty line. It is a robust finding within the growth and development field of research that a large middleclass is necessary for economic growth. Further, the ticket to the middle class is a job in the formal sector and/or setting up a business. Both routes to prosperity require skills and access to credit. In Botswana skills are probably even more important than in the average middle-income

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[22] This discussion draws on Stiglitz (1998).

country. The country is land-locked, sparsely populated, remote relative to international markets, and has a relatively high cost level compared to other middle-income countries. Therefore, the present income level and growth performance can probably only be sustained if industries with a relatively high value added per worker take over from the mineral sector and the government as engines of growth. Since Botswana is probably too small for the establishment of large-scale, capital intensive industries, competitiveness in skill-intensive industries is probably crucial for future growth. This requires a well-educated and motivated labor force.

If endowed with sufficient human capital, Botswana could for example take advantage of the rapid growth in international service trade. Increasingly, multinational companies such as airlines, financial service institutions and computer software producers to mention but a few, outsource their back-office services to developing countries. In order to participate in this trade, good and low-cost infrastructure, particularly in telecommunications is needed in addition to skills. The government therefore needs to reassess its role in the telecommunication industry and improve the quality of education and the incentives and opportunities to obtain education.

To conclude, the Botswana government needs to scale back its activity level by withdrawing from the provision of a number of private services, as shown in section 3.2. This would create more space for the private sector and introduce competition, which in turn would enhance effectiveness. Liberalization of international trade and investment in some areas such as telecommunication, financial services and other services and utilities could further enhance competition and improve cost effectiveness. The Botswana government also needs to strengthen areas such as health and education in order to meet the challenges from the HIV/Aids epidemic and the requirements for an economic transition from stage 2 to stage 4 and 5 in the development path we sketched in section 2. In these areas improved efficiency is probably the key issue, since the government is already spending more on these sectors than almost any country in the world.

Appendix

A.1. Redsitribution

This appendix develops the analytical framework behind figure 4.1 and the analysis in section 5. We start by analyzing government provision of services for redistribution reasons. Assume that there are two types of households in the economy, rich households and poor households, earning average incomes y_h and y_l respectively. Further, assume that there are two categories of products in the economy, denoted h and b. Product h is provided by government at a uniform quantity g to all households. In addition, households can purchase supplementary quantities of h from the private sector. The products under consideration are goods that are essential for human welfare, such as health, or essential inputs in the production of goods and services such as services from infrastructure. In the following we will for short call the product health. The product b should be interpreted as a bundle of goods and services that are produced and purchased in the market only. Both goods are assumed to be normal goods (e.g., demand increases with income). We define households' utility function over the two categories of products as follows:

$$U = U(h,b) \tag{A.1.1}$$

For illustrative purposes, we specify the utility function as $U_i = h_i^a b_i^{1-a}$ where $h_i = g + z_i$. Health is provided to all households in quantity g. In addition, households purchase an amount z from the market at a unit cost p. We assume that g and z are perfect substitutes. The cost p is given in terms of quantities of the consumer good bundle, b, which is the numeraire of the model. Government produces health services at a unit cost p, similar to the private sector.[23] Government provision is financed by a proportional tax on income, t. The government budget constraint is thus:

$$(n+m)gp \leq (ny_l + my_h)t \tag{A.1.2}$$

where n and m are the number of low-income and high-income households respectively. When condition A.1.2 holds with equality, government provision of health to each household can be expressed as:

$$g = \frac{(ny_l + my_h)t}{(n+m)p} = (\sigma y_l + (1-\sigma)y_h)t/p \tag{A.1.3}$$

where σ is the share of low-income households in total households, e.g., *n/(n+m)*.

The household budget constraint for both households is:

$$b_i + pz_i \leq y_i(1-t) \qquad i = l,h \tag{A.1.4}$$

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[23] In section 3.2 we demonstrated that the cost of government provision of goods and services does not deviate systematically from private provision of goods and services.

Maximizing utility subject to the household budget constraint and combining the first-order conditions yield the familiar:

$$\frac{a}{1-a}\frac{b_i}{z_i+g} = p \tag{A.1.5}$$

Combining this with the household budget constraint yields demand for health services in the market as follows:

$$z_i = \frac{ay_i}{p}(1-t)-(1-a)g \tag{A.1.6}$$

Consider a government expenditure strategy where the government wants to provide a uniform quantity of health services to all households in a way that targets the poor. A common assumption in the literature is that government wants to provide the poor household with the service up to the point where the poor household would just be crowded out from the private market. Given our simple demand structure we find the proportional tax necessary to provide such a service by setting (A.1.6) for $i = l$ equal to zero and insert in (A.1.3). This yields:

$$t = \frac{1}{1+\dfrac{1-a}{a}\left(s+(1-s)\dfrac{y_h}{y_l}\right)} \tag{A.1.7}$$

Clearly, $dt/ds > 0$, $dt/d(y_h/y_l) < 0$ Meaning that a large income differential between rich and poor households reduces the taxation necessary to finance redistribution through expenditure, while a large incidence of poverty increases the tax rate necessary to finance equitable expenditure. If we define poor households as those falling below the poverty line; about 40 percent of all households, we have a value of $\sigma = 0.4$ and relative income $y_h/y_l = 7.33$ in Botswana. These are the figures used in figure 3.1, while we let α vary.

A.2 Public goods with externalities

We turn to a dynamic model in order to explore the optimal size of the public sector given externalities in the consumption of public services. Household preferences are now represented by intertemporal preferences for consumption:

$$u(c) = \int u(c(t))e^{nt}e^{-rt}dt \tag{A.2.1}$$

where c represents household consumption, n is the population growth rate and ρ the household time preference rate. Further, we define the utility of consumption as follows:

$$u(c) = \frac{c^{1-q}-1}{1-q} \tag{A.2.2}$$

where θ is the elasticity of marginal utility.

We introduce an aggregate production function that incorporates the flow of government services:

$$Y = AL^{1-b}G^{1-b}H^{b} \qquad (A.2.3)$$

where A is an aggregate productivity parameter, L is the labor force, G is the flow of government expenditure, and H is the aggregate capital stock in the economy, consisting of both physical and human capital. Notice that the production function is subject to constant returns to scale in the private inputs L and H, but it is subject to increasing returns when government services are taken into account. The role of government expenditure in the production function is thus to enhance productivity of labor. There are several ways that government expenditure may enhance labor productivity. Better communications can for example reduce the time it takes workers to get to work, and reduce transport costs in the economy altogether. Expenditure on health may reduce absenteeism and so on. The production function builds on Barro and Sala-i-Martin (1995). In per capita terms the production function reads:

$$y = AG^{1-b}h^{b} \qquad (A.2.3')$$

Assuming that the capital stock of the economy is ultimately held by households, the intertemporal budget constraint is:

$$\dot{h} = w + (r+n)h - c \qquad (A.2.4)$$

where the left hand side represents the time derivative of the capital stock per capita, or accumulation of capital, w is the wage rate per unit of labor, r is the return to capital, and n is the population growth rate.

We can obtain the optimal feasible consumption growth path (or the Euler equation) by maximizing (A.2.1) subject to the budget constraint (A.2.4), which yields:

$$\frac{\dot{c}}{c} = \frac{1}{\boldsymbol{q}}(r - \boldsymbol{r}) \qquad (A.2.5)$$

Turning to the production side, firms maximize after-tax profits. It is assumed that firms pay a proportionate tax, t on revenue:

$$\boldsymbol{p} = (1-t)AL^{1-b}G^{1-b}H^{b} - wL - rH \qquad (A.2.6)$$

The first-order condition for profit maximization yields:

$$\frac{d\boldsymbol{p}}{dH} = \boldsymbol{b}(1-t)AG^{1-b}h^{b-1} - r = 0 \qquad (A.2.7)$$

Hence capital is employed up to the point where its marginal product equals the cost of capital, represented by the interest rate. We finally turn to the government provision of services. We start by assuming that government services are produced by the same technology as the production of goods and services in the private sector, e.g., government and private sector production have the same capital and labor intensity. We further assume that the government spends all its tax revenue. In addition, tax revenue is augmented by mineral rent, represented by the parameter s in the government budget constraint:

$$G = stY \qquad\qquad (A.2.8)$$

Using (A.2.8) and (A.2.3), we get $G = (tsA)^{1/b} L^{1/(1-b)} H$. We now plug this expression into the first-order condition and obtain:

$$\boldsymbol{b}(1-t)A^{1/b}(tsL)^{(1-b)/b} = r \qquad\qquad (A.2.9)$$

This expression represents the steady state rate of return to capital in the economy. Note that it is a function of exogenous parameters, including the policy parameters t and s, only. The economy is in equilibrium when the rate of interest derived from the production side equals the interest rate in the Euler equation (A.2.5). Thus, we get the optimal growth rate of the economy as a function of the tax rate t, the mineral revenue injected into the economy, s, the total labor force, L, and the capital share β as follows:

$$\frac{\dot{c}}{c} = \left(\boldsymbol{b}(1-t)A^{1/b}(tsL)^{(1-b)/b} - \boldsymbol{r}\right) \qquad\qquad (A.2.10)$$

It is worth noticing that the growth rate is higher the larger the labor force. This is a common feature of growth models with externalities. The reason is simply that when externalities are present, the more people who can benefit from them, the more productive the economy. However, this feature also implies that large economies should grow faster than small economies, which is not supported by the data. The reach of an externality does not necessarily follow international borders, though. Therefore, the scale effect from a larger labor force can also be interpreted to mean that open economies grow faster than closed economies, which finds empirical support. National borders may nevertheless be most relevant for externalities related to government expenditure. In that case, we can infer that small countries need a larger government sector relative to GDP in order to ensure the same increase in labor productivity as large countries. Equation (A.2.10) is depicted in figure 5.1 in the report.

A.2.1 Government and private sector use different technology
So far we have assumed that the government and the private sector use the same technology and that mineral rents are spent on imports such that additional government expenditure resulting from the injection of mineral rents into the economy does not draw on scarce labor and capital.

We now relax that restriction and analyze the situation when government is more skill-intensive than the private sector and skills can not be imported, at least not

without incurring significant costs. We extend the production function (A.2.3) by disaggregating human and physical capital into two distinct inputs. In addition, we introduce the share of labor employed by the private sector denoted by v, the share of human capital employed by the private sector denoted u, and the share of physical capital employed by the private sector, denoted f.

$$Y = A(vL)^{1-e-s} G^{1-e-s} (uH)^e (fK)^s \tag{A.2.11}$$

Government services are produced according to the production function

$$G = ((1-v)L)^{1-g-d} ((1-u)H)^g ((1-f)K)^d \tag{A.2.12}$$

We assume that $\gamma > \varepsilon$, e.g., the government is more human capital intensive than the private sector. We then insert equation (A.2.12) into equation (A.2.11), and maximize the output of Y with respect to the share that the private sector employs of each factor of production:

$$\underset{u,v,f}{Max} \ A(vL)^{1-e-s} \left[((1-v)L)^{(1-g-d)} ((1-u)H)^g ((1-f)K)^d \right]^{1-e-s} (uH)^e (fK)^s$$

This yields the first-order conditions:

$$u = \frac{e}{e + g(1 - e - s)}$$

$$f = \frac{s}{d(1 - e - s) + s} \tag{A.2.13}$$

$$v = \frac{1}{2 - g - d}$$

These conditions are independent on the stock of capital and the labor force and apply to the transition path towards steady state growth as well as in steady state. The optimal shares of production factors employed in the private sector depend on the relative human and physical capital intensity in the two sectors. Table A.1 below shows the values of the parameters and the optimal allocation of skills between government and the private sector under different classifications of skills. The private sector includes all sectors except mining.

Table A.1. Optimal allocation of human capital

Definition of skill	α	γ	β	Private share u	Government share 1-u
Prof., techn., admin. and manag.	0.21	0.29	0.40	0.64	0.36
Prof., techn., admin. and manag., clerical, skilled manual	0.41	0.55	0.40	0.80	0.20

We can then finally find the optimal injection of mineral rents in the economy by imposing this restriction on the growth model. In a growth model taxes have a

negative impact on growth because it reduces after tax return to physical and human capital. This is counterbalanced by the positive impact government expenditure has on economic growth. Our model will therefore produce the results that government should first spend the mineral rents available and only finance the residual between the cost of employing the optimal share of factors of production and mineral revenue through taxation. The actual rate of injection of the mineral resources into the economy needs to take into account the total stock of mineral resources and the consideration that the mineral wealth should be reinvested, not consumed.

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Summary

Botswana has experienced one of the highest growth rates in the world over the past three decades. Growth can, however, be attributed to a long-lived diamond sector boom and the injection of mineral revenue into the economy through government expenditure and government production of goods and services. Botswana has at present one of the highest government expenditure/GDP rates in the world. Still the country has one of the most unequal distributions of income in the world, and the largest discrepancies between economic and social development. This report analyzes the performance of the Botswana public sector, its role in the economy as a provider of public and private goods, its role in income distribution and its activities' impact on economic growth. It is argued that the government needs to reduce its share in total expenditure by 10-15 percentage points in order to facilitate a transition from mineral and government-led growth to sustained economic growth based on a diversified private sector. Further, it is argued that a more equal distribution of income is imperative for sustained growth.

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