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October 22, 2001

To: Members of the Executive Board

From: The Secretary

Subject: **Zambia—Selected Issues and Statistical Appendix**

This paper provides background information to the staff report on the 2001 Article IV consultation discussions with Zambia (to be issued), which is tentatively scheduled for discussion on Wednesday, November 7, 2001. At the time of circulation of this paper to the Board, the Secretary's Department has received a communication from the authorities of Zambia indicating that they consent to the Fund's publication of this paper.

Questions may be referred to Mr. Hossain (ext. 36861) and Ms. Sgherri (ext. 35969).

Unless the Documents Section (ext. 36760) is otherwise notified, the document will be transmitted, in accordance with the procedures approved by the Executive Board and with the appropriate deletions, to the WTO Secretariat on Tuesday, October 30, 2001; and to the African Development Bank, the Common Market for Eastern and Southern Africa, the European Commission, the European Investment Bank, the Food and Agriculture Organization, and the United Nations Development Programme, following its consideration by the Executive Board.

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INTERNATIONAL MONETARY FUND

ZAMBIA

Selected Issues and Statistical Appendix

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Approved by the African Department

October 19, 2001

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I. The Implications of HIV/AIDS for the Zambian Economy [1, 2]

A. Introduction

1. The HIV/AIDS pandemic in sub-Saharan Africa has become one of the most devastating human tragedies in recent history. From its emergence in Africa in the early 1980s to today, HIV/AIDS has had catastrophic humanitarian and economic effects of an unparalleled magnitude. Though the disease has not spared any particular class or socioeconomic group, the pandemic is undoubtedly aggravated by the severe poverty in the region. Zambia ranks as one of the nine African countries hit hardest by the HIV virus, with 19.7 percent of its adult population infected with HIV in 1999.[3]

2. Recent estimates illustrate the scale and implications of HIV/AIDS in the case of Zambia (Figure I.1): [4]

- 830,000 adults and 40,000 children were living with HIV infection at the end of 1999.
- 100,000 people died of AIDS-related diseases during 1999.
- Life expectancy declined from 50 years in 1990 to 37 years in 1999.
- 520,000 children have lost their mother or both parents to AIDS since the beginning of the pandemic. By 2010, 35 to 40 percent of the population under 15 is estimated to be orphaned—totaling nearly 2 million orphans.[5]

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[1] Prepared by Kahwa Douoguih and Silvia Sgherri.

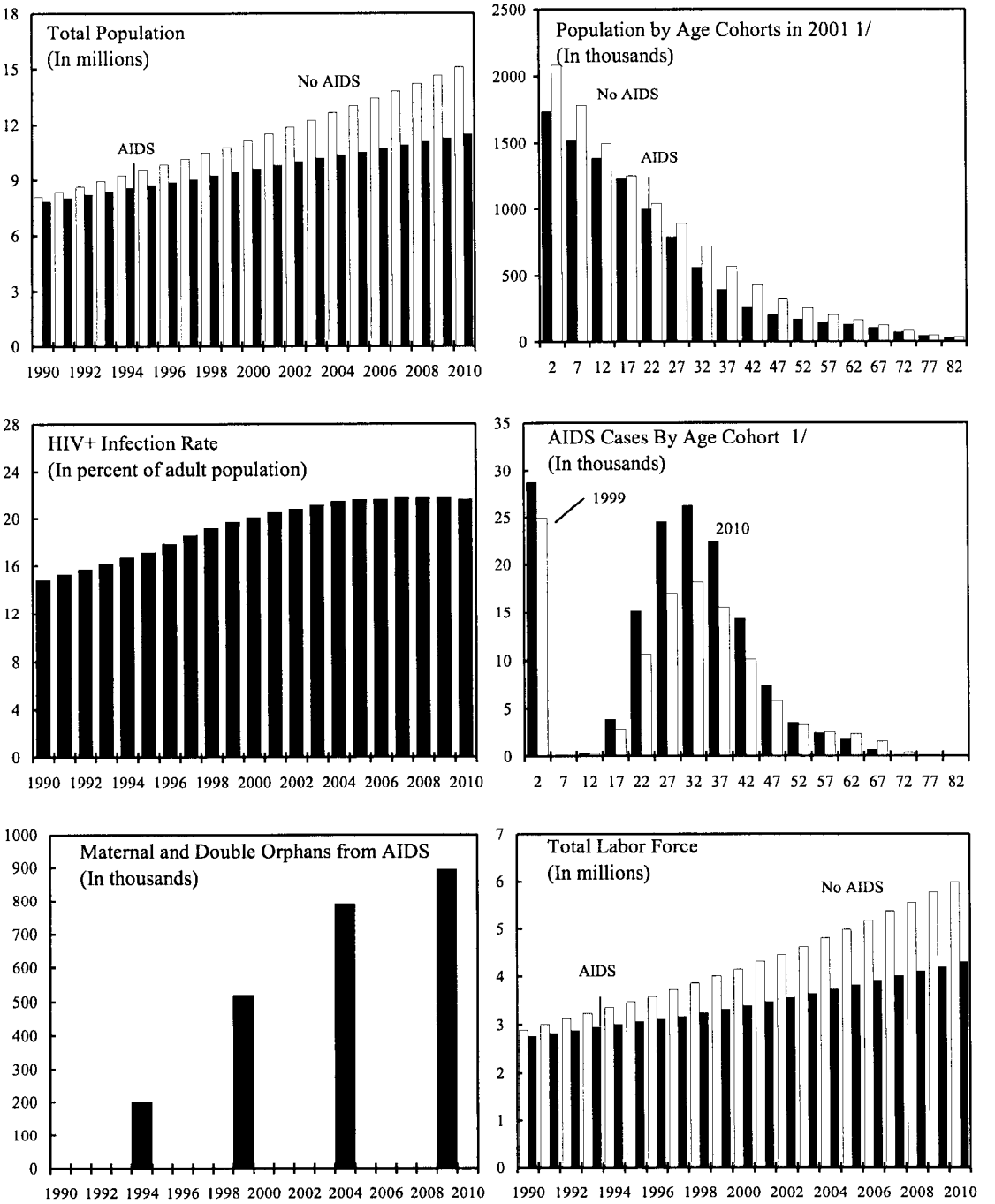
[2] The paper has been discussed with the UNAIDS Resident Representative, the Director General of the National HIV/AIDS/STD/TB Council, officials at the Ministry of Finance and Economic Development, and representatives of the Central Statistical Office in the course of the IMF mission to Zambia for the 2001 Article IV consultation and the third review of the Poverty Reduction and Growth Facility arrangement.

[3] UNAIDS (2000). According to a recent study by the Ministry of Health and Central Board of Health (1999), the HIV infection rate among 15- to 49-year olds was estimated to be over 28 percent in urban areas and 13.6 percent in the countryside. Even though the overall prevalence rate in Zambia continued to increase throughout the decade, it may be expected to stabilize by 2010, as declining HIV prevalence in urban sites balance rising infection rates in rural areas. Nonetheless, as population is projected to grow over the period, the number of HIV-infected persons will continue to increase even if prevalence levels off.

[4] UNAIDS (2000).

[5] Ministry of Health and Central Board of Health (1999) and Hunter and Williamson (2000).

Figure I.1. Zambia: Selected Demographic Indicators, 1990-2010



Sources: U.S. Bureau Census (1999); Ministry of Health and Central Board of Health (1999); UNAIDS (2000); and Fund staff estimates and projections.

1/ For each age cohort, the horizontal axis reports the corresponding median age.

3. While the focus of this paper is on the future impact of the HIV/AIDS pandemic, it must be acknowledged that the disease currently imparts a tremendous strain on all social and economic institutions in Zambian society. Provision of the most basic services by families, organizations and the government is jeopardized by the rising death rates in the working population. The phenomenon is portrayed by recent statistics:

- 75 percent of Zambian households are caring for at least one orphan, in addition to caring for sick family members.

- The health sector has been overwhelmed by the loss of health care workers to AIDS and the increase demand for hospital care; for example, in Lusaka, 60 to 80 percent of all hospital admissions are AIDS related.

- In 1998, 1,300 Zambian teachers died of AIDS--two-thirds of all teachers trained annually.[6]

4. There is no way of measuring the misery and distress that is being and will be caused by the pandemic. The consequences for individuals, both those who get sick and die, and their friends and relatives, are appalling. This paper cannot possibly address this; what it does is present model predictions on the expected long-term impact of HIV/AIDS on Zambia's productive capacity, labor productivity, and other macroeconomic variables of interest, drawing on available demographic projections and a range of other assumptions. Particular attention is paid to the sensitivity of the estimates to variations in these underlying assumptions. In this regard, a key objective is to reflect in model simulations what might happen if the approaching acceleration in AIDS-related deaths leads to a profound change in social and economic conditions—including, for example, a collapse of domestic and external investor confidence.

5. The paper is organized as follows. Section B provides an overview of the socioeconomic effects of HIV/AIDS in Zambia, focusing on the key channels through which the pandemic is likely to affect the macroeconomic outlook and on the uncertainties involved. Section C presents model-based estimates of the impact of HIV/AIDS on potential output and other key macroeconomic variables, and considers the possible effects of HIV/AIDS on the long-term fiscal stance of Zambia. Section D concludes. Details of the theoretical model and of the data are given in Appendices I and II, respectively.

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[6] UNAIDS (1999).

B. An Overview

6. The characteristics of HIV/AIDS and its mode of transmission are the principal determinants of its unique impact on society. This impact can be divided into three broad areas, namely, demographic, social, and economic.

Demographic impact

7. HIV/AIDS will affect the population in a number of ways. There will be increased mortality (more people will die), and many of these people will be in their reproductive years. This is expected to reduce the fertility rate by more than 30 percent. In Zambia, HIV/AIDS is estimated to slow the rate of population growth from 2.7 percent in 1990 to 1.7 percent in 2010 and alter the structure of the population. By the end of the next decade, the population in the working-age cohort is estimated to be 26 percent smaller that it would have been without AIDS, resulting in a 5 percent increase in the dependency ratio and substantial losses of human capital investment.

Social impact

8. As a result of the illness and death of individuals, HIV/AIDS will have an effect on families, communities, and the broader society. Adult death and associated loss of income lead to lower investment in schooling, as children are withdrawn from school to substitute for adult labor. If it is accepted that socioeconomic development goes beyond economic growth and increases in per capita income and includes aspects such as longevity and infant, child and maternal mortality and education, then it is here that the impact of the pandemic will be the most devastating. In the specific case of Zambia, this will make further developmental attempts much more difficult, as the HIV/AIDS hurdle will have to be surmounted, in addition to the other pressing developmental problems. Widespread poverty may also threaten the implementation of any effective HIV/AIDS program in Zambia. With 70 percent of the population living in households unable to fulfill basic needs and a malnourishment rate of 50 percent among Zambian children, the resource base available to fight the deadly disease is severely constrained by the economic realities within the country.

Economic impact

9. There is general consensus among policymakers and economists that HIV/AIDS may cause disorganization and productivity losses, and, in particular, might result in a slowing of economic growth. Several channels of influence can be identified, including the impact on labor supply, saving and investment, and financial intermediation. While these linkages are considered in this section, the effects of the pandemic on prospective health spending and—more broadly—its burden on public finance will be assessed in Section C.

Impact on labor supply

10. A central role is played by labor supply, as implied by demographic profiles incorporating the effects of HIV/AIDS. Growth in labor force is likely to slow at least as much as population growth: as some people will need to stay home to look after sick relatives, falling participation ratios are to be expected. The effects of the pandemic on productivity and human capital are also likely to be significant. Productivity will suffer as a result both of AIDS-related health problems among workers themselves—leading, for example, to increased sick leave, reduced work intensity, and increased labor turnover—and as individuals take time away from work to care for sick family members, attend funerals, and meet other such responsibilities.[7]

11. The prospects for growth in Zambia will be further hampered by the loss of skilled labor—a particularly serious concern, given chronic skill shortages and the limited scope for substitution using unskilled labor, which is in excess supply.[8] While the relative returns to investment in skills and training are likely to increase, sharply reduced life expectancies, potential shortages of personnel able to provide training, and a decrease in general confidence could well weaken incentives and opportunities for such investment.

12. In particular, the impact of the pandemic on the labor force might seriously threaten mine production in Zambia. Copper mining in Zambia is a labor-intensive industry, employing the young and healthy in the population—15 percent of total wage employment in 1996—and accounting for about 12 percent of total GDP and 75 percent of the country's export earnings. Since the industry generally provides training for all its recruits in most of the skilled jobs on the mines and highly trained mining engineers can be very difficult to replace, the losses in skills are likely to be considerable.[9]

Impact on saving and investment

13. A further key channel for the macroeconomic impact of HIV/AIDS is through the effects of the pandemic on saving and—thereby—on investment. With national saving already at an exceptionally low level and international borrowing capacity on the edge of sustainability, Zambia faces one of the most stringent degrees of financing constraint on

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[7] Early case studies on the typology of costs associated with AIDS have found that absenteeism was the major cost experienced by companies in Zambia, as the number of hours lost due to sickness and funerals had already tripled from 1992/3 to 1994/5 (Smith, 1995).

[8] Worrying examples of "brain drain" in Zambia have been pointed out very recently by the *Financial Times* (2001).

[9] Early estimates show that 68 percent of the men who tested positive for HIV in the copper belt were professionals in the mining industry (Nkowane, 1988).

investment among sub-Saharan countries. Overall, the pandemic is likely to magnify the risks for both the saving and the investment outlook, although not necessarily to the same extent.

14. Owing to HIV/AIDS, saving is likely to decline further as a share of GDP. There is some evidence, more generally, that the saving rate in poor, developing countries may be negatively related to the HIV prevalence rate.[10] Considering private saving, the bulk of households will probably be compelled to reduce both saving and non-AIDS-related consumption in order to finance greater health care costs, cover the costs of additional dependents, and meet other adverse effects of AIDS on family expenditure or income. Public resources will also be further depleted, as a result of increased government spending on medical care and various forms of social support.

15. The gloomy outlook for saving would be further affected if highly active antiretroviral treatments (HAARTs) were at some point made more widely available to HIV-positive patients. This would require substantial initial investment in upgrading and extending the health sector infrastructure that is needed to support such treatments. The huge cost impact of HAARTs, even at sharply lower drug prices, is largely a result of the sheer number of patients that would potentially be eligible for treatment, coupled with the fact that these treatments represent ongoing, lifetime expenditures, rather than onetime outlays. In the case of Zambia, the scope of introducing HAARTs is likely to be very limited—even assuming a very low coverage rate, increased international support, and restraints in nonpriority areas of the domestic budget—given the significant proportions of public resources that would be necessary to improve access to them.[11]

16. The outlook for investment is uncertain, however. HIV/AIDS may significantly change investment prospects. Shortages of skilled labor, and its higher cost, would tend to increase the demand for capital investment at a given level of output. But this factor may well be offset by the negative effects on domestic and foreign investment resulting from the impact of AIDS on economic growth, on confidence, and on other aspects of the investment climate.

Impact on financial intermediation

17. The banking sector in Zambia also faces a range of potential pressures as a result of HIV/AIDS. These could include possible increases in loan losses, as mortality rates rise among borrowers, and business sector difficulties—including in the banking sector itself—as skill shortages and employment benefits grow. Several factors could help mitigate these concerns, however. First, banks' business lending tends to concentrate in a few large corporations (including some multinationals) and parastatals, rather than spread over a wide

[10] World Bank (2000).

[11] These issues are discussed in greater detail in Section C.

range of small and medium-sized enterprises. Second, with substantial foreign ownership, the banks may have access to a wider base of funding and expertise than would be available to purely domestically owned and operated banks. Third, banks may require unsecured personal lending to be backed by AIDS insurance. Given the uncertainties over current and future HIV prevalence, this insurance would help transfer the associated financial risks not just outside the banking sector but also outside the country, as at least some of the insurance carriers are part of large international groups.

18. Nevertheless, some important risks and uncertainties remain. Sizable moral hazard problems may arise in cases where the legislation, in order to safeguard privacy, does not require personal lending to be backed by AIDS insurance, especially in a context where AIDS is leading to a significant drop in the life expectancy of those affected.[12] If banks are not fully insulated against loan losses, they may still have substantial exposure to future defaults. Such difficulties could be exacerbated if companies providing AIDS insurance have underestimated the scale of the pandemic. A further uncertainty arises from the future path of national savings and, hence, the extent of banks' ability to provide intermediation services.

C. Modeling the Macroeconomic Impact of AIDS

19. There is a growing literature applying standard models of economic growth to an assessment of the long-term effects of HIV/AIDS on economic performance, particularly in sub-Saharan Africa.[13] Substantial uncertainty, however, still surrounds estimates of the magnitude of these effects. Following closely earlier attempts to model the macroeconomic impact of AIDS, the current paper attempts to predict the long-term macroeconomic impact of HIV/AIDS in Zambia by focusing on its repercussions on the medium- to long-term productive capacity of the economy.[14]

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[12] The extent to which lending to parastatals and personal loans to public sector and parastatal employees are backed by explicit or implicit government guarantees has yet to be determined. While this practice would greatly reduce banks' exposures, it would equally increase the pressure on the public budget and national social security system.

[13] Among the recent studies that have attempted to assess the effect of HIV/AIDS on economic growth, see Forgy (1994) for Zambia; Over (1992), Arndt and Lewis (2000), Bonnel (2001), and ING Barings (2000) for South Africa; Cuddington (1993) for Tanzania; Cuddington and Hancock (1995) for Malawi; BIDPA (2000) and MacFarlan and Sgherri (2001) for Botswana; and Haacker (2000) for a cross-country analysis.

[14] Demand-side effects, such as might arise from changes in consumer or investor confidence, are usually handled by varying the associated model parameters (e.g., for saving and investment rates) rather than by being modeled explicitly, but this is clearly an area where there is scope for further extensions and elaborations of the models involved.

20. Before considering the model-based results of the effects of HIV/AIDS that are presented in the next section, a few comments on earlier findings may be useful. In particular, given the enormity of the human problem arising from AIDS, the macroeconomic effects of the pandemic, as suggested by most recent studies, could be seen as surprisingly modest. In the case of Zambia, for example, Forgy (1994) estimate that, under the worst-case scenario—where Zambia is forced to absorb internally AIDS-related costs—GDP growth over the period 1991-2010 would fall from an average of 3.3 percent a year without AIDS to 2.2 percent a year on average with AIDS. As a result, by 2010 the economy would be 9 percent smaller than it would have been without AIDS. Using more recent demographic projections that incorporate higher rates of HIV prevalence, the current paper estimates that GDP growth would fall on average by 1.5-2.3 percent a year over the coming decade, depending on exactly how the pandemic affects the outlook. Nevertheless, it may seem surprising that output and incomes continue growing at all, when one-fifth of the current working-age population is expected to die within about ten years.

21. The model simulations reported in the next subsection address some of these issues. Attention is given, for example, to the macroeconomic implications of a larger shock to productivity and investment than assumed in previous estimates of the effects of AIDS. In this perspective, the model assesses the impact of AIDS on the economy under different hypothetical scenarios accounting for the following:

- a permanent decline in the rate of capital inflows;
- a permanent decline in the rate of capital accumulation;
- a permanent decline in total factor productivity; and
- greater losses of working time associated with each AIDS case.

The model

22. The theoretical framework adopted in this paper is based on a Solow growth model that has been modified to allow for two sectors (formal and informal) and two labor skill categories (skilled and unskilled). These enhancements allow the model to take into account key features of Zambia's economy, namely, low domestic saving and investment rates, low rate of capital inflows, and high labor intensity, especially in the informal sector.

23. The two sectors are characterized by Cobb-Douglas production functions. Each exhibits constant returns to scale in which output is calculated as a function of inputs (labor and capital) and productivity. Theoretical details of the model, its parameters, and data sources are discussed in the Appendices I and II.

24. The model comprises three labor markets: skilled labor in the formal sector, unskilled labor in the formal sector, and unskilled labor in the informal sector. (All skilled workers are employed in the formal sector.) The three labor markets behave differently. In the skilled formal market, wages adjust to equate demand and supply. In the unskilled formal sector, there is a fixed minimum wage, which is assumed to be higher than the equilibrium wage. As

a result, unemployment arises among unskilled workers in the formal sector. These unemployed workers make up the supply of labor in the informal sector, where market forces operate to equate demand and supply.

25. The model incorporates the impact of AIDS on the economy in several ways:

- The major and most direct effect of the pandemic is captured by the change in the size, age structure, and—therefore—degree of experience of the labor force.

- The model takes into account lower productivity of AIDS-infected workers by including an effective labor supply parameter.

- AIDS-related health spending is assumed to affect both consumption and saving behavior and, therefore, capital accumulation. Increases in health care expenditures are assumed to be met by reductions in saving (50 percent) and nonhealth consumption (50 percent). Capital formation in the informal sector is assumed to be limited by the amount of saving generated in the sector itself. By contrast, investment in the formal sector can make use of domestic and foreign saving. On the basis of available information on the financing of health expenditure, the model also allows for the existence of some form of social security by providing for transfers from the formal sector to the informal sector to support health care spending in the latter.

26. The model is calibrated to reproduce the actual values at constant prices of total output, capital stock, wages, and other key variables for 1996, as explained in details in Appendix II. The main demographic data and projections that underlie model results are shown in Figure 1.

Simulation results: AIDS scenario versus a counterfactual no-AIDS scenario

27. This part of the paper develops scenario projections of key macroeconomic variables under alternative AIDS assumptions, including a no-AIDS counterfactual scenario.[15] The model provides **equilibrium** levels and growth rates for total output, capital stock, consumption, AIDS-related health spending, and labor productivity in both formal and informal sectors. Furthermore, it generates outcomes for employment and wages for skilled and unskilled workers. It also permits changes in key parameters to test the sensitivity of results to assumptions on indirect AIDS effects, including its impact on labor efficiency and foreign investment.

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[15] Given that the disease has been actually affecting the Zambian economy since the first half of the 1980s, it seems more appropriate to present simulation results incorporating the effects of AIDS as the baseline, and the no-AIDS scenario as the hypothetical counterfactual.

The no-AIDS counterfactual scenario

28. Under the assumption of no AIDS, total output would grow at an annual rate of 6.6 percent between 2001 and 2010—or 2.7 percent in per capita terms (Tables I.1and I.2, and Figure I.2). Labor is the main contributor to output growth over the period, reflecting the small capital share that is assumed to characterize the economy in general and the informal sector in particular.[16] The share of capital accumulation in growth is virtually constant over the period because its rate of accumulation would have been low even without the AIDS crisis.

The AIDS baseline scenario

29. The AIDS baseline incorporates the projected effects of AIDS on the population and labor force. With AIDS, growth would slow to 5.1 percent a year over the period 2000-10, compared with 6.6 percent in the no-AIDS scenario (Table I.1, lower panel and Table I.3). This reduction in economic growth comes mainly through two channels. First and by far more important, the direct impact of AIDS on Zambia's labor force would cut growth by about 1 percent, compared with the no-AIDS counterfactual. Second, with AIDS, both national consumption and national saving are assumed to fall in order to finance AIDS-related care. As a consequence, capital accumulation would also slow, and its contribution to growth would fall almost ½ of 1 percentage point below the no-AIDS counterfactual. The overall projected reduction in economic growth due to AIDS—around 1½ percentage points—is broadly in line with Forgy's (1994) predictions, although slightly higher because the estimated prevalence of HIV/AIDS in Zambia has increased since that study was prepared. In addition, the current model incorporates the feedback effects of lower saving on capital accumulation and, therefore, potential output growth.

30. In both formal and informal sectors, the impact of AIDS through the labor force channel can be expected to outweigh the impact through the capital accumulation channel because of the country's low investment rates and capital shares. However, the decline in labor supply growth in the AIDS scenario is somewhat larger in the more labor-intensive informal sector—a contraction of 1.2 percentage points a year versus a decrease of 0.9 percentage points a year in the formal sector. In the latter, skilled labor is the main

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[16] Whereas the formal sector features a capital-output ratio of 1.9 and a capital share parameter of 0.3, the informal sector is assumed to be even more labor intensive, with a capital-output ratio below 0.8 and a capital share parameter of 0.1. Total factor productivity (TFP) is also assumed to grow at different rates in the two sectors: 2.25 percent in the formal sector and 1.125 percent in the informal sector. The economy-wide saving rate is 20 percent, while the rate of capital inflow is 14 percent. These outcomes seem to be broadly consistent with the duality and the binding constraints on capital accumulation characterizing the Zambia economy (see Appendix I).

contributor to the decline in labor growth over the period, accounting for 0.6 percentage points of the whole reduction.

31. With AIDS, output per worker would still grow at the rate of 2.7 percent per annum.[17] Owing to the low rates of capital accumulation, formal and informal labor productivity would be virtually the same as in the no-AIDS scenario, as in both sectors the reduction in GDP growth is accrued almost entirely through the reduction in labor supply. As a consequence, and because wages are driven by labor productivity, the model suggests that AIDS would not significantly affect the income gap between the two sectors.

Table I.1. Zambia: Alternative AIDS Scenarios, 2001-10 1/
(Contributions to output growth, in percent)

No-AIDS counterfactual scenario

	TFP	Labor	Capital	Potential Output
2001	2.0	2.7	1.8	6.5
2003	2.0	2.7	1.8	6.5
2005	2.0	2.7	1.9	6.6
2007	2.0	2.7	1.9	6.6
2010	2.0	2.7	1.9	6.6

AIDS baseline scenario

	TFP	Labor	Capital	Potential Output
2001	1.9	1.7	1.4	5.0
2003	1.9	1.7	1.4	5.1
2005	2.0	1.7	1.4	5.1
2007	2.0	1.8	1.5	5.2
2010	2.0	1.8	1.5	5.2

Source: Fund staff estimates and projections.

1/ Constant 1994 prices

[17] Incidentally, with life expectancy falling, the expected discounted value of GDP per worker falls by much more than the annual rates. This indicates that the situation is actually worse than the GDP per worker numbers indicate. In addition, it should be remembered that the GDP per worker statistic refers only to those who survive the pandemic.

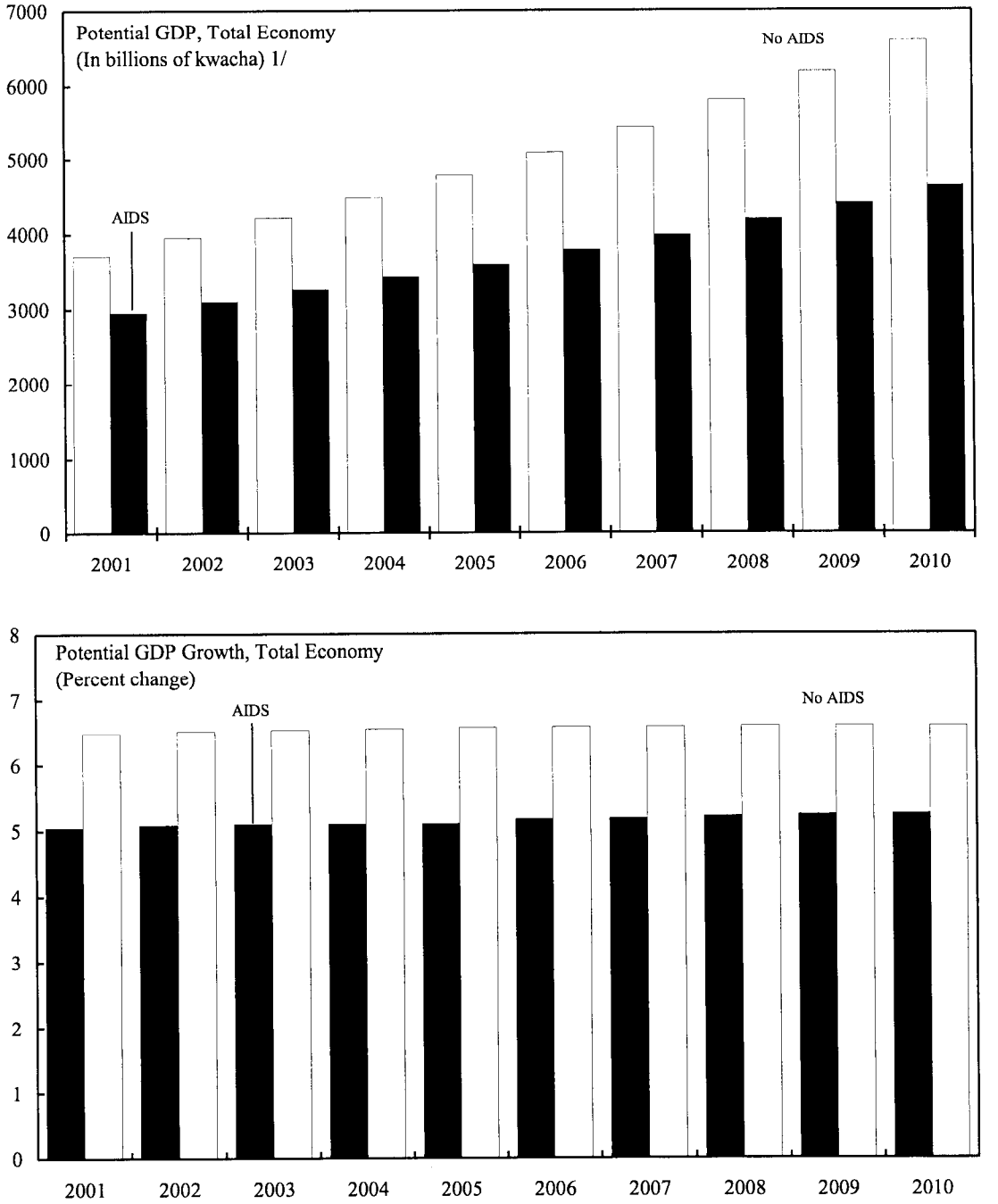
Table I.2. Zambia: No-AIDS Counterfactual Scenario (Simulation A), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	6.5	6.5	6.6	6.6	6.6	6.6
Formal sector	7.1	7.1	7.1	7.1	7.1	7.1
Informal sector	5.0	5.0	5.0	5.1	5.0	5.0
Capital stock growth						
Total economy	1.8	1.8	1.9	1.9	1.9	1.9
Formal sector	2.3	2.3	2.3	2.3	2.3	2.3
Informal sector	0.6	0.6	0.6	0.6	0.6	0.6
Distribution effects						
Output per worker growth						
Total economy	2.7	2.7	2.7	2.7	2.8	2.7
Formal sector	3.4	3.4	3.4	3.4	3.4	3.4
Informal sector	1.3	1.3	1.3	1.3	1.3	1.3
Labor market						
Employment growth						
Total economy	2.7	2.7	2.7	2.7	2.7	2.7
Formal sector	2.5	2.5	2.5	2.5	2.5	2.5
Skilled	1.7	1.7	1.7	1.7	1.7	1.7
Unskilled	0.8	0.8	0.8	0.8	0.8	0.8
Informal sector	3.2	3.2	3.3	3.3	3.3	3.3
Wage growth						
Skilled wages	3.4	3.4	3.4	3.4	3.4	3.4
Unskilled wages (F)	3.4	3.4	3.4	3.4	3.4	3.4
Unskilled wages (I)	1.3	1.3	1.3	1.3	1.3	1.3

Source: Fund staff estimates and projections.

1/ Constant 1994 prices

Figure I.2. Zambia: AIDS and No-AIDS Scenarios, 2001-10



Sources: U.S. Bureau of Census (1999); and Fund staff estimates and projections.

1/ Constant 1994 prices.

Table I.3. Zambia: AIDS Baseline Scenario (Simulation B), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	5.0	5.1	5.1	5.2	5.2	5.1
Formal sector	5.7	5.7	5.7	5.8	5.8	5.7
Informal sector	3.5	3.6	3.6	3.6	3.7	3.6
Capital stock growth						
Total economy	1.4	1.4	1.4	1.5	1.5	1.4
Formal sector	1.8	1.8	1.8	1.8	1.8	1.8
Informal sector	0.4	0.4	0.4	0.5	0.5	0.5
AIDS-related health spending (percent of GDP)						
Total economy	1.4	1.4	1.3	1.2	1.1	1.3
Formal sector	0.9	0.9	0.8	0.8	0.7	0.8
Informal sector	2.4	2.4	2.4	2.3	2.2	2.3
Distribution effects						
Output per worker growth						
Total economy	2.6	2.7	2.7	2.8	2.8	2.7
Formal sector	3.3	3.3	3.3	3.4	3.4	3.4
Informal sector	1.3	1.3	1.3	1.3	1.3	1.3
Labor market						
Employment growth						
Total economy	1.8	1.8	1.7	1.7	1.7	1.7
Formal sector	1.7	1.7	1.6	1.6	1.6	1.6
Skilled	1.1	1.1	1.1	1.1	1.1	1.1
Unskilled	0.5	0.5	0.5	0.5	0.5	0.5
Informal sector	2.0	2.0	2.0	2.0	2.0	2.0
Wage growth						
Skilled wages	3.3	3.3	3.3	3.4	3.4	3.3
Unskilled wages (F)	3.3	3.3	3.4	3.4	3.4	3.4
Unskilled wages (I)	1.2	1.2	1.2	1.3	1.3	1.3

Source: Fund staff estimates and projections.

1/ Constant 1994 prices

Alternative scenarios and sensitivity analysis

32. Estimates of the macroeconomic consequences of AIDS are subject to considerable uncertainty. The key uncertainty concerns the extent of HIV infection and the progression of the disease—including the possibility of a medical breakthrough. Other uncertainties relate to model assumptions, especially the many embedded parameters, the true values of which are largely unknown. The robustness of model results to changes in these parameters can be assessed through sensitivity analysis. The following variations from the baseline AIDS scenario are considered:

- **The rate of capital inflows.** The rate of capital inflows is reduced from 14 percent of GDP in the baseline case to 4 percent.

- **The rate of capital accumulation**. The rate of capital accumulation in the formal sector is reduced by 10 percentage points through an increase in the depreciation rate of the capital stock from 7 percent to 17 percent.

- **The rate of total factor productivity (TFP)**. AIDS reduces TFP growth in the formal and informal sector by ½ of 1 and ¼ of 1 percentage point, respectively.

- **Working time losses associated with each AIDS case.** These are assumed to double compared with the base case, as a result of increased workers' time off for sick leave and the need to look after sick family members.

Permanent decline in the rate of capital inflows

33. If the rate of capital inflows is reduced from 0.14 to 0.04 of GDP, both GDP and output per worker growth are further reduced by 0.2 percent a year on average over the projection period (Table I.4). This is because in the model a reduction in the rate of capital inflows reduces the rate of capital accumulation in the formal sector, thereby slowing the corresponding rates of GDP and productivity growth. As a consequence, demand for both skilled and unskilled labor falls in this sector, and the wage differential for unskilled labor between the two sectors shrinks. The informal sector is not affected, as foreign capital flows only to the formal sector.

Permanent decline in the rate of capital accumulation in the formal sector

34. On the assumption that the pandemic generates a permanent reduction of 10 percentage points in the rate of capital accumulation in the formal sector, the model indicates that GDP growth over 2001-10 would decline to around 4.9 percent a year from 5.1 percent under the baseline scenario (Table I.5). This shock is comparable to a permanent reduction in investor confidence in the formal sector. By construction, the impact on the informal sector is the same as under the baseline AIDS scenario. As a result, the wage gap between unskilled labor in the formal and informal sectors narrows.

Table I.4. Zambia: Lower Rate of Capital Inflows (Simulation C), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	4.7	4.8	4.8	4.9	5.0	4.9
Formal sector	5.2	5.3	5.4	5.5	5.6	5.4
Informal sector	3.5	3.6	3.6	3.6	3.7	3.6
Capital Stock growth						
Total economy	1.1	1.1	1.2	1.2	1.3	1.2
Formal sector	1.3	1.4	1.5	1.6	1.6	1.5
Informal sector	0.4	0.4	0.4	0.5	0.5	0.5
AIDS-related health spending (percent of GDP)						
Total economy	1.5	1.4	1.4	1.3	1.2	1.4
Formal sector	1.0	0.9	0.9	0.8	0.8	0.9
Informal sector	2.4	2.4	2.4	2.3	2.2	2.3
Distribution effects						
Output per worker growth						
Total economy	2.3	2.4	2.4	2.5	2.6	2.5
Formal sector	2.8	2.9	3.0	3.1	3.2	3.0
Informal sector	1.3	1.3	1.3	1.3	1.3	1.3
Labor market						
Employment growth						
Total economy	1.8	1.8	1.7	1.7	1.8	1.8
Formal sector	1.7	1.7	1.6	1.6	1.6	1.6
Skilled	1.1	1.1	1.1	1.1	1.1	1.1
Unskilled	0.5	0.5	0.5	0.5	0.5	0.5
Informal sector	2.0	2.0	2.0	2.0	2.0	2.0
Wage growth						
Skilled wages	2.8	2.9	3.0	3.1	3.2	3.0
Unskilled wages (F)	2.9	3.0	3.0	3.1	3.2	3.0
Unskilled wages (I)	1.2	1.2	1.2	1.3	1.3	1.3

Source: Fund staff estimates and projections.
1/ Constant 1994 prices.

Table I.5. Zambia: Lower Rate of Capital Accumulation (Simulation D), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	4.7	4.8	4.9	5.0	5.1	4.9
Formal sector	5.3	5.4	5.5	5.6	5.6	5.5
Informal sector	3.5	3.6	3.5	3.6	3.7	3.6
Capital Stock growth						
Total economy	1.0	1.1	1.2	1.3	1.3	1.2
Formal sector	1.3	1.5	1.6	1.6	1.7	1.5
Informal sector	0.4	0.4	0.4	0.4	0.4	0.4
AIDS-related health spending (percent of GDP)						
Total economy	1.7	1.7	1.6	1.5	1.4	1.6
Formal sector	1.1	1.1	1.1	1.0	0.9	1.0
Informal sector	2.7	2.7	2.7	2.6	2.5	2.6
Distribution effects						
Output per worker growth						
Total economy	2.3	2.4	2.5	2.6	2.6	2.5
Formal sector	2.9	3.0	3.1	3.2	3.3	3.1
Informal sector	1.3	1.3	1.3	1.3	1.3	1.3
Labor market						
Employment growth						
Total economy	1.8	1.8	1.8	1.8	1.8	1.8
Formal sector	1.7	1.7	1.7	1.7	1.7	1.7
Skilled	1.1	1.1	1.1	1.1	1.1	1.1
Unskilled	0.6	0.6	0.5	0.5	0.6	0.6
Informal sector	2.0	2.0	2.0	2.0	2.1	2.0
Wage growth						
Skilled wages	2.8	3.0	3.1	3.2	3.2	3.1
Unskilled wages (F)	2.9	3.0	3.1	3.2	3.3	3.1
Unskilled wages (I)	1.2	1.2	1.2	1.3	1.3	1.3

Source: Fund staff estimates and projections.
1/ Constant 1994 prices

Permanent reduction in the rate of total factor productivity growth in both sectors

35. If TFP growth is reduced in both the formal and informal sectors by ½ of 1 percentage point, growth is projected to slow to 4.6 percent a year over 2001-10, representing a fall of ½ of 1 percentage point a year compared with the AIDS baseline scenario (Table I.6). Compared with the baseline, both sectors now have slower capital accumulation, together with weaker wage and per capita income growth.[18]

Doubling working time losses associated with AIDS cases

36. If working-time losses double, then effective labor supply expressed in terms of efficiency units would decrease in both sectors. Under this scenario, GDP growth is further reduced on average by 0.1 percentage point over the projection period, compared with the AIDS baseline (Table I.7). Given its higher labor intensity, the informal sector would be slightly more affected than the formal sector. Output per worker and wage growth in both sectors are marginally lower than in the AIDS baseline scenario.

An AIDS scenario with multiple shocks

37. A further scenario is estimated incorporating a combination of the shocks outlined above.[19] GDP growth in this scenario falls to 4.3 percent on average over the next ten years (Table I.8). It is noteworthy that the growth rate arising from multiple small shocks is only 0.3 percentage point lower than that of the earlier scenario incorporating a larger TFP shock alone. Even under multiple shocks, the major reason for slower growth than in the baseline is the reduction in TFP growth. However, lower rates of capital inflows and falling investor confidence further reduce the rate of capital accumulation and GDP growth in the formal sector. The differential in wage growth between unskilled labor in the two sectors becomes very small, meanwhile skilled wage growth is driven below unskilled wage growth in the formal sector, as the productivity growth of skilled labor in the formal sector actually falls below that of unskilled labor.

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[18] The disorganization caused by the pandemic has the potential to induce very profound losses of output. In this respect, falls in TFP are likely to be almost inevitable. This is especially true if one considers the reduction in effort caused by the realization that the longer-term rewards for each worker and his/her family members are likely to be smaller than they would have been without AIDS.

[19] Specifically, the rate of capital inflows is reduced to 0.04 of GDP (compared with 0.14 in the baseline scenario); the rate of capital accumulation is reduced by 10 percentage points; TFP growth is reduced by ½ of 1 percentage point in the formal sector and by ¼ of 1 percentage point in the informal sector; and working-time losses double, as in the previous scenario.

Table I.6. Zambia: Lower TFP (Simulation E), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	4.5	4.6	4.6	4.6	4.7	4.6
Formal sector	5.0	5.0	5.0	5.0	5.1	5.0
Informal sector	3.2	3.3	3.3	3.3	3.4	3.3
Capital Stock growth						
Total economy	1.3	1.3	1.3	1.3	1.4	1.3
Formal sector	1.6	1.6	1.6	1.6	1.6	1.6
Informal sector	0.4	0.4	0.4	0.4	0.4	0.4
AIDS-related health spending (percent of GDP)						
Total economy	1.3	1.3	1.2	1.2	1.1	1.2
Formal sector	0.8	0.8	0.7	0.7	0.6	0.7
Informal sector	2.5	2.5	2.5	2.4	2.3	2.4
Distribution effects						
Output per worker growth						
Total economy	2.1	2.2	2.2	2.2	2.3	2.2
Formal sector	2.5	2.6	2.6	2.7	2.7	2.6
Informal sector	1.0	1.0	1.0	1.0	1.0	1.0
Labor market						
Employment growth						
Total economy	1.7	1.7	1.7	1.7	1.7	1.7
Formal sector	1.7	1.7	1.6	1.6	1.6	1.6
Skilled	1.1	1.1	1.1	1.1	1.1	1.1
Unskilled	0.5	0.5	0.5	0.5	0.5	0.5
Informal sector	2.0	2.0	2.0	2.0	2.0	2.0
Wages growth						
Skilled wages	2.5	2.6	2.6	2.7	2.7	2.6
Unskilled wages (F)	2.6	2.6	2.7	2.7	2.7	2.7
Unskilled wages (I)	0.9	0.9	1.0	1.0	1.0	1.0

Source: Fund staff estimates and projections.

1/ Constant 1994 prices

Table I.7. Zambia: Higher Work Loss Owing to AIDS (Simulation F), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	4.8	4.9	4.9	5.0	5.1	5.0
Formal sector	5.4	5.5	5.5	5.6	5.6	5.5
Informal sector	3.5	3.5	3.5	3.6	3.7	3.6
Capital Stock growth						
Total economy	1.2	1.2	1.2	1.3	1.3	1.3
Formal sector	1.5	1.5	1.6	1.6	1.7	1.6
Informal sector	0.4	0.4	0.4	0.4	0.4	0.4
AIDS-related health spending (percent of GDP)						
Total economy	1.6	1.6	1.5	1.4	1.3	1.5
Formal sector	1.0	1.0	1.0	0.9	0.8	0.9
Informal sector	2.7	2.7	2.7	2.6	2.5	2.6
Distribution effects						
Output per worker growth						
Total economy	2.6	2.6	2.6	2.7	2.7	2.7
Formal sector	3.2	3.3	3.3	3.3	3.3	3.3
Informal sector	1.3	1.3	1.3	1.3	1.3	1.3
Labor market						
Employment growth						
Total economy	1.8	1.8	1.8	1.8	1.8	1.8
Formal sector	1.7	1.7	1.7	1.7	1.7	1.7
Skilled	1.1	1.1	1.1	1.1	1.1	1.1
Unskilled	0.6	0.6	0.5	0.5	0.6	0.6
Informal sector	2.0	2.0	2.0	2.0	2.1	2.0
Wage growth						
Skilled wages	3.2	3.2	3.2	3.3	3.3	3.3
Unskilled wages (F)	3.2	3.3	3.3	3.3	3.3	3.3
Unskilled wages (I)	1.2	1.2	1.2	1.3	1.3	1.3

Source: Fund staff estimates and projections.
1/ Constant 1994 prices

Table I.8. Zambia: "AIDS-Pessimistic" Scenario (Simulation G), 2001-10 1/
(Percentage change, unless otherwise stated)

	2001	2003	2005	2007	2010	Average
Macroeconomic impact						
Output growth						
Total economy	4.0	4.2	4.3	4.5	4.6	4.3
Formal sector	4.3	4.6	4.8	5.0	5.1	4.8
Informal sector	3.4	3.4	3.4	3.5	3.5	3.4
Capital Stock growth						
Total economy	0.6	0.8	0.9	1.0	1.2	0.9
Formal sector	0.7	1.0	1.2	1.3	1.5	1.2
Informal sector	0.4	0.4	0.4	0.4	0.4	0.4
AIDS-related health spending (percent of GDP)						
Total economy	1.8	1.8	1.7	1.6	1.5	1.7
Formal sector	1.2	1.2	1.2	1.1	1.0	1.1
Informal sector	2.7	2.7	2.7	2.6	2.5	2.6
Distribution effects						
Output per worker growth						
Total economy	1.6	1.8	1.9	2.1	2.2	1.9
Formal sector	1.9	2.2	2.4	2.6	2.7	2.4
Informal sector	1.1	1.1	1.1	1.2	1.2	1.1
Labor market						
Employment growth						
Total economy	1.8	1.8	1.7	1.7	1.7	1.7
Formal sector	1.7	1.7	1.6	1.6	1.6	1.6
Skilled	1.1	1.1	1.1	1.1	1.1	1.1
Unskilled	0.5	0.5	0.5	0.5	0.5	0.5
Informal sector	2.0	2.0	2.0	2.0	2.0	2.0
Wages growth						
Skilled wages	1.8	2.1	2.4	2.6	2.7	2.4
Unskilled wages (F)	1.9	2.2	2.4	2.6	2.8	2.4
Unskilled wages (I)	1.1	1.1	1.1	1.1	1.1	1.1

Source: Fund staff estimates and projections.
1/ Constant 1994 prices

Fiscal implications

38. HIV/AIDS is likely to lead to a significant increase in public expenditures in the years ahead, especially because of rising health spending. With output growth expected to slow, public revenues will also be lower than in a no-AIDS context. Largely because of the uncertainty surrounding prospective health spending—particularly the types of HIV/AIDS treatments that will be available, their cost, and likely take-up rates—it is not possible to arrive at a single "most probable" fiscal profile for Zambia over the next five to ten years. This section aims, instead, to indicate the rough order of magnitude of some public expenditure scenarios implied by AIDS and its consequences, drawing where possible on the model results presented in Section B. This subsection does not address a broader concern relating to the operations and efficiency of the public sector itself—whether there is a risk that rising rates of illness and death, especially among skilled personnel, will significantly impair the ability of public agencies to administer tax systems and spending programs, provide quality advice and support to government, and handle other responsibilities.

Public expenditure

39. In the central AIDS scenario presented in Table I.3, AIDS-related health spending is projected to rise by 1.3-1.9 percentage points of GDP over the next ten years. This apparently mild impact is based, however, on conservative assumptions regarding treatment approaches. First, such basic treatments essentially take the form of the palliative care, prevention, and clinical treatment of opportunistic infections for AIDS patients—comforting the sick but, ultimately, probably not prolonging their life significantly in most cases. An alternative approach that extends to the provision of HAARTs, which can delay the development of full-blown AIDS among those infected with HIV, is considered briefly below. Second, the cost of providing such basic treatments to AIDS patients is assumed to be about $420, approximately twice the GDP per capita.[20] These costs appear to vary widely from country to country, and costs between 100 percent and 400 percent of GDP per capita have been observed in several sub-Saharan countries.[21]

40. The increased health spending noted above is an economy-wide result; the model as specified does not distinguish between public and private sector impacts. However, with the bulk of health spending—and almost all AIDS-related expenditures—currently financed by the public sector, it would appear reasonable to assume that most of the increase in spending would also come from the public sector. Based on available information on the financing of health expenditure (see Appendix II), the model assumes that 39 percent of increased health

[20] Haacker (2001).

[21] BIDPA (2000).

spending is financed through increased public health expenditure. Hence, owing to AIDS-related health care, public expenditure would increase by ½ of 1 and ¾ of 1 percentage point of GDP per year under these assumptions. These estimates would, however, rise rapidly—indeed, at a disproportionate rate—if higher treatment costs are assumed, because national saving (and, hence, capital accumulation and economic growth) would decline as health care costs rise.

41. While, according to model estimates, AIDS-related public health spending is expected to increase by ½ of 1 and ¾ of 1 percentage point of GDP per year, it is worth noticing that for 2001 9 percent of the programmed Initiative for Heavily Indebted Poor Countries (HIPC) assistance—totaling US$86 million over the year—was allocated to HIV/AIDS, although another 13 percent was allocated to the health sector. Overall, HIPC-financed health spending accounted for 0.6 percent of total GDP in 2001, approximately what was needed to cover the estimated increase in public health spending due to AIDS.

42. As noted above, these estimates do not provide for the introduction of the combination therapies that are now widely used in advanced economies. In this regard, the number-one issue affecting the outlook for health spending concerns the extent to which HAARTs are made available to HIV-positive patients.[22] At western prices—amounting to at least $10,000 per patient per year—such treatment costs would be larger than the total Zambian GDP, even if take-up rates were only 5 percent. Expenditures on HAARTs would still be prohibitive—absorbing more than 10 percent of the total national resources—even if prices were reduced to about $1,000. At prices of about $350—as recently proposed by a manufacturer of generic versions of these drugs—and maintaining the assumption of a 5 percent coverage rate, the implied health spending would be reduced to 3-4 percent of GDP (Figure I.3). While the last-mentioned scenario may be hypothetical at this point, it does serve to illustrate the point that the scope for introducing these advanced-treatment options through public health services is extremely limited in Zambia, at least under current conditions. At the current cost of $60 per month, only a coalition of private companies in the mining and banking sectors is providing triple therapy with antiretrovirals to managers and highly skilled personnel living with HIV. Although antiretroviral therapies will remain accessible to a minority of the Zambian population only, proposed reductions in the prices of HAARTs have the potential to expand the range of those who can afford them. Restraints in nonpriority areas of the domestic budget and significant international support are, therefore, essential for combination therapies to be feasibly introduced through public health services.

43. A further impediment to the widespread adoption of HAARTs is the inadequate development of the health sector infrastructure that would be needed to support these regimes. The expenditure estimates above do not include any provision for further capital

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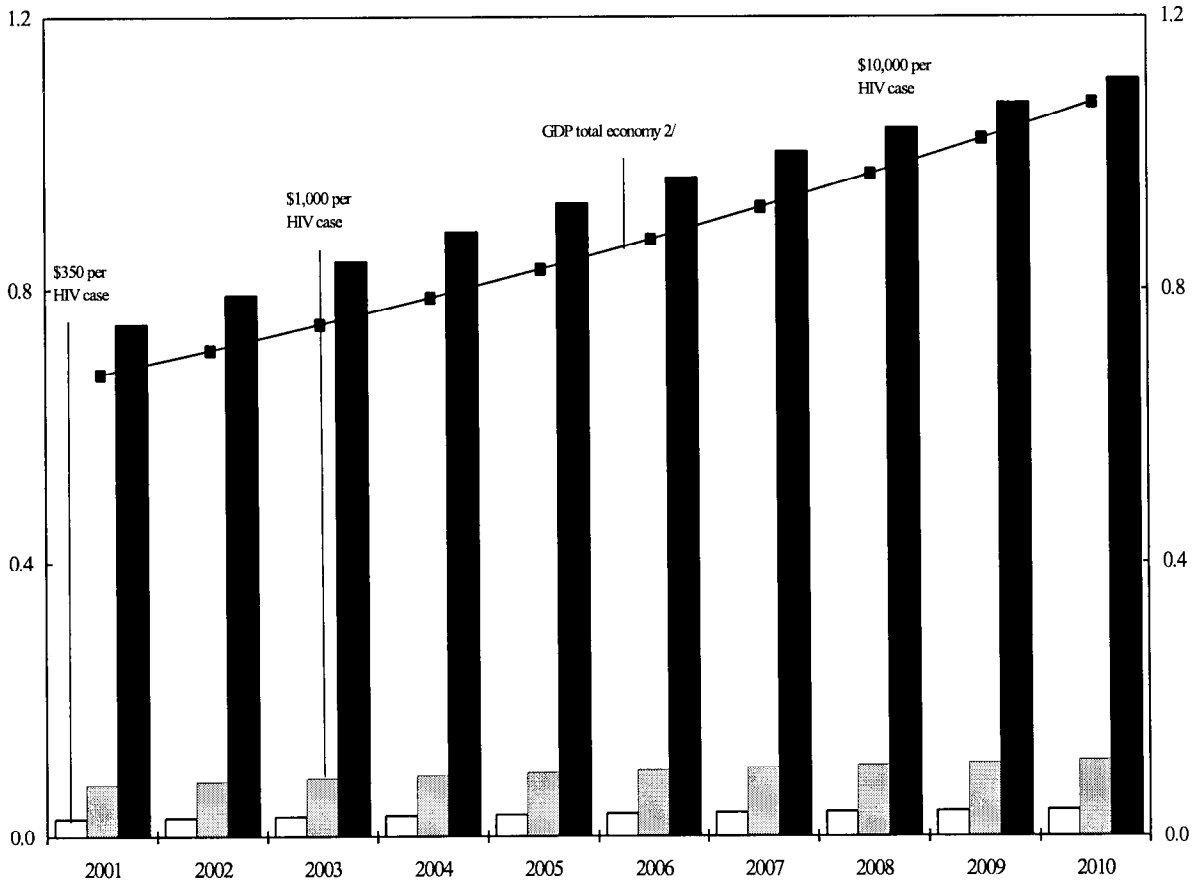
[22] The possibility of introducing temporary treatments to reduce the rate of mother-to-child transmission is not considered here.

Figure I.3. Zambia: Illustrative HIV Treatment-Cost Scenarios, 2001-10 1/
(In billions of U.S. dollars)



Sources: UNAIDS (2000); and Fund staff estimates and projections.

1/ Assuming 5 percent coverage.
2/ "Total economy" GDP is obtained by using total GDP model estimates under the baseline AIDS scenario, evaluated at a fixed exchange rate (US$1= K3,900).

costs in the health sector, or for additional staffing, training, and other forms of development.[23]

44. The spread of HIV/AIDS will also affect other areas of public spending. In particular, there are likely to be pressures for a significant rise in spending on social support, given the expected increases in poverty and in the number of orphans. With the number of orphans expected to explode to over 2,000,000 by 2010, increased spending on orphans' allowances could be substantial.

Revenues

45. HIV/AIDS may affect the prospective flow of public revenues through changes both in the revenue base and in effective tax rates on that base. The largest impact on revenues will come from the slowdown in GDP growth. If the share of fiscal revenue in GDP were to remain constant, in 2010 revenues would be 16 percent lower than without AIDS, assuming that, in 10 years' time, is GDP growth will be 1½ percentage points lower than it would have been otherwise. In addition, there is a risk that the revenue share of GDP could fall (in the absence of offsetting policy adjustments). Such a decline could result, for example, from increased difficulties in tax administration, if labor turnover and skill shortages rise sharply in the public sector, and possibly also from reduced tax compliance as AIDS-related economic and social pressures increase.

D. Conclusions

46. The principal conclusions of the analysis are as follows:

- Growth impediments in Zambia appear to be magnified by the deadly virus. Three reasons can be noted. First, AIDS is likely to reduce the size and the productivity of the labor force, deplete human capital investment, and, hence, add to the obstacles to growth already apparent in the economy. Second, the current constraints on physical investment—both from domestic sources and the drawing on foreign capital—may be further aggravated as the impact of AIDS takes its toll on economic activity and confidence. Third, a less tangible but possibly significant risk could come from a broader weakening in the fabric of society as mortality rates, orphan numbers, dependency ratios, and other sources of social pressure rise to unprecedented levels. AIDS will have a negative impact on the rate of economic growth in Zambia over the coming decade. Simulations incorporating a necessarily limited range of potential effects arising from the pandemic suggest that the rate of GDP growth could fall from 6.6 percent a year without AIDS to between 4.3-5.1 percent a year on average with

[23] On this point, see Haacker (2001).

AIDS. As a result, in 2010 the economy would be one-fifth smaller than it would have been without AIDS.

- In a capital-constrained economy such as Zambia's, the major impact of the disease comes from the projected lower rates of growth in effective labor productivity. As investment rates would have been low and capital shares small even without AIDS, the impact of the pandemic through the labor force channel can be expected to outweigh the negative effects of slower capital accumulation.

- Redistribution effects across sectors and labor skills arising as a result of AIDS are estimated to be negligible. These might stem from changes in the relative growth rate of the formal and informal sectors, compared with the growth of their labor supply. In these circumstances, the main sectoral impact on income distribution would arise from a shrinking of the wage differential between the formal and informal sectors, as formal sector productivity growth is expected to suffer more from the impact of AIDS than informal sector productivity growth.

- The fiscal situation in Zambia will almost certainly deteriorate as a result of HIV/AIDS. Even under quite conservative assumptions about AIDS treatment strategies, public expenditures could rise by ½ of 1 to ¾ of 1 percentage point of GDP as a result of higher health care spending, together with increased social support and public sector employment costs. Public revenues could also fall as a share of GDP if economic and social pressures lead to weaker tax administration and compliance. Finally, the scope for the introduction of HAARTs through public health services remains extremely limited in Zambia over the short term, even at the lowest end of their price range and for low coverage rates, given the significant proportions of public resources that would be necessary to improve access to the treatments. International support and donor intervention should, therefore, be deemed as essential in this respect.

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Theoretical Model

47. This appendix provides analytical details of the theoretical model used in Section C. Parameters are given in Appendix Table I.9.

Health spending allocation

48. The immediate impact of AIDS is on health spending. Following Cuddington and Hancock (1995), AIDS-related health care costs incurred by individuals in the formal and informal sectors are represented by H_f and H_i, respectively:

$$H_f = m_f a_f L_f + m_f^c a_f^c N_f^c \quad (1)$$

$$H_i = m_i a_i L_i + m_i^c a_i^c N_i^c \ , \quad (2)$$

where m is the yearly medical cost per AIDS cases, a is the rate of AIDS cases in the adult population, and a^c the corresponding rate with respect to the population below the age of 15 years; L is labor force, and N^c is the population below the age of 15 years. Subscripts f and i denote the formal and informal sectors, respectively, whereas superscript c stands for children whose parents are working in either sector[24].

Capital accumulation and consumption

49. Health care expenditures in (1) and (2) are met by reducing both saving and consumption. Moreover, the model assumes that informal sector capital formation is limited by the amount of saving generated by the sector itself. Foreign reserves are available only for investment in the more capital-intensive formal sector. Nonetheless, the model allows for transfers from the formal to the informal sector as a form of social security. The capital accumulation process in the two sectors of the economy can be represented as follows:

$$\Delta K_{f,t} = \sigma_f Y_{f,t} + \sigma_{ff}(Y_{f,t} + Y_{i,t}) - x_f(H_{f,t} + \omega\ H_{i,t}) - \delta_f K_{f,t-1}$$
$$\Delta K_{i,t} = \sigma_i Y_{i,t} - x_i(1-\omega)H_{i,t} - \delta_i K_{i,t-1} \ ,$$

where σ denotes the saving rate, foreign saving is assumed to be a constant proportion of GDP, and δ is the depreciation rate. x represents the proportion of AIDS-related medical costs that are paid for by reducing saving in either sector, whereas ω is the

[24] Health costs related to children and children with AIDS are allocated across formal and informal sectors in the same proportion as labor force.

Table I.9. Zambia: Initial Model Parameters

Symbol	Description	Value	Symbol	Description	*Value*
	Formal Sector			**Informal Sector**	
m_f	yearly medical cost per adult AIDS cases (kwacha)	507,360	*m_i*	yearly medical cost per adult AIDS cases (kwacha)	507,360
m_cf	yearly medical cost per children AIDS cases (kwacha)	507,360	*m_ci*	yearly medical cost per children AIDS cases (kwacha)	507,360
σ_*f*	saving rate	0.20	σ_*i*	saving rate	0.20
σ_*ff*	rate of capital inflow	0.14			
x_f	AIDS costs met by reducing saving	0.50	*x_i*	AIDS costs met by reducing saving	0.50
ω	rate of AIDS-related transfer costs	0.61	$1-\omega$	rate of AIDS-related transfer costs	0.39
δ_*f*	depreciation rate	0.07	δ_*i*	depreciation rate	0.07
α_*f*	constant -- production function	4,531	α_*i*	constant -- production function	19,204
γ_*f*	exogenous technological trend	0.0225	γ_*i*	exogenous technological trend	0.01125
β_*s*	skilled labor share of output	0.46			
β_*u*	unskilled labor share of output	0.22	β_*i*	unskilled labor share of output	0.87
λ_*s*	productivity lost per AIDS case -- skilled	1			
λ_*u*	productivity lost per AIDS case -- unskilled	1	λ_*i*	productivity lost per AIDS case -- unskilled	1
ρ1_*s*	constant -- age efficiency	6.2			0.12
ρ2_*s*	linear term -- age efficiency	0.067			0.46
ρ3_*s*	quadratic term -- age efficiency	-0.0012			0.22
ρ1_*u*	constant -- age efficiency	5.6	ρ1_*u*	constant -- age efficiency	5.6
ρ2_*u*	linear term -- age efficiency	0.027	ρ2_*u*	linear term -- age efficiency	0.027
ρ3_*u*	quadratic term -- age efficiency	-0.0006	ρ3_*u*	quadratic term -- age efficiency	-0.0006
w_s	wage, skilled (kwacha, constant prices 1994)	1,182,469			
w_u	wage, unskilled (kwacha, constant prices 1994)	431,998	*w*_*u*	wage, unskilled (kwacha, constant prices 1994)	111,601
Y_f/Y	share of total output -- formal	0.64	*Y_i/Y*	share of total output -- informal	0.36
K_f/Y_f	capital-output ratio	1.91	*K_i/Y_i*	capital-output ratio	0.77

share of medical costs incurred by individual in the informal sector that are covered by reducing formal sector saving. Rearranging the above equation yields the following:

$$\Delta K_{f,t} = [\sigma_f + \sigma_{ff}(1 + \frac{Y_{i,t}}{Y_{f,t}}) - x_f(\frac{H_{f,t}}{Y_{f,t}} + \omega \frac{H_{i,t}}{Y_{f,t}})]Y_{f,t} - \delta_f K_{f,t-1}$$

$$\Delta K_{i,t} = [\sigma_i - x_i(1-\omega)\frac{H_{i,t}}{Y_{i,t}}]Y_{i,t} - \delta_i K_{i,t-1} \ .$$

The capital accumulation process in the two sectors reduces to

$$\Delta k_{f,t} = [\sigma_f + \sigma_{ff}(1 + \frac{Y_{i,t}}{Y_{f,t}}) - x_f(\frac{H_{f,t}}{Y_{f,t}} + \omega \frac{H_{i,t}}{Y_{f,t}})]y_{f,t} - \frac{\delta_f + n_f}{1+n_f} k_{f,t-1}$$

$$\Delta k_{i,t} = [\sigma_i - x_i(1-\omega)\frac{H_{i,t}}{Y_{i,t}}]y_{i,t} - \frac{\delta_i + n_i}{1+n_i} k_{i,t-1} \ ,$$

where lower-case letters indicate corresponding levels per worker and n stands for the rate of population growth in each sector.

The steady state capital stock for the two sectors can be derived by letting Δk_f and

Δk_i equal to zero and solving for $\bar{k}_f$ and $\bar{k}_i$, respectively. It follows that

$$\bar{k}_f = \frac{1+n_f}{\delta_f + n_f}[\sigma_f + \sigma_{ff}(1 + \frac{Y_{i,t}}{Y_{f,t}}) - x_f(\frac{H_{f,t}}{Y_{f,t}} + \omega \frac{H_{i,t}}{Y_{f,t}})]y_{f,t} \qquad (3)$$

$$\bar{k}_i = \frac{1+n_i}{\delta_i + n_i}[\sigma_i - x_f(1-\omega)\frac{H_{i,t}}{Y_{i,t}})]y_{i,t} \ . \qquad (4)$$

The above medical expenditure and saving equations imply nonmedical consumption equal to the following:

$$C_f = (1-\sigma_f)Y_f - (1-x_f)H_f - (1-x_f)\omega \ H_i$$

$$C_i = (1-\sigma_i)Y_i - (1-x_i)(1-\omega)H_i$$

for the formal and informal sectors, respectively. Dividing both sides of the consumption equations by total labor force in the corresponding sector (i.e. L_f and L_i) yields the following expressions for per capita consumption by sector:

$$c_f = (1-\sigma_f)y_f - (1-x_f)h_f - (1-x_f)\omega\ h_i \tag{5}$$

$$c_i = (1-\sigma_i)y_i - (1-x_i)(1-\omega)h_i\ . \tag{6}$$

Production functions and efficiency units

50. Output in both sectors is represented by a Cobb-Douglas production function exhibiting constant returns to scale. Specifically, the formal sector employs three inputs: skilled labor, unskilled labor, and capital. The informal sector, instead, uses only two factors: unskilled labor and capital. The corresponding production functions are given below:

$$Y_f = \alpha_f e^{\gamma_f (t-t_0)} Z_s^{\beta_s} Z_u^{\beta_u} K_f^{(1-\beta_s-\beta_u)} \tag{7}$$

$$Y_i = \alpha_i e^{\gamma_i (t-t_0)} Z_i^{\beta_i} K_i^{(1-\beta_i)}\ , \tag{8}$$

where Z indicates effective labor supply measured in efficiency units. The term γ represents an exogenous technological trend, while the constant term α is used to calibrate the model to fit the data in the base year 1996. Finally, the β's signify the shares of output attributable to each factor.

51. AIDS has a direct impact on labor supplies by changing the size, the structure, and the level of experience (i.e., efficiency) of the labor force. In line with Cuddington and Hancock (1995), labor experience is captured by measuring effective labor supply in terms of efficiency units:

$$Z_s = \sum_{j=15}^{64} (1-\lambda_s a_{j,s})\left[\rho_{1s} + \rho_{2s}(j-15) + \rho_{3s}(j-15)^2\right] L_{j,s}$$

$$Z_u = \sum_{j=15}^{64} (1-\lambda_u a_{j,u})\left[\rho_{1u} + \rho_{2u}(j-15) + \rho_{3u}(j-15)^2\right] L_{j,u}\ ,$$

where L_j is the number of workers in cohort j, a_j is the number of AIDS cases in cohort j, and λ is the fraction of work year lost per AIDS case as a result of sick leave or absence to take care of an AIDS-infected family member. As the productivity gains from work experience cannot be evaluated directly, a nonlinear relationship between earnings and productivity is assumed. It is proxied by a second-order polynomial with: ρ parameters. In this way, indices of experience for each skill category can be derived as follows:

$$\bar{\rho}_s = \frac{Z_s}{L_s} \tag{9}$$

$$\bar{\rho}_u = \frac{Z_u}{L_u} \tag{10}$$

Plugging these indices into the formal sector production function, yields:

$$Y_f = \alpha_f e^{\gamma_f (t-t_0)} \left(\bar{\rho}_s^{\beta_s} \bar{\rho}_u^{\beta_u}\right)\left(L_s^{\beta_s} L_u^{\beta_u}\right) K_f^{(1-\beta_s-\beta_u)} \quad . \tag{11}$$

Similarly, for the informal sector, it holds:

$$Y_i = \alpha_i e^{\gamma_i (t-t_0)} \left(\bar{\rho}_i^{\beta_i}\right)\left(L_i^{\beta_i}\right) K_f^{(1-\beta_i)} \tag{12}$$

where

$$\bar{\rho}_i = \frac{Z_i}{L_i} = \sum_{j=15}^{64} (1-\lambda_i a_{j,i})\left[\rho_{1u} + \rho_{2u}(j-15) + \rho_{3u}(j-15)^2\right]\frac{L_{j,i}}{L_i} \quad . \tag{13}$$

Equations (11) and (12) can be rewritten in terms of output per worker as follows:

$$y_f = \alpha_f e^{\gamma_f (t-t_0)} \left(\bar{\rho}_s^{\beta_s} \bar{\rho}_u^{\beta_u}\right)\left(\frac{L_s}{L_f}\right)^{\beta_s}\left(\frac{L_u}{L_f}\right)^{\beta_u} k_f^{(1-\beta_s-\beta_u)} \tag{14}$$

$$y_i = \alpha_i e^{\gamma_i (t-t_0)} \left(\bar{\rho}_i^{\beta_i}\right) k_i^{(1-\beta_i)} \tag{15}$$

Substituting equations (14) and (15) back into equations (3) and (4) and rearranging, let the steady state capital stock in the two sectors be functions of income allocation between sectors, labor force allocation between skill categories, health care costs, and labor efficiency indices. These variables are assumed to remain unchanged throughout the simulation period (we are implicitly assuming that AIDS does not generate any redistribution effect apart from the one on age/experience structure of the labor force):

$$\bar{k}_f = \left\{\frac{1+n_f}{\delta_f + n_f}\left[\sigma_f + \sigma_{ff}\left(1 + \frac{Y_{i,t}}{Y_{f,t}}\right) - x_f\left(\frac{H_f}{Y_f} + \omega\frac{H_i}{Y_f}\right)\right]\alpha_f e^{\gamma_f (t-t_0)}\left(\bar{\rho}_s^{\beta_s}\bar{\rho}_u^{\beta_u}\right)\left(\frac{L_s}{L_f}\right)^{\beta_s}\left(\frac{L_u}{L_f}\right)^{\beta_u}\right\}^{\frac{1}{\beta_s+\beta_u}} \tag{16}$$

$$\bar{k}_i = \bar{\rho}_i\left\{\frac{1+n_i}{\delta_i + n_i}\left[\sigma_i - x_f(1-\omega)\frac{H_i}{Y_i}\right]\alpha_i e^{\gamma_i (t-t_0)}\right\}^{\frac{1}{\beta_i}} \quad . \tag{17}$$

Labor allocation

52. While the economy is made up of a formal and an informal sector, labor is divided into skilled and unskilled categories. As we implicitly assume that all skilled workers are employed in the formal sector, the model comprises three labor markets: skilled formal sector, unskilled formal sector, and unskilled informal sector.

53. The three labor markets behave differently. The skilled formal sector is assumed to be a perfectly competitive market, where wages adjust to equate demand and supply at any time. In the unskilled formal sector, instead, there is a fixed minimum wage that is higher than the equilibrium wage. As a result, unemployment arises among unskilled workers in the formal sector.

54. As labor demand in the informal sector is derived from the excess of unskilled labor supply in the formal sector, let us first focus on the allocation of skilled and unskilled labor within the formal sector. Firms in the formal sector are assumed to choose the optimal composition of skilled/unskilled labor as a solution to a constrained minimization problem. Namely, we suppose that firms in the formal sector are supposed to choose the skill composition of their labor force in such a way that the total cost of production is minimized, subject to (i) a given production function, (ii) a given minimum wage for unskilled workers, and (iii) a labor supply featuring long-run demographic constraints (i.e., a vertical long-run labor supply). Because of (iii), the constrained minimization problem can be restated in terms of average cost per unit of labor:

$$\min_{\frac{L_s}{L_f},\frac{L_u}{L_f}} w_s \frac{L_s}{L_f} + w_u \frac{L_u}{L_f} + i\bar{k}_f \tag{18}$$

$$\textbf{such that } \bar{y}_f = \alpha_f e^{\gamma_f (t-t_0)} \left(\bar{\rho}_s^{\beta_s} \bar{\rho}_u^{\beta_u}\right) \left(\frac{L_s}{L_f}\right)^{\beta_s} \left(\frac{L_u}{L_f}\right)^{\beta_u} \bar{k}_f^{(1-\beta_s-\beta_u)} \tag{19}$$

$$\textbf{such that } w_u = w_u^{\min}. \tag{20}$$

Substituting $\frac{L_u}{L_f}$ out for (19) and plugging it back into (18)—when (20) also holds true—the average cost is minimized with respect to $\frac{L_s}{L_f}$. The first-order condition yields the optimal conditional demand function for skilled labor in the formal sector:

$$\left(\frac{L_s}{L_f}\right)^* = \left(\frac{\beta_s w_u^{\min}}{\beta_u \rho_u w_s^*}\right)^{\frac{\beta_u}{\beta_s+\beta_u}} \left(\frac{\bar{y}_f}{\alpha e^{\gamma_f (t-t_0)}}\right)^{\frac{1}{\beta_s+\beta_u}} (\rho_s)^{-\frac{\beta_s}{\beta_s+\beta_u}} \left(\bar{k}_f\right)^{1-\frac{1}{\beta_s+\beta_u}} . \qquad (21)$$

55. Since the skilled labor market is assumed to be perfectly competitive, with wages w_s adjusting to equate demand and supply, then both L_s^* and w_s^* are directly observable in the market:

$$\left(\frac{L_s}{L_f}\right)^* = \left(\frac{L_s}{L_f}\right)^d = \left(\frac{L_s}{L_f}\right)^s \quad \text{and} \quad w_s^* = w_s.$$

By contrast, the equilibrium wage and equilibrium level of unskilled labor in the formal sector are not directly observable because the unskilled formal sector is not assumed to clear. Their suboptimal values can, however, be derived under constraints (19) and (20) by plugging equation (19) into equation (21). Rearranging yields the classical result that the relative cost of any factor must be equal to the relative share of output attributable to that factor:

$$\frac{w_u^{\min} \overline{L_u}}{w_s^* L_s^*} = \frac{\beta_u}{\beta_s} .$$

This implies that, in the formal sector, the optimal combination of labor across skills categories is such that

$$\left(\frac{\overline{L_u}}{L_f}\right) = \frac{\beta_u w_s^*}{\beta_s w_u^{\min}} \left(\frac{L_s}{L_f}\right)^* . \qquad (22)$$

Note that, if $w_u^{\min} = w_u^*$, then the unskilled labor market clears, with $\left(\frac{\overline{L_u}}{L_f}\right) = \left(\frac{L_u}{L_f}\right)^*$.

Otherwise, if $w_u^{\min} > w_u^*$, then $\left(\frac{\overline{L_u}}{L_f}\right) < \left(\frac{L_u}{L_f}\right)^*$ and underemployment arises.

Underemployed, unskilled workers in the formal sector make up the supply of labor in the informal sector, where market forces operate to equate demand and supply. The congruent share of unskilled labor accruing to the informal sector can, therefore, be derived from the excess of unskilled labor supply in the formal sector:

$$L_i = L_f \cdot \left[\left(\frac{L_u}{L_f} \right)^* - \left(\overline{\frac{L_u}{L_f}} \right) \right] \quad , \qquad \text{that is,} \qquad L_u^* = L_u + L_i \, . \tag{23}$$

The system of equations (1), (2), (5), (6), (14), (15), (16), (17), (21), (22), and (23) can thus be simulated under alternative AIDS assumptions to make medium-term projections for key economic variables. Such a system permits the variation of key parameters, enabling thereby the identification of the areas where policy intervention may help to minimize the impact of AIDS on the economy.

The Data

56. In order to apply the model, it is necessary to calibrate it, so that its projections match the actual (known) values of relevant economic variables in some base period. In this case, 1996 has been chosen as the base year. Besides providing updated GDP values, national account figures allow us to compute the level of capital stock for the whole economy and to estimate the size of the formal and informal sectors.

57. Since updated employment data are not available, the 1996 Living Conditions and Monitoring Survey from the Zambia Central Statistical Office (CSO) has been used to calculate participation rates in each of the age cohorts, in the formal and informal sectors, and for skilled and unskilled laborers. The labor force data provided by the CSO are presented in various comparisons in terms of age cohort, rural/urban inhabitance, formal/informal sector, industry, and profession. Assuming a fixed participation rate per age cohort, the labor force can be derived from demographic projections of the population--assuming that, although AIDS has no effect on the participation rate, it can reduce total employment and total output.

58. To calculate the skilled formal wage and the unskilled wage, average monthly wage data provided by the CSO have been used. After designating each profession as formal or informal and skilled or unskilled, the average wage for each labor category is computed using a simple weighted average of the wages across professions.

59. Demographic projections of the population with and without AIDS are taken from the U.S. Bureau of Census International Data Base (1999). As for HIV prevalence rates, the UNAIDS (2000) report shows that in urban areas these are at 28 percent and projected to stabilize at 25 percent. HIV prevalence in rural areas is currently 13 percent and continues to rise. Projections of the HIV prevalence rates in Zambia assume, therefore, that the pandemic follows log linearly the historical growth pattern until the declining HIV prevalence in urban sites will balance rising infection rates in rural areas. At that point, the overall prevalence rate is expected to level off at about 21 percent before it starts decreasing, as the number of AIDS deaths outnumbers the number of new infections.

60. Estimates of the yearly cost of providing basic treatments to AIDS patients are taken from Haacker (2001) and include palliative care, prevention of opportunistic infections, and clinical treatment of opportunistic infections.[25] These costs are estimated to be about US$420 a year per AIDS case in low-income countries--approximately two times the Zambian per capita GDP in 1996. In the specific case of Zambia, Mpundu (2000) estimates the average cost per day for those living with AIDS and needing hospital care lies between $3.31 and $7.25—excluding pharmaceuticals and other direct costs—with the average hospital stay ranging between 15 and 80 days. Finally, the share of AIDS-related transfer costs from the

[25] See also World Bank (2001).

formal to the informal sector is assumed to reflect the share of public health expenditure in Zambia. According to Haacker (2001), in Zambia public heath expenditure accounts for 39 percent of total health expenditure.[26]

[26] See also WHO (2000).

II. Inflationary Dynamics in Zambia, 1980-2001[27, 28]

A. Introduction

61. High and variable inflation has been a central feature of the Zambian economy during the past decades. While, in the 1980s, the annualized rate of inflation (measured by four-quarter changes in the consumer price index) averaged 43 percent, in the first half of the 1990s inflation surged to over 120 percent. During the second half of the 1990s, inflation fell sharply to an average of 31 percent per annum, declining further to 25 percent in year 2000. With such a record of high inflation, Zambia stands out as one of the few peaceful African countries that has not yet achieved price stabilization (Figure II.1).

62. Various hypotheses have been put forward as the main cause of hyperinflation in Zambia, including inadequate stabilization measures, persistently large fiscal deficits coupled with an accommodating monetary policy, adverse external shocks to the termS of trade. The question of which has been the main determinant of high inflation in Zambia is an empirical one. Certainly, the kwacha substantially depreciated over the 1990s, and other special shocks, including the rise in global and Zambian oil product prices, have hit Zambia's open economy severely in recent years.[29] This approach would blame exogenous factors rather than policies. However, the role of policies should not be understated. Although over the past 15 years the Zambian economy has witnessed a number of structural reforms, economic policy implementation has been weak and frequently plagued by failures to address key policy concerns, in particular to bring down the fiscal deficit. Monetary policy has often been too accommodating, in part due to insufficient policy independence enjoyed by the Bank of Zambia. Possibly more important, commitments to broad adjustment programs have not always been deemed credible in the eyes of the private sector. These factors may have combined with the effects of financial liberalization to result in a substitution out of domestic money and into alternative assets. Specifically, if the fall in domestic money demand has actually been faster and more severe than the reduction in money supply triggered by contractionary fiscal adjustments, then hyperinflation may well have been the perverse response to a record of poor reputation in commitment to reform.

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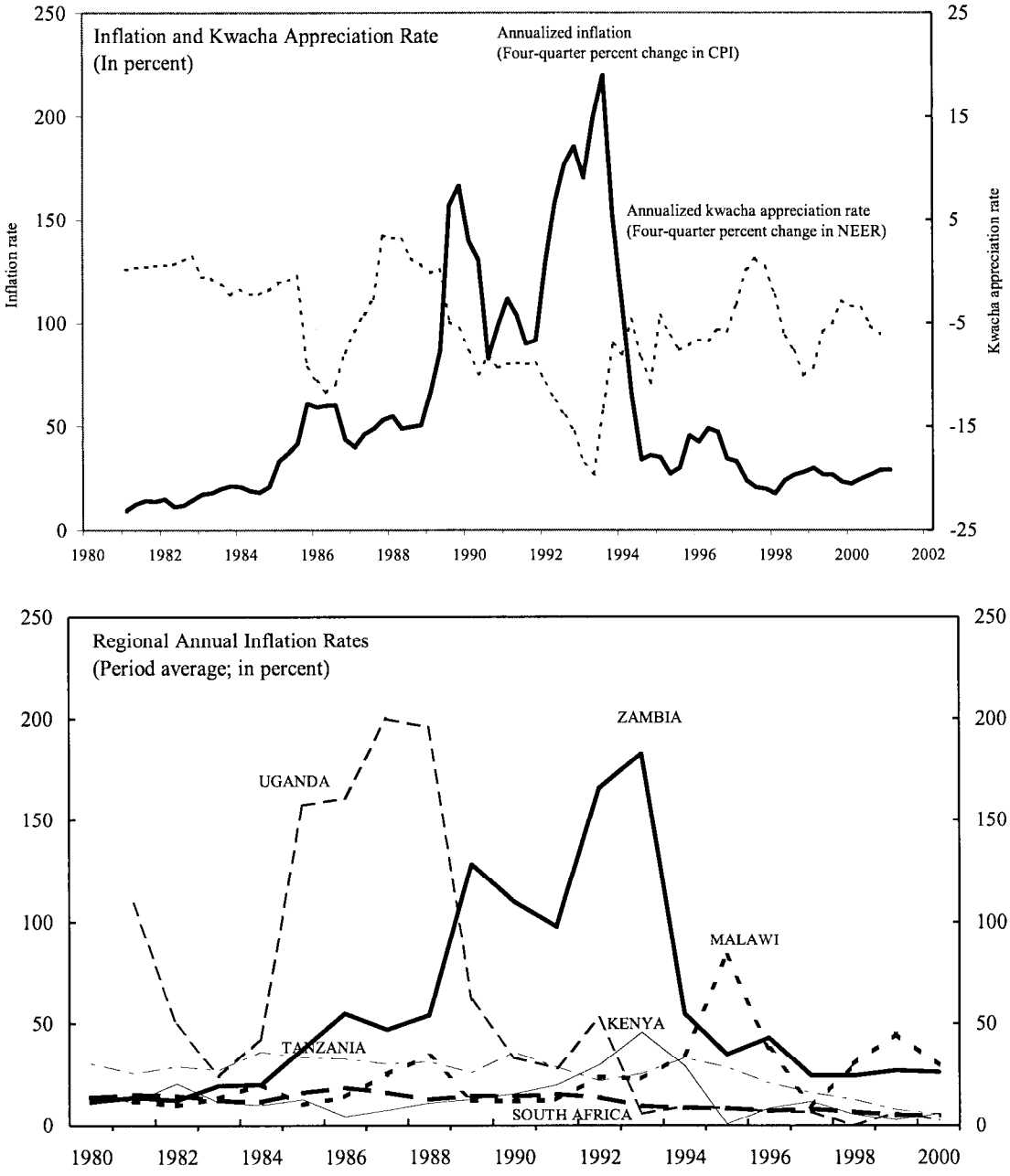
[27] Prepared by Silvia Sgherri.

[28] The paper has benefited from discussions with officials at the Bank of Zambia in the course of the IMF mission to Zambia for the 2001 Article IV consultation and the third review of the PRGF program.

[29] In 2000, foreign trade in goods and services accounted for about one-third of GDP.

Figure II.1. Zambia: Selected Inflation Indicators, 1980:Q1-2001:Q2



Sources: IMF, *International Financial Statistics*; and Fund staff calculations.

63. This section of the recent economic developments (RED) develops an original framework to identify the potential forces driving inflation in Zambia in recent years. In particular, it stresses the importance of policy credibility and the role played by inflation expectations in shaping domestic money demand during hyperinflation periods in Zambia. Two regime changes are identified that appeared to result in major revisions to policy credibility and, thereby, expectations of inflation—the abandon of the IMF program in 1989 and the implementation of a cash budget in 1993. In each case, it appears that anticipations of money growth or monetary tightness caused inflation to overshoot changes in the money growth.

64. In its core formulation, the model used in this paper is similar to the Cagan (1956), Bruno and Fischer (1987), Ball (1993), and Adam (1995) models of hyperinflation, all accounting for inflation tax as a key determinant of the demand for real money balances. However, its assumptions about price setting and expectation formation represent major departures from its earlier counterparts. In Cagan and in Adam, inflation is tied down by the adaptive expectation mechanism featuring money demand: given nominal money growth, inflation expectations adjust passively to ensure that real money balances equal the desired level. In Bruno and Fischer, inflation is left indeterminate unless a monetary anchor is exogenously provided by monetary policy, as foresight is assumed to be perfect. In Ball, inflation is sluggish, although expected inflation equals current inflation at any time: since inflation is inertial, the interest rate adjusts to equate money demand and supply, thus influencing aggregate demand. Aggregate demand, in turn, affects inflation through an accelerationist Phillips curve. The current model, like the one by Ball, assumes that prices are set as a markup on costs and that the markup increases as demand pressure rises. However, here inflation is not solely determined by deviations of output from potential. Making in allowance for shifts in cost components, such as indirect taxation and import tariffs, proves to be essential to predict price dynamics in Zambia. More important, and unlike any other of the studies mentioned above, inflation expectations are treated in a model-consistent manner. This avoids the major weakness implicit in models of adaptive expectations, namely not allowing for expectations to adjust in response to policy announcements or to changes in the private sector's perception of their credibility. At the same time, ruling out perfect foresight allows us to derive a time-varying path of actual (i.e. non-steady state) seigniorage, under the assumption that future changes in prices are **correctly** anticipated, on average, but not **exactly** foreseen.

65. The estimated model is then used to compare the results of past stabilization programs implemented in Zambia and to verify the feasibility of the targets implied by the current monetary program. Interestingly, the model is able to generate transitory opposite movements in seigniorage and inflation, a fact that is often cited as a puzzle in economics (Blanchard and Fischer, 1989, Chapter 10). As such, it can be regarded as closely related to the Drazen and Helpman (1990) fiscal model of inflation, where inflation is driven by the anticipated effects of future fiscal restructuring.

66. From a technical viewpoint, this section employs Kalman filter techniques by specifying levels and trends in underlying macroeconomic variables as stochastic time-series. Breakpoints in the unobserved components are not exogenously determined but rather fitted side by side with the other explanatory variables entering the structural model. In this way, structural stochastic models are not only more robust, but also more suitable to model inflationary dynamics in developing economies than vector autoregression (VAR) models. In particular, this paper intends to investigate the consequences of the profound structural breaks experienced by the Zambian economy in the last two decades, including changes in the openness to financial and trade competition, exchange rate and monetary policy regime shifts, and capital flow reversals. Stochastic trend models offer a satisfactory econometric tool to deal with shifts in long-run inflationary expectations, money velocity, and productivity growth of the kind one might expect in an economy subject to such regime changes. Methodologically, the models presented in this paper for estimating domestic inflation and real money demand can be seen as reduced-form equations of the related VAR system. These models easily lend themselves to being combined as a system, such that a stylized model of the Zambian economy can be constructed. This allows the model to single out the role of policy credibility and the effects of financial liberalization on real wealth, which are difficult to capture in a more conventional multivariate cointegration context.

67. The paper is organized as follows. Section B briefly reviews the process of macroeconomic adjustment and stabilization in Zambia during the 1990s and introduces a theoretical framework to illustrate the dynamic relationship among inflation expectations, demand for money, and seigniorage. Section C provides econometric evidence of the structure of the demand for money in Zambia. Here, the originality of the empirical framework adopted for the analysis is also discussed. Section D employs the estimates obtained in Section C to illustrate the actual inflation and seigniorage dynamics arising as a result of the stabilization measures of the 1990s and assess the latest monetary developments. Section E concludes the paper.

B. Theoretical Framework

Stabilization programs in Zambia

68. There is agreement among economists and policymakers that the success of financial liberalization programs depends on the private sector's asset demand for money and its expectations concerning the final outcome of the stabilization measures. In economies where the private sector holds very low levels of real money balances, economic reform and stabilization proceed relatively rapidly. Moreover, if the private sector expects that the reform program will be implemented successfully, financial liberalization may lead to an immediate increase in the demand for local currency. In these circumstances, inflation can be reduced at a relatively low cost in terms of fiscal contraction. In contrast, in economies where the initial money stock is large and there is uncertainty about the timing and the ultimate outcome of the process, the opposite may hold true, as the private sector seeks to move its wealth out of domestic money in response to financial liberalization measures.

69. The process of macroeconomic adjustment in Zambia has experienced hiccups and faced impediments since its outset. The 1985-87 IMF-supported adjustment program was unilaterally canceled by the government of President Kaunda in 1987. As an alternative, a "growth from home resources" economy recovery program was introduced in the same year. Its collapse forced the Zambian government to embark on a new adjustment program supported by the IMF and World Bank in 1989.[30] Central to the 1989-94 Economic Recovery Program was the rights accumulation program (RAP), which was designed to facilitate clearance of arrears on debt to the IMF and consisted of a series of quarterly targets for domestic credit to government and reserve money, in addition to specific measures of financial and trade opening. Both domestic and external participants viewed the attainment of RAP targets as the principal indication of the government' commitment to the broader adjustment program. Although progress was made in dismantling many of the domestic price controls that had built up over the previous decades, stabilization efforts were weak during the first two years of the program, with the annualized rate of growth in narrow money increasing from 55 percent a year in the third quarter of 1989 to 212 percent a year in mid-1991. The macroeconomic outlook worsened dramatically prior to the election of the government of President Chiluba in October 1991. A range of contributory factors can be identified, such as the preelection cessation of donor disbursements, the surge in domestic financing emanating from preelection wage commitments by the incumbent government, and the drought of 1992.[31]

70. Despite these adverse shocks, from the moment the new government took office, public expenditure fell from 24 percent of GDP in 1991 to 12 percent of GDP in 1993, while the primary budget balance improved by 8 percent, and total credit to government nearly halved in real terms over the same period (Figure II.2). From mid-1991 to the third quarter of 1993, narrow money growth slowed down from 212 percent a year to 93 percent a year, with a substantial fall in the **level** of money supply in mid-1992 (Figure II.3). With a fiscal contraction of this magnitude, inflation would be expected to decline steadily, in line with the reduction in money supply growth. In Zambia the opposite occurred, and domestic inflation rose sharply from an annualized rate of 90 percent in mid-1991 to 220 percent per annum in the third quarter of 1993.

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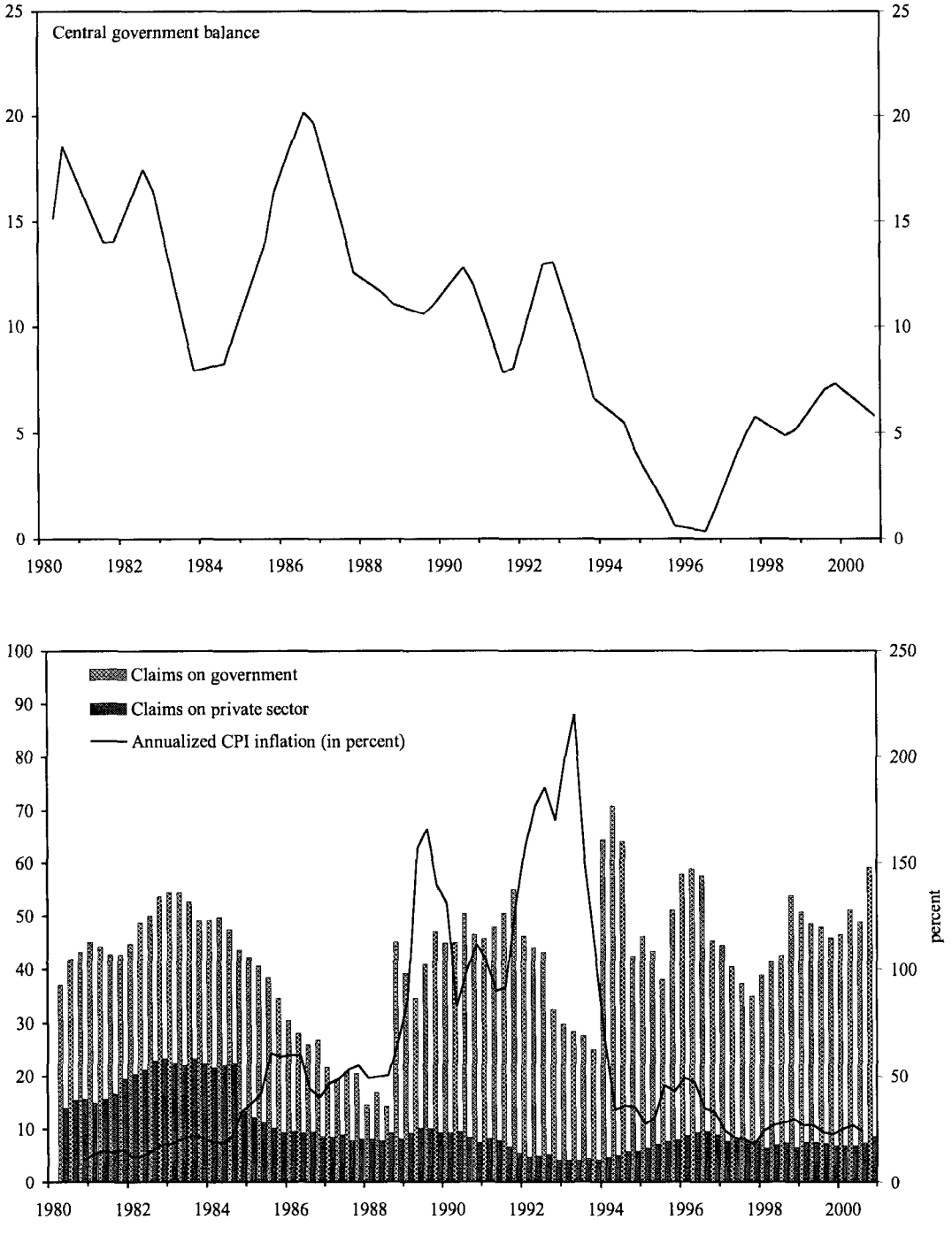
[30] Bates and Collier (1993).

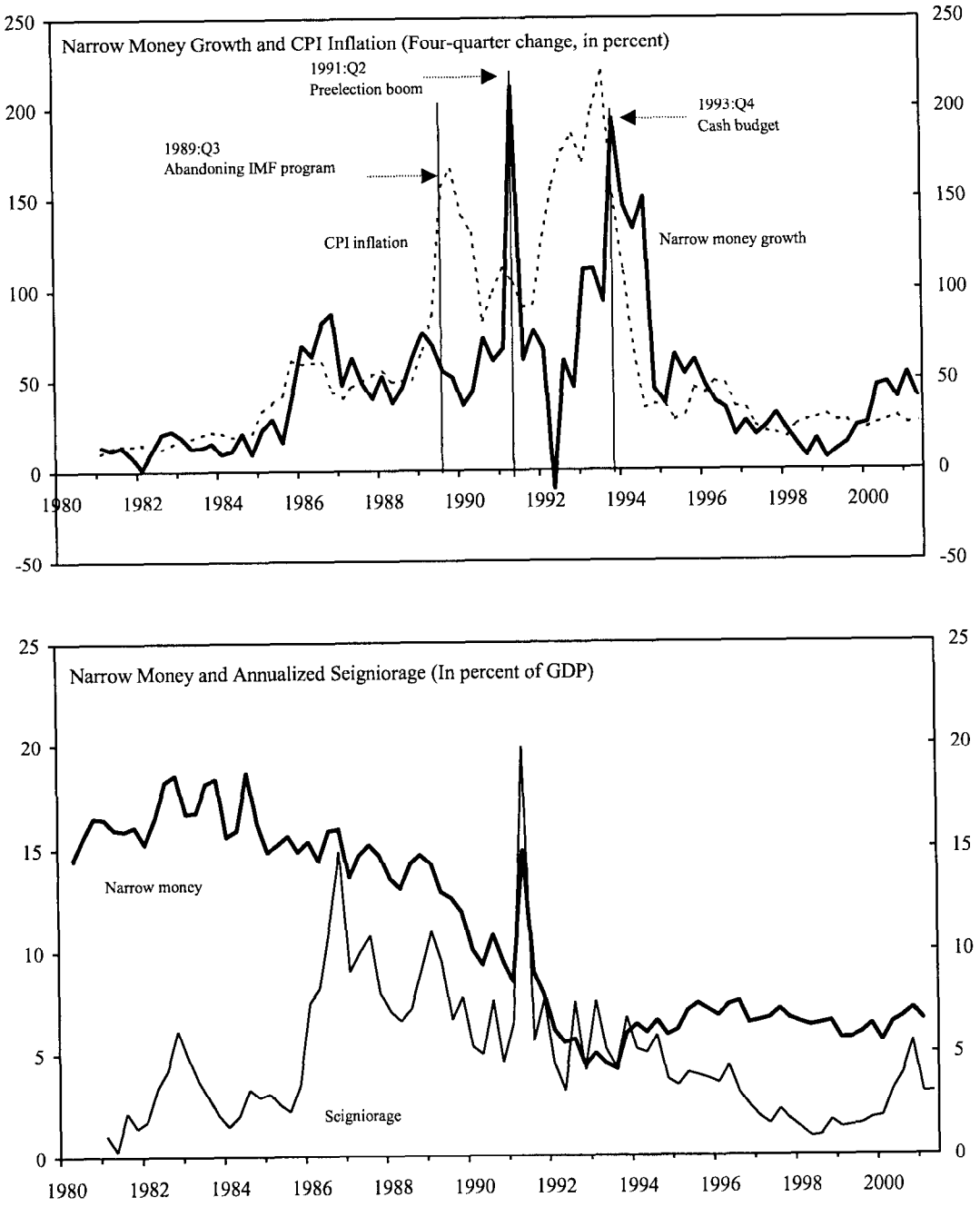
[31] Adam (1995).

Figure II.2. Zambia: Selected Fiscal Indicators, 1980-2000
(In percent of GDP unless otherwise indicated)



Sources: IMF, *Government Finance Statistics Yearbook*; and Fund staff calculations.

Figure II.3. Zambia: Selected Monetary Indicators, 1980:Q1-2001:Q2



Sources: IMF, *International Financial Statistics*; and Fund staff calculations.

71. An intuitive explanation for this apparently perverse inflationary response is that inflation expectations and the effects of financial liberalization combined to ensure that the demand for domestic money fell even more rapidly than money supply. As a consequence, hyperinflation arose. On the one hand, the events of the second half of the 1980s and beginning of the 1990s left the government with a very poor reputation for commitment to adjustment programs. The private sector—which in mid-1991 was forming its expectations about the new government—may have interpreted the 1989-91 lack of control over monetary aggregates as an indication of a lack of commitment to reform. Although the fiscal outturn for 1991 and 1992 suggested that the government was maintaining a very tight fiscal stance, this was not known at the moment and inflation expectations mounted. On the other hand, important liberalization measures were taken in 1992 and early 1993, including the liberalization of the current account and payments system. These reforms increased the opportunity costs of holding domestic money, while raising the expected rate of return (and/or the liquidity) of alternative assets, including foreign currency. As the demand for real domestic balances is known to be dominated by asset market considerations during periods of high uncertainty and low income growth, it is likely that high inflation expectations and high expected returns on alternative financial assets resulted in a substitution out of domestic money and into alternative assets. Unless the decline in real money demand is offset by an even sharper reduction in money supply, rising inflation and falling seigniorage revenue are to be expected in these circumstances.

72. In Zambia, between the second quarter of 1991 and the third quarter of 1993, narrow money as a share of GDP fell from 15 percent to 4.2 percent of GDP, while its annualized growth slowed by 120 percent. Over the same period, the annualized rate of inflation climbed sharply by 130 percent, whereas seigniorage revenue dropped from 20 percent of GDP to 4 percent of GDP (Figure II.3). In May 1993, in order to restore domestic price stability, a cash budget mechanism was introduced, thereby substantially reducing money creation as a means of financing the fiscal deficit. As a result of such a drastic fiscal squeeze, annualized inflation fell by over 185 percent within one year. These stylized facts appear to be largely in agreement with the argument suggested above; analytical formalization is, nonetheless, presented in the next subsection.

A stylized model of inflation and seigniorage

73. A large body of literature discusses the sources of inflation in hyperinflation countries and the many stabilization programs (for example, Bruno and others, 1988; Bruno and others, 1991). An unique explanation for high-inflation episodes cannot, however, be found, as discussions are not focused on a common theoretical framework. Something close to a consensus theory is the Cagan (1956) textbook model. Nevertheless, this model is too limited to explain central issues such as the real effects of inflation and stabilization, since it assumes constant output and real interest rates, with no role for credibility considerations or for wealth effects induced by financial liberalization.

74. This subsection presents a simple model designed to illustrate the main interactions among real money demand, seigniorage and actual inflation. This theoretical framework will then be used to analyze the effects that financial liberalization policies may have produced on the dynamics of inflation in Zambia. In its core formulation, the model is very much in the spirit of the Cagan (1956), Bruno and Fischer (1987), Ball (1993), and Adam (1995) models of hyperinflation, as it also regards inflation tax as a key determinant of real money demand during periods of high uncertainty and low income growth.

75. Specifically, the demand for real domestic money balances is here assumed to be of a log-linear form, positively related to the level of real income (y), reflecting transaction demand, and inversely related to the nominal interest rate ($i=r+\pi^e$), reflecting the opportunity cost of holding a non-interest-bearing monetary asset. However, in circumstances of hyperinflation, the relationship between money and price changes, as the real value of money holdings is likely to be eroded by the cost of the inflation tax.[32] The money demand equation is therefore augmented to account for expected high inflation (π^e). Given the inflationary record of Zambia, one would also expect that foreign currency would play a major role in Zambia's demand for money (Berg and Borensztein (2000)).[33] The model takes into account this aspect only indirectly, by allowing the **nominal** interest rate to determine domestic money demand alongside the expected rate of inflation. If open interest parity holds, the elasticity of money demand to the expected nominal interest rate reflects, in fact, the expected rate of currency depreciation.[34] In this way, the demand function attempts to capture both the opportunity cost elements of holding domestic money as an asset, namely, the expected rate of currency devaluation and the expected rate of inflation (Figure II.1). Letting lower cases denote logs, the augmented money demand equation can thus be formulated as follows:

$$(m-p)=\delta_0+\delta_1 y+\delta_2 i+\delta_3\pi^e \qquad (24)$$

where $(\delta_2+\delta_3)$ measures domestic money demand elasticity.

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[32] Cagan's (1956) theory extends the money demand equation along the quantitative theory of money, according to which real money balances remain proportional to real income, given a constant velocity.

[33] Foreign currency deposits are not included in the monetary aggregate considered here, as they did not exist before the liberalization of the Zambia's current account and the full unification of the official exchange rate with the foreign exchange bureau rate, in December 1992. Quarterly data on foreign currency deposits for Zambia are available starting from 1995.

[34] If open interest parity holds, the expected nominal interest rate can be defined as $i=i^f+\dot{e}$.

76. For the money market to be in equilibrium, the expected rate of inflation must be such as to maintain sufficient real balances to ensure the fulfillment of transaction demand. The steady state inflation rate can thus be derived by differentiating equation (24) with respect to time. Recalling that in equilibrium $\dot{\pi} = \dot{r} = \dot{\dot{e}} = 0$, it yields the following:

$$\pi^e = \pi = \sigma - \delta_1 g, \tag{25}$$

where σ is the growth rate of the nominal domestic money stock. Equation (25) indicates the locus of all the (σ, π) pairs ensuring the equilibrium of the money market in an economy characterized by (a given) nonzero real growth (g). Among these equilibrium pairs, it is of interest to identify (i) for which equilibrium level of inflation the government can maximize its inflation tax (seigniorage) revenue, and (ii) which equilibrium level of inflation is likely to prevail.

77. To answer these questions, it is necessary to derive the time path of seigniorage as a function of the rate of growth of the money supply, given the structure of money demand defined by (24). As the actual flow of seigniorage revenue to the government (S) is equivalent to the real value of the increment in the nominal stock of domestic money held by the private sector, one can write

$$S = \frac{\dot{M}}{M} \cdot \frac{M}{P}, \tag{26}$$

or equally,

$$\log(S) = \log(\sigma) + (m - p).$$

Making use of the steady state relationship between money growth and inflation given in equation (25), the equilibrium level of seigniorage can be obtained as a function of inflation expectations, namely:

$$\log(S) = \log(\pi^e + \delta_1 g) + (m - p), \tag{27}$$

which defines the so-called equilibrium seigniorage Laffer curve.

78. Using the equilibrium money demand equation (24) and differentiating (27) with respect to π^e, we can derive the rate of expected inflation that maximizes the steady state seigniorage revenue, S^{max}, as the following:

$$\pi^{max} = -\frac{1}{\delta_2 + \delta_3} - \delta_1 g. \tag{28}$$

79. Because of the concavity of the Laffer curve (4), depending on the amount of inflation tax revenue collected, the economy may possess zero, one, or two equilibria. Because there is no way to obtain more than S^{max} in steady state, there is no equilibrium for $S>S^{max}$. For $S=S^{max}$, there exists a unique equilibrium, defined by π^{max}. For $S<S^{max}$, there are two equilibrium levels of inflation that generate an identical amount of seigniorage revenue to the government: a low-inflation, high-money demand equilibrium and a high-inflation, low-money demand equilibrium. Ceteris paribus, an economy may find itself at the low or at the high inflation equilibrium, depending on its respective stability properties. This, in turn, is strictly determined by the assumptions underlying the formation of inflation expectations.

80. Under Cagan's (1956) assumption of adaptive expectations, inflation expectations are adjusted according to

$$\dot{\pi}^e = \beta(\pi - \pi^e), \tag{29}$$

where β is the speed at which individuals revise their expectations. By substituting for π in (29) from (25) we obtain the following:

$$\dot{\pi}^e = \frac{\beta}{[1-(\delta_2+\delta_3)\beta]}(\sigma - \pi^e - \delta_1 g). \tag{30}$$

Hence, if expectation are adaptive, in order to ensure the global stability of expectation dynamics and, thereby, of the system, it is necessary that $\beta < \frac{1}{(\delta_2+\delta_3)}$, that is, the speed of adjustment of expectation must be sufficiently low or, equally, money demand must be sufficiently inelastic. Only under this condition it is possible to ensure that hyperinflation is a transitory phenomenon, as the economy moves gradually back to equilibrium in the face of unanticipated shocks to the growth of money supply emanating, for instance, from fiscal expansion. However, while this condition is necessary to ensure the intrinsic stability of the economy, it seems very unrealistic when uncertainty is high and financial liberalization is ongoing.[35] As noted above, in these circumstances the elasticity of money demand would become higher as the opportunity cost of holding domestic money versus alternative financial assets rises. Similarly, if monetary policy becomes highly inflationary, the proportion of myopic agents would decline, the speed at which agents learn about shifts in policy objectives would increase, and—in general—the degree of nominal inertia in the economy

[35] In most historic cases, hyperinflations have been highly unstable and accelerating—though transitory—phenomena, stopped mostly by exchange rate stabilizations and/or other drastic measures. It could then be argued that it is precisely the inherent instability of a hyperinflation that leads to its being a transitory phenomenon.

would fall. In addition, an adaptive expectation model such as (29) fails to provide an effective channel for "regime changes" to affect inflation expectations realistically.

81. The obvious alternative to (29) is to assume rational expectations in the form of perfect foresight, as in Bruno and Fischer (1987). Assuming that $\pi^e=\pi$ at any time allows inflation expectations to jump immediately in response to changes in policy, so that policy credibility may play an active role in determining inflationary dynamics. However, as argued by Adam (1995), perfect foresight is not illuminating for models with time-varying seigniorage like the current one, as the economy is assumed to be always in steady state.

82. In light of these considerations, the present model treats inflation expectations in a model-consistent manner. This implies that the expected value of inflation at time *t*—that is, π^e_t—equals the model's predictions for inflation at time *t*, that is, $\hat{\pi}_t = E[\pi_t|\Omega_t]$, so that the following expression holds true at any time:

$$\pi^e_t = \hat{\pi}_t = \pi_t - \varepsilon_t. \tag{29'}$$

If ε_t is a stationary, zero-mean forecast error, then equation (29') implies that expectations are rational, as future changes in prices are **correctly** anticipated (on average) though not **exactly** foreseen. In addition, model-consistent expectations have the potential to allow for expectations to adjust in response to policy announcements, admitting that policy shifts are included in the information set Ω_t on which the predictor $\hat{\pi}_t$ is conditioned. Finally, by ruling out perfect foresight, it is still possible to derive a time-varying path of actual seigniorage, since from (29') and (25) it follows that

$$\dot{\pi} = \frac{1}{(\delta_2+\delta_3)}(\sigma - \hat{\pi} - \delta_1 g). \tag{31}$$

83. The forecasting model for inflation used here makes use of the definitional identity according to which (the logs of) the predicted consumer price level ($\hat{p}^c$) equals the sum of producer prices (p^p) and the tax wedge (τ). In turn, producer prices are thought of as a markup on unit labor costs (*ulc*) and import prices ($p^w - e$), with the markup being a positive function of the real aggregate demand (y). After a simple algebraic manipulation, the predicted level of the consumer price index can be thus rewritten as the following:

$$\hat{p}^c = ulc + \alpha_0 + \alpha_1\rho + \alpha_2\tau + \alpha_3 y, \tag{32}$$

where $\rho = e + p^p - p^w$ denotes the real exchange rate. Predictions of the price level are then employed to form inflation expectations. By letting $\hat{p}^c_t = p^c_t - \upsilon_t$ and $\pi_t = \dot{p}^c_t$, it follows that $\hat{\pi}_t = \pi_t - \dot{\upsilon}_t$. Under the strict assumption of υ_t being white noise, the current model allows explicit characterization of the expectation error (ε_t) embedded in the inflation expectations

formation (29'). Namely, as $\varepsilon_t = \upsilon_t$ by construction, the inflation expectations error is described by a zero-mean, stationary process containing a negative first-order moving-average error term. This implies that inflation expectations are not only rational—that is, correct on average—but also formed according to a mean-reverting learning process. In this way, as the private sector revises its past forecasting "mistakes" over time, the stability of (non-steady state) inflation dynamics is also locally guaranteed.

C. Econometric Evidence

Structural stochastic models

84. In recent years, the widespread use of time-series cointegration techniques has proved extremely helpful in describing the equilibrium structure of economies and their process of dynamic adjustment to equilibrium. In this section of the RED, cointegration analysis is applied in a single-equation context, rather than in a multivariate cointegration framework for three reasons. The first is the "curse of dimensionality": the number of variables is too great for successful implementation of the VAR-based procedures of Johansen (1988). Second, whereas some of the variables under consideration are processes integrated of second order (i.e., prices, narrow money, and nominal effective exchange rate), near-unit root processes (such as real GDP and the nominal interest rate) also feature in the analysis. Although VAR-based techniques can be applied to test for cointegration among processes integrated of different order (Johansen, 1995; and Juselius, 1998), we note that in these circumstances alternative testing procedures may be more robust than those of Johansen (on this point, see Gonzalo and Lee (1998)). Last but not least, major structural breaks and policy shifts occurred in Zambia over the period under investigation. The presence of such (unknown) regime changes suggests the use of alternative detrending techniques, such as Kalman filter techniques, in which regime shifts in the unobserved components are not exogenously determined but rather estimated alongside the other explanatory variables entering the structural model (Harvey and Jaeger, 1993).[36]

85. The structural stochastic models employed in the analysis have the following general representation:

$$y_t = \gamma_0 \mu_t + \sum_{i=1}^{k} \gamma_i x_{it} + \varepsilon_t, \qquad (33)$$

where the vector x_t includes a range of potential regressors and ε_t is white noise. Lagged values of the endogenous variable are included in the x term. μ_t is a local linear trend defined as follows:

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[36] Aron and Muellbauer (2000) adopt an analogous estimation technique to explore the monetary transmission mechanism in South Africa under the new inflation-targeting regime.

$$\mu_t = \mu_{t-1} + \varphi_{t-1} + \eta_t \qquad \eta_t \sim \text{NID}(0, \sigma_\eta^2) \qquad (34)$$

$$\varphi_t = \varphi_{t-1} + \zeta_t \qquad \zeta_t \sim \text{NID}(0, \zeta_\eta^2), \qquad (35)$$

where φ_t is the slope and the normal white noise disturbances, η_t and ζ_t, are independent of each other. In this way, the trend component is equivalent to a series integrated of order two (i.e., requiring twice differences in order to give a stationary series) containing a first-order moving-average error term. The trend reduces to a random walk with drift if its slope is constant, that is, $\sigma^2_\varphi = 0$, and becomes a deterministic time trend if both its level and its slope are constant, that is, σ^2_η and σ^2_φ are both zero. Finally, if the level is constant but the slope is stochastic, then the trend component is relatively smooth (see Harvey and Jaeger (1993)).[37]

86. The technique is suitable to cope with some crucial features of the Zambian economy. Over the period 1980-2000, both consumer prices and monetary aggregates appear to be statistically indistinguishable from I(2) processes, which, at a first glance, may raise doubts about the stationarity of the error term ε_t in equation (33). However, stating that **changes** in money and prices are nonstationary over the period of interest does not necessarily imply that a stationary equilibrium relationship between money and prices cannot be identified. In fact, our representation in (33) suggest that—when adjusted for a stochastic trend component—the term $(y_t - \gamma_0 \mu_t - \sum_{i=1}^{k} \gamma_i x_{it})$ is I(0), that is, the components in this expression cointegrate. In other words, to analyze the money-prices relationship in Zambia, it seems appropriate to account for a number of shifts in underlying trends—reflecting, for instance, developing financial market liberalization and price deregulation—that prevent the relationship of interest from being constant over time and, therefore, unlikely to be uncovered in a multivariate cointegration framework including only deterministic components.[38]

The data

87. The data set consists of quarterly observations for the period 1980:Q1-2000:Q4 obtained from the International Monetary Fund's Electronic Data Sharing System (EDSS). The actual macroeconomic variables used in the analysis are described in detail in Table II.1, along with their definitions and sources. Lower-case letters denote the natural logarithm of

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[37] Estimation of all the parameters of the model can be carried out simultaneously using STAMP 6.0 (Koopman and Harvey, 1999).

[38] Among the recent studies that have employed a multivariate cointegration technique to analyze money demand and inflation dynamics in African countries, see Adam (1995) for Zambia; Jonsson (1999) for South Africa; Kovanen (2001) for Zimbabwe; Nachega (2001) for Cameroon; and Sacerdoti and Xiao (2001) for Madagascar.

variables and "Δ" denotes the first difference of variables. Conventional augmented Dickey-Fuller (ADF) tests for unit root for the level and first differences of each series are also reported in the table. Construction and interpretation of the tests are explained in details in footnote 1 of Table II.1. Filtering the data using a structural stochastic model confirms the presence of second order stochastic trends in the CPI, narrow money—defined as the sum of currency outside deposit money banks and transferable deposits—and the nominal effective exchange rate. Surprisingly, indirect and import tax rates are also found to be statistically indistinguishable from I(2) processes exhibiting a nonconstant slope. Real money balances—defined as the scaled ratio of narrow money to CPI—and the nominal interest rate are instead statistically better described as random walks with drift, namely, stationary in first differences. Real output also shows extremely high persistence and appears to be characterized by a twenty-quarter (that is, five years) business cycle around a flat (stochastic) level. This amounts to saying that the growth of real **potential** output in Zambia was statistically insignificant over the period 1980-2000. Finally, the real effective exchange rate—the nominal effective exchange rate corrected by the ratio of domestic to foreign CPI—and the real interest rate appear to be stationary over the sample period. In order to cope with the lack of quarterly data for GDP and fiscal variables, annual series are converted to quarterly measures by taking the five-quarter moving average of the step function implied by the annual data. Appropriate model specifications take care of the (artificially created) positive autocorrelation in the series.

88. The permanent and transitory components of quarterly seasonally unadjusted CPI and real money—obtained by detrending the series using structural time-series models (Harvey and Jaeger, 1993)—are illustrated in Figure II.4. For each variable, four graphs are drawn: the upper-left graph shows the series at issue with its trend; the upper-right graph plots, respectively, the slope of the trend component for CPI, and the level of the trend component for real money; the lower-left graph describes the seasonal component; and the lower-right graph pictures the cyclical component.

89. The CPI decomposes into a second-order nonsmooth stochastic trend, a cycle, and a trigonometric seasonal component. A statistically significant upward shift in the level (i.e., a one-off increase in inflation) is estimated to have occurred in the third quarter of 1989 and a statistically significant downward break in the slope (i.e., a permanent decrease in the rate of inflation) is detected in the third quarter of 1993. The trend growth rate (i.e., "structural" annualized inflation) in the fourth quarter of 2000 is estimated to have been 17.7 percent. The cyclical component appears to be quite volatile and to extend over five quarters. Its amplitude is small, as it rarely deviates from trend by more than 1 percent.

90. Real narrow money decomposes into a first-order stochastic trend (i.e., a random walk with drift) and a trigonometric seasonal component. A statistically significant permanent reduction in the level of real money is found to have occurred in the third quarter of 1989, while a similar permanent increase in real money is detected in the fourth quarter of 1993. A transitory increase in real domestic balances (i.e., an irregular disturbance) is instead detected

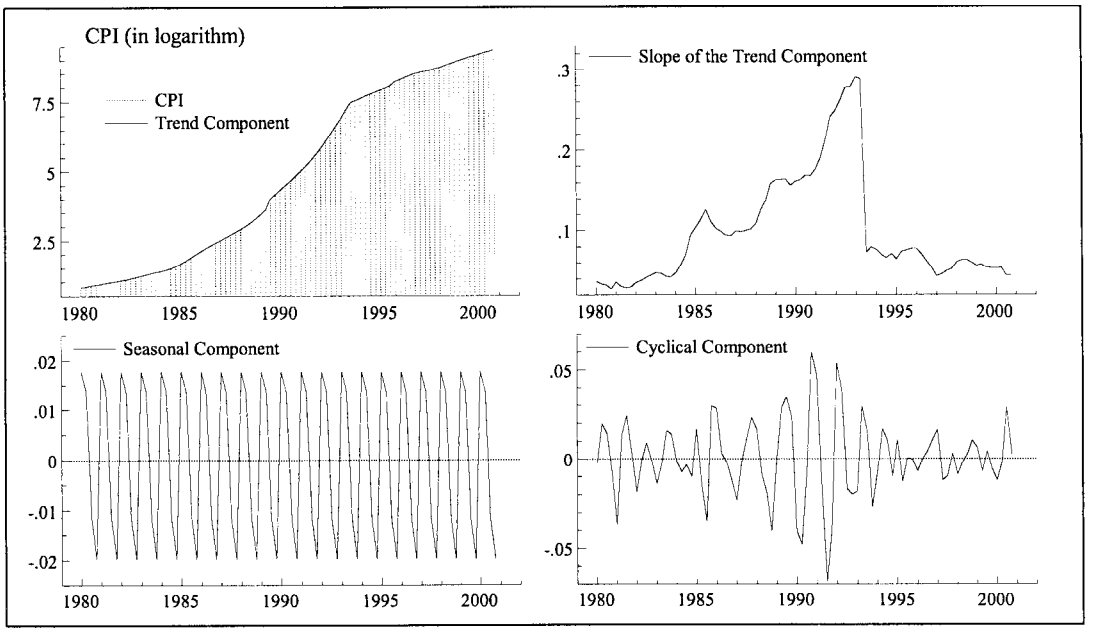
Table II.1. Zambia: Variable Definitions and ADF Unit Root Tests, 1980:Q1-2000:Q4

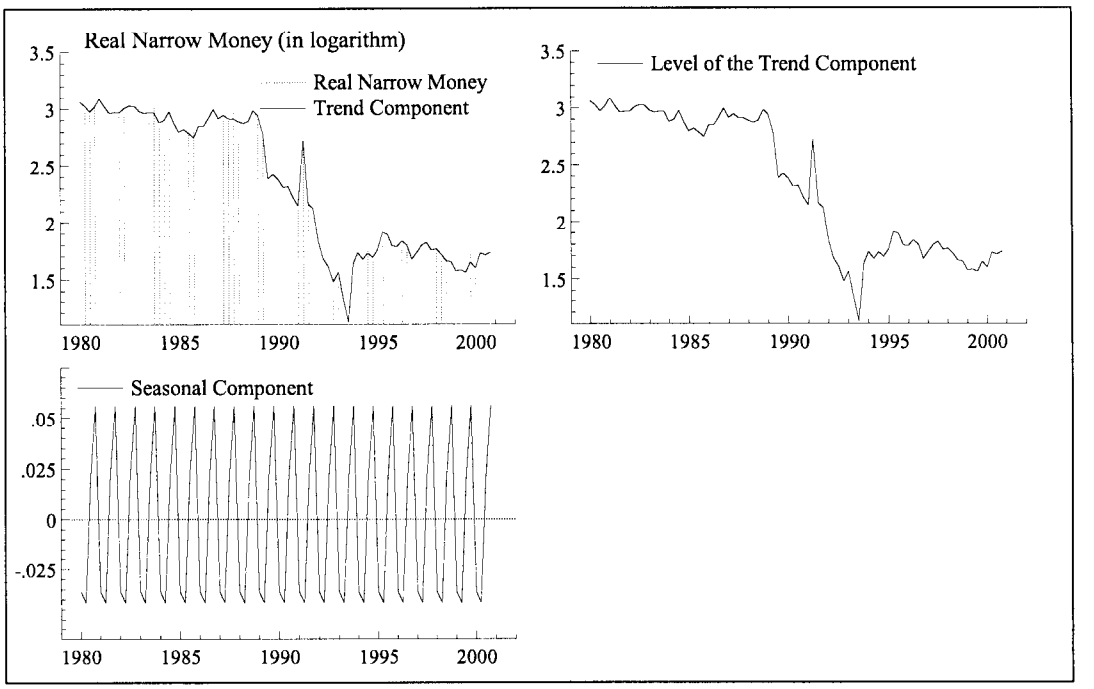
Variable	Definition	Source	I(1) 1/	I(2) 1/
$p = \log(P)$	Seasonally unadjusted CPI (index: 1995=100)	*IFS*	-1.23	-1.27
$m = \log(M)$	Seasonally unadjusted narrow money, including currency outside deposit money banks and transferable deposits (billions of kwacha)	*IFS*	-1.33	-1.58
$(m-p) = \log(100 \cdot \frac{M}{P})$	Seasonally unadjusted real narrow money (billions of kwacha)	*IFS*	-1.08	-3.46**
$y = \log(GDPX)$	Five-period moving average of annual GDP at 1994 constant prices (billions of kwacha)	*WEO*	-2.13	-2.73**
$e = \log(NEER)$	Nominal effective exchange rate (index: 1995=100)	*IFS*	-1.03	-2.67
$\rho = \log(REER)$	Real effective exchange rate based on relative CPI (index: 1995=100)	*IFS*	-3.46*	-3.45**
$i = INT$	Treasury bill rate – government secured (units per quarter)	*IFS*	-2.04	-4.66**
$r = INT - \Delta\log(P)$	Real interest rate (units per quarter)	*IFS*	-3.70**	-8.64**
$t^i = \log(\frac{INDTAX}{GDP})$	Five-period moving average of the annual ratio of domestic taxes on goods and services to GDP (billions of kwacha)	*GFSY*	-2.54	-1.60
$t^m = \log(\frac{TRDTAX}{IMPORT})$	Five-period moving average of the annual ratio of taxes on international trade and transactions to merchandise imports (billions of kwacha)	*GFSY*	-0.63	-2.85

Sources: IMF, *International Financial Statistics (IFS);* IMF, *World Economic Outlook (WEO);* IMF, *Government Finance Statistics Yearbook (GFSY)*; and Fund staff calculations.

1/ For each variable X, the augmented Dickey-Fuller (ADF) statistic is the t-ratio on α from the regression $\Delta X_t = \alpha X_{t-1} + \mu_0 + \mu_1 t + \Sigma^k_{i=1}\theta_i \Delta X_{t-i} + \varepsilon_t$, where k is the number of lags of the dependent variable, μ_0 is a constant term, and t is a time trend. The k-th order ADF statistic is reported, where k is the last significant lag of the 12 lags employed. Constant and trend are included only if significant. For null order I(2), ΔX replaces X in the above equation. Critical values are obtained from MacKinnon (1991). Asterisks * and ** denote rejections at 5 percent and 1 percent critical values.

Figure II.4. Zambia: CPI and Real Money Stochastic Properties, 1980:Q1-2000:Q4
(In logarithms)





Sources: IMF, *International Financial Statistics*; and Fund staff calculations.

in the third quarter of 1991. At the end of 2000, the level of domestic real balances in Zambia is estimated to have been approximately K185.7 billion (at constant 1994 prices).

91. The stylized facts presented in section B appear to be broadly consistent with the stochastic properties of the data. The empirical forecasting model presented in the next subsection builds in an allowance for these underlying evolutionary trends to generate predictions about the long-run dynamics of inflation. By incorporating structural regime shifts within the model, inflation forecasts are also likely to be fairly immune to the "Lucas critique".

Forecasting models for consumer prices and money demand

Consumer prices

92. On the basis of the theoretical motivations discussed in Section B, an empirical forecasting model for consumer prices is derived from equation (32) using a general-to-specific testing procedure. The structural time-series model—whose general representation is given in (33)—is estimated with quarterly data over the period 1980:Q3-2000:Q4. Estimation results are presented in Table II.2, along with standard diagnostic tests and measures of goodness of fit. The model defines a stationary equilibrium relationship between the Zambia's CPI and a set of long-run macroeconomic factors—including a stochastic trend—whose parameters are estimated from the data.

93. As discussed above, prices are expected to be set as a markup on costs, with the markup being a function of demand pressures. Whether this is procyclical or countercyclical is uncertain theoretically, and empirical evidence is often ambiguous. Nevertheless, effects for lagged aggregate output are found to be significantly positive for Zambia. In this respect, the hypothesis of a unit demand elasticity cannot be rejected by the data.[39] Cost components comprise labor and import goods. In the current empirical formulation, the effect of unit labor costs on the price level is not explicitly estimated. Rather, movements in unit labor costs are implicitly embedded in the stochastic component, given the lack of reliable data on wages at an aggregate level and the crucial impact of unobservable shocks on labor productivity. Import prices are determined by a pass-through of world tradeables prices expressed in domestic currency. Their impact on CPI is thus incorporated by allowing for a lagged real exchange rate transmission channel. The inflationary consequences of real exchange rate

[39] The high demand elasticity may be due to the existence of binding constraints on production capacity. The hypothesis would be supported by the econometric evidence of zero growth in the underlying trend of real GDP (see the subsection on structural stochastic models).

Table II.2: Zambia: Estimates of Seasonally Unadjusted CPI, 1980:Q3-2000:Q4

Dependent Variable: p_t 1/	
Stochastic trend: level component	-4.67 (-1.68)
ρ_{t-1}	-0.055 (-1.76)
t_t^i	0.283 (5.38)
t_t^m	0.163 (4.66)
y_{t-1}	0.872 (2.38)
p_{t-1}	0.722 (9.86)
p_{t-2}	-0.095 (-1.37)
Intervention 1989:Q3: irregular component	0.265 (9.72)
Intervention 1993:Q3: level component	-0.237 (-5.75)
Diagnostic tests 2/	
R^2_D	0.863
Prediction error variance	$988 \cdot 10^{-6}$
Serial Correlation: $r(1)$	-0.011
$r(8)$	-0.059
$Q(8,6)$	6.66 [0.25]
Normality: $\chi^2(2)$	2.95 [0.23]

Source: Fund staff calculations.

1/ The equation is estimated over the period 1980:Q3-2000:Q4 by maximum likelihood, using STAMP 6.0 (Koopman and Harvey, 1999). Asymptotic *t*-ratios are given in brackets.
The equation includes an I(1) stochastic trend, a trigonometric seasonal component and intervention dummies on the level and on the irregular component.

2/ R^2_D is *R*-squared computed for first differences of the dependent variable.
Serial correlation statistics report the first- and eighth-order correlation coefficient and the value of the portmanteau statistics (also called Box-Pierce or *Q*-statistic) for eighth-order residual autocorrelation.
The normality test reports the value of the Chi-square with two degrees of freedom and includes all moments of the residual distribution up to the fourth.
P-values are given in square brackets.

depreciations are found to be quite small and only marginally significant.[40] Indirect tax rates and measures of import tariffs and surcharges are instead likely to be crucial in predicting future CPI changes. In particular, a 1 percent increase in the rate of incidence of indirect taxes on total GDP is estimated to raise the CPI by 0.28 percent with a confidence interval of over 99 percent. Analogously, the elasticity of consumer prices to import tariffs is estimated to be 0.16 and highly significant, highlighting the importance of accounting for measures of trade openness and proxies of the effectiveness of tax reforms while forecasting price level dynamics.

94. Measures of deregulation in trade and tax policies appear to be essential to capture evolutionary trends in prices (Figure II.5). Their critical role for inflation forecasting is supported by the evidence that the stochastic trend component in the price level becomes insignificant as indicators of trade and tax regime changes are included. This appears to be entirely consistent with the common statistical properties shared by the CPI and tax rates—as briefly discussed above—and reflects the general understanding that significantly lower prices are to be expected as a result of far-reaching deregulation policies, such as those implemented in Zambia in the second half of the 1990s.[41]

95. Finally, the inclusion in the model of a stochastic trend allows us to pick up the large and permanent decline in expected inflation that occurred in the third quarter of 1993. This means that the introduction of a cash budget mechanism in May 1993 and the consequent fiscal squeeze were regarded as credible measures by the private sector and succeeded in reducing inflation expectations over the long term. Conversely, the failure of the "growth from home resources" economic program in the third quarter of 1989 is found to have induced a severe but transitory increase in inflation expectations. Possibly, the private sector adjusted upward its inflation expectations in response to the collapse of the program, but the adjustment was promptly reversed as the liberalization reforms entailed in the 1989/94 RAP fed back into lower import tariffs and price controls. This is in line with the view that the same future regime change (i.e. the implementation of a fiscal stabilization program) may trigger opposite inflation dynamics if there is uncertainty about the timing or the nature of the policy switch. Specifically, as formalized in Drazen and Helpman (1990), if the expectation is that the policy change will entail an increase in the rate of monetary growth, the price level is likely to jump up to ensure consistency with the dynamic trajectory defined by the expected policy outcome. If the actual policy then embeds a smaller increase in the rate of money growth than was expected, so that the actual dynamic path diverges from the expected one based on the contrary expectations, the price level will eventually adjust downward.

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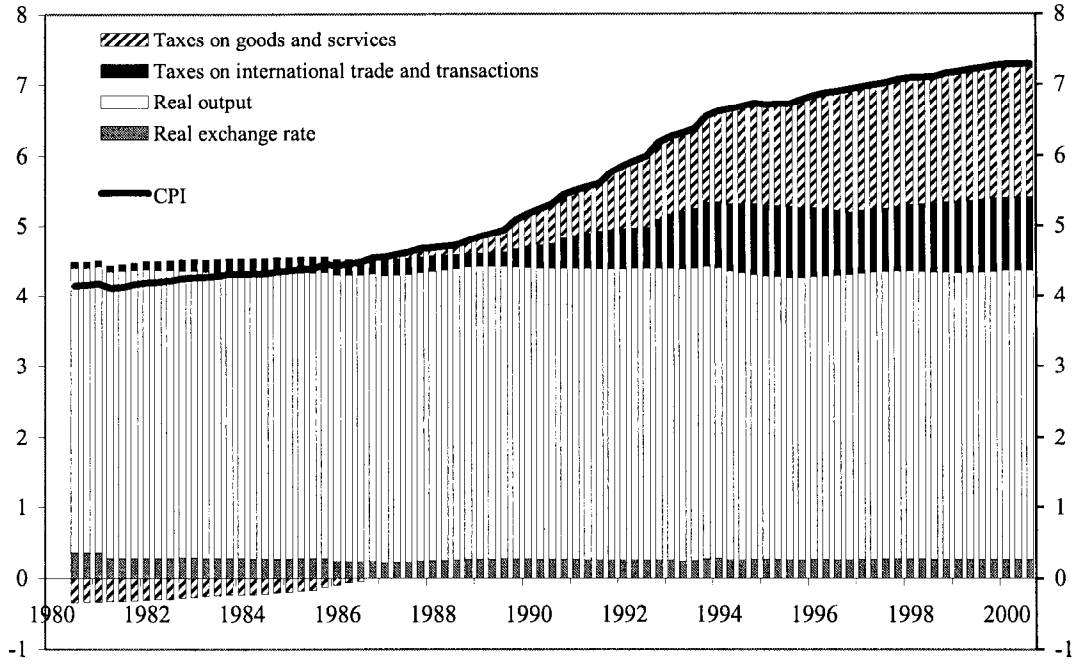
[40] This result may conceal the successful attempts of monetary policy to stabilize the nominal exchange rate, in order to prevent exchange rate depreciation (or a deteriorating terms of trade) from feeding into domestic prices.

[41] Van Til and others (1997).

Figure II.5. Zambia: Contributions to CPI Forecast, 1980:Q3-2000:Q4 1/
(In logarithms)



Sources: IMF, *International Financial Statistics*; and Fund staff calculations.

1/ The right-hand side variables are shown weighted by their regression coefficients (Table II.2). The weighted dependent variable term is the estimated level- and seasonally adjusted CPI defined as $p_t - 0.722p_{t-1} + 0.095p_{t-2}$.

96. Given the satisfactory properties of the CPI forecasting model—in both theoretical and statistical terms—its predictions are used to form inflation expectations, as discussed in Section B. The contribution of inflation expectations to money demand dynamics in Zambia is estimated below.

Money demand

97. A forecasting model for the demand of real domestic balances in Zambia is derived from equation (24) and estimated with quarterly data over the period 1981:Q2-2000:Q4, using a structural stochastic model of the form given in (35). The model describes the structure of money demand in Zambia as a stable equilibrium relationship among a few key economic indicators. Corresponding parameter estimates and relevant statistics are reported in Table II.3.

98. Specifically, real money demand is estimated as a log-linear function of the following macroeconomic variables:

- real income, reflecting transactions demand of real balances;
- the expected real interest rate, reflecting asset market considerations; and
- expected inflation, reflecting the cost of the inflation tax;

The estimate of the income elasticity of demand (δ_1 following the notation in (24)) appears to be quite uncertain, though insignificantly different from unity, which is consonant with conventional wisdom about money transaction demand and previous findings for Zambia.[42] A negative elasticity of money demand to the lagged nominal interest rate is instead found to be highly significant, while also close to unity in absolute value. This evidence suggests that asset market and opportunity cost considerations are still relevant in circumstances of high inflation and uncertainty, like those characterizing Zambia in the past two decades, and should not be neglected a priori. Finally, the demand for domestic money is strongly and negatively elastic with respect to our measure of expected inflation. Specifically, a one percent increase in inflation expectations is predicted to reduce overall demand for real balances by 1½ percent ($\delta_2 + \delta_3$, according to the notation in (24)). It is important to stress that, in the current forecasting model, the inflation elasticity of demand represents a "structural" parameter—thanks to the estimation technique adopted here. The estimate is, therefore, likely to be immune from liberalization-induced shifts in the steady state Laffer curve. As stressed above, these are already captured by $\hat{\pi}_t$, our measure of inflation expectations.

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[42] Adam (1995).

Table II.3. Zambia: Estimates of Seasonally Unadjusted Real Money, 1981:Q2-2000:Q4

Dependent Variable: (m-p) 1/	
Stochastic trend: level component	-4.13 (-1.74)
i_{t-1}	-0.773 (-2.46)
$\hat{\pi}_t$	-0.759 (-4.35)
y_{t-1}	0.759 (4.34)
Intervention 1991:Q3: irregular component	0.561 (8.49)
Intervention 1993:Q3: irregular component	-0.255 (-3.61)
Diagnostic Tests 2/	
R^2_D	0.690
Prediction error variance	$7199 \cdot 10^{-6}$
Serial Correlation: $r(1)$	0.098
$r(8)$	-0.066
$Q(8,7)$	1.96 [0.92]
Normality: $\chi^2(2)$	1.28 [0.53]

Source: Fund staff calculations.

1/ The equation is estimated over the period 1981:Q2-2000:Q4 by maximum likelihood, using STAMP 6.0 (Koopman and Harvey, 1999). Asymptotic *t*-ratios are given in brackets.
The equation includes an I(1) stochastic trend, a fixed seasonal component and intervention dummies on the irregular component.

2/ R^2_D is *R*-squared computed for first differences of the dependent variable.
Serial correlation statistics report the first- and eighth-order correlation coefficient and the value of the Portmanteau statistics (also called Box-Pierce or *Q*-statistic) for eighth-order residual autocorrelation.
The normality test reports the value of the Chi-square with two degree of freedom and includes all moments of the residual distribution up to the fourth.
P-values are given in square brackets.

99. Given the stochastic properties of real money illustrated in the subsection on structural stochastic models, the evidence that the stochastic trend becomes insignificant as the long-run influence of certain macroeconomic variables is accounted for means that the estimated domestic money demand function describes a stationary cointegrating relationship. In addition, the stability of such a long-run relationship over the liberalization period is supported by the absence of a statistically significant shift in the underlying evolutionary trend in real balances. Two episodes are detected as outliers with respect to the estimated long-run trend in money demand—the sharp expansion in money balances in the second quarter of 1991 and the subsequent adjustment in the third quarter of the same year. However, these events are likely to have provoked only transitory shifts in the real value of money balances, leaving the structure of the demand function (and, thereby, the underlying velocity) unaltered.

Testing for Granger causality

100. The last question to be answered is whether the causality relationship running from inflation expectations to real money is data congruent or artificially imposed by the structure of the model. For instance, one could argue that the hyperinflation of the early 1990s has been simply the response to high money deficit financing, whereas the sharp fall in money creation following the introduction of a cash budget established the basis for the drop in inflation in the second half of the 1990s. This hypothesis, however, does not appear to find support in the data (Table II.4). To show that the monetary aggregate had a very limited predictive value for future inflation in Zambia, an unrestricted quarterly VAR on inflation and money growth has been estimated, initially over the entire sample and then over the most recent subsample (i.e., from 1993:Q4 onward).[43] In neither case, and despite the presence of cointegration between changes in narrow money and changes in prices, there is evidence that money growth "Granger causes" inflation.[44] On the contrary, the hypothesis of a causality relationship running from inflation to money growth cannot be rejected by the data, although such causality tends to fade away in the more recent subsample. In this respect, our thesis seems to find further econometric support. As noted above, in circumstances of high uncertainty and low policy credibility like those characterizing Zambia's stabilization

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[43] The analysis was repeated by including measures of fiscal deficits, also corrected as suggested in Catao and Terrones (2001). Results have not been reported, as neither monetary nor fiscal indicators were found to "Granger cause" inflation.

[44] Granger causality tests whether the past of one variable explains the current value of another variable; it does not test logical causality. The finding that changes in narrow money do not Granger cause changes in prices is consistent with the hypothesis that regime changes (such as abandoning stabilization programs or implementing cash budgeting) altered expectations of inflation **before** the money growth.

programs during the first half of the 1990s, the speed of revision of inflation expectations and the elasticity of money demand become higher. In this way, inflation expectations are likely

Table II.4. Zambia: Testing for Causality from Money Growth to Inflation, 1982:Q2-2001:Q2

	Sample: 1982:Q2 – 2001:Q2	
	$\Delta\log(M) \Rightarrow \Delta\log(P)$	$\Delta\log(P) \Rightarrow \Delta\log(M)$
Bivariate VAR 1/		
No cointegrating vector		
Granger causality 2/	0.6005	0.0019**
	Diagnostic Tests 3/	
R-squared	0.716	
VAR serial correlation $F(20,84)$	1.40 [0.14]	
VAR normality $\chi^2(4)$	7.44 [0.11]	
VAR heteroscedasticity $F(114,36)$	0.40 [1.00]	
	Sample: 1993:Q4 – 2001:Q2	
	$\Delta\log(M) \Rightarrow \Delta\log(P)$	$\Delta\log(P) \Rightarrow \Delta\log(M)$
Bivariate VAR 4/		
No cointegrating vector		
Granger causality 2/	0.1657	0.0000**
	Diagnostic Tests 3/	
R-squared	0.623	
VAR serial correlation $F(12,26)$	1.39 [0.22]	
VAR normality $\chi^2(4)$	2.97 [0.56]	
Vector heteroscedasticity $F(48,3)$	0.27 [1.00]	

Source: Fund staff calculations.
1a/ A quarterly VAR with narrow money growth and inflation is estimated using PcFiml 9.30 (Doornik and Hendry, 2000). It includes eight lags and two dummy variable for 1989:Q3 and 1991:Q3, entering the cointegrating vector.
2/ Statistic shown in the first (second) column is the *p*-value of the hypothesis that no lags of the money (price) variable belong in the price (money) equation (for a formalization of the test see Mosconi and Giannini (1992)).
3/ Vector serial correlation statistics report the multivariate fifth-order Lagrange Multiplier test.
Vector normality test reports the value of the Chi-square with 2x2 degrees of freedom and includes all moments of the residual distribution up to the fourth.
Vector heteroscedasticity statistics test the significance of a regression of the endogenous variables on all squares of the regressors. Asterisks * and ** denote significance at 5 percent and 1 percent levels.
4/ A quarterly VAR with narrow money growth and inflation, including four lags, is estimated using PcFiml 9.30 (Doornik and Hendry, 2000).

to have had a greater impact in shaping the evolutionary pattern of money demand and actual inflation.

101. As a final remark on the lack of a causal link running from money growth to inflation, it should be noted that actual inflation has been higher than the growth in money supply during periods when inflation expectations rose—e.g., 1984/86 and 1989/93—whereas it has been lower than money growth during periods in which inflation expectations were falling—e.g. 1980/83, 1987/88, and 1994-2000 (Figure II.3, top panel). This seems to further deny the existence of stable adaptive expectations dynamics in the form of (30). Conversely, this outcome seems consistent with the idea that expectations about future policy changes may induce fluctuations in the rate of inflation lacking any past or contemporaneous correlation with the rate of monetary growth, even though excessive money deficit financing **is** the ultimate cause of inflation.

D. The Laffer Curve: The Past and The Present

102. The econometric estimates of the previous section can now be used to calculate the notional seigniorage-maximizing inflation rate, that is, the rate of inflation that maximizes the revenue from inflation tax, according to equation (28). As already noted, the estimation technique employed ensures parameter constancy, given that regime shifts are already embedded in the inflation expectations dynamics and, thereby, in the structure of the demand function.

103. Over the whole sample period (1981:Q1-2000:Q4), the average growth in real GDP was 0.39 percent per annum. Applying this rate to equation (28), along with the long-run money demand estimates for δ_1, δ_2, and δ_3 as reported in table II.3, a notional long-run revenue-maximizing rate of inflation of approximately 47 percent per annum can be derived. Using the money demand equation forecast standard error as a measure of variation around this point estimate, one may conclude that the seigniorage-maximizing rate of inflation over the sample period was in the range of 54-75 percent. Using the average GDP in equation (26), it is also possible to obtain an indication of the average amount of inflation tax revenue collected by the government over the same period: approximately 5 percent of GDP. In this respect, it is interesting to note that the estimated long-run revenue-maximizing inflation rate does not differ significantly from the realized average inflation rateover the entire period. Therefore, the null hypothesis that monetary policy in Zambia was implemented with a view to maximizing the inflation tax revenue for the whole period would not be rejected by the data. This conclusion would, however, be highly misleading. Given the number of policy regime shifts characterizing the economy in the past two decades which were extensively discussed in Section B, looking at the evolution of the equilibrium Laffer curve over time should be considered more informative for the analysis of inflationary dynamics in Zambia.

104. Table II.5 describes the evolution of the Laffer curve over time and calculates the value of the inflation tax revenue relative to its sustainable value over four subperiods during 1981:Q1-2000:Q4, according to the breaks detected in the CPI and real money data. It also makes use of out-of-sample forecasts to provide model predictions of the corresponding average values over the four quarters of 2001. The table clearly reflects the concave nature of the Laffer curve and illustrates how the economy moved to hyperinflation with low money balances at the end of the 1980s; subsequently it has reversed to a lower-inflation, higher-money configuration since the second half of the 1990s. During 1981:Q1-1989:Q3 a seigniorage of 5.5 percent was yielded from a domestic inflation rate of 39 percent, while in 1989:Q4-1991:Q2 an inflation tax revenue of 8.1 percent of GDP was generated with an inflation rate of almost 120 percent. Following the collapse of the "homegrown" economic program in October 1989, narrow money growth also increased, from 35 percent to 78 percent, whereas real money fell from 16 percent to 11 percent of GDP. In mid-1991, the Zambia's economy was then shocked by the strong monetary expansion coinciding with the preelection boom. The following period between 1991:Q3 and 1993:Q3 saw the annualized money growth rate decline by 9 percent a year, while inflation reached a record high, averaging almost 160 percent per annum. As inflation expectations jumped up and the private sector promptly substituted out of domestic money, real balances fell sharply from 10.7 percent to below 6 percent of GDP. Because of the shrinkage of the money base and the slowdown in money supply growth, inflation tax revenue fell by 3 percent of GDP despite the substantial increase in the inflation tax rate. This transitory opposite movement in inflation and seigniorage is explained, in the current model, by the impact of the sharp adjustment in inflation expectations on real money demand. Finally, by May 1993, an effective cash budget mechanism was put in place and a severe fiscal squeeze undertaken. As a result, from the third quarter of 1993 onwards, the economy witnessed an actual reduction in money growth and inflation, which dropped to annualized averages of 48 percent and 39 percent, respectively. As confidence in policy commitments to fiscal adjustment was regained, money holdings started increasing again (see Figure II.3) and the economy converged toward a lower inflation-higher money configuration, moving back to the "correct" side of the equilibrium Laffer curve.

105. The short-run dynamics of inflation and seigniorage in Zambia are illustrated in Figure II.6. In particular, the bottom panel plots annualized quarterly inflation against annualized quarterly seigniorage as a percent of GDP for the period of interest, together with the estimated equilibrium Laffer curve at the end of the period. In this context, the opposite effects of two major historical shocks are highlighted. During the preelection monetary expansion in mid-1991, when the private sector revised dramatically its judgment about the attainability of the 1989/94 RAP targets, seigniorage revenue fell by over 15 percent of GDP in one single quarter, even though inflation hardly changed. The drastic reduction in inflation tax revenue is the consequence of the severe contraction in demand for real balances which followed the preelection boom. On the contrary, following the severe fiscal squeeze undertaken in May 1993, inflation dropped by almost 200 percent over one year, although the amount of seigniorage revenue collected by the government was virtually unchanged. The

result is essentially driven by the different speeds at which inflation and money growth adjusted.

106. Table II.5 and Figure II.6 also present forecasts for inflation, money growth, and seigniorage over the current year, 2001. Under the assumption that GDP will grow by 5 percent in real terms, and using model predictions for real money and CPI, the average inflation tax revenue is estimated to decline to 1 percent of GDP, whereas narrow money is predicted to expand to 7.1 percent of GDP. Over the same period, the average annualized inflation rate is expected to fall below 22 percent, while the corresponding narrow money growth rate is forecasted to average 34 percent. [45] These predictions seem to be broadly in line with the latest monetary developments and with the objectives of the current monetary program, which target end-December 2001 CPI inflation at 17.5 percent.

E. Conclusions

107. This section of the RED examines inflationary dynamics in Zambia during the last 20 years. It presents some empirical evidence regarding the factors contributing to high inflation in the past and the role played by inflation expectations in shaping domestic money demand during hyperinflation periods in Zambia. Econometric estimates suggest that there exists in Zambia a stationary money demand relationship among narrow money, prices, income, and nominal interest rates, provided that shifts in inflation expectations are also taken into account. The Kalman filtering or stochastic trend approach illustrated here helps to control for the effects of structural changes (e.g., trade and financial liberalization, and deregulation of markets) and policy regime shifts. At the same time, it offers a practical way of dealing with the Lucas critique, thereby permitting us to describe the evolutionary inflationary trends in a developing economy like Zambia's reasonably well.

All in all, the empirical findings seem to support the thesis that hyperinflation in Zambia was the response to the high uncertainty characterizing the implementation of stabilization programs in the early 1990s. Specifically, inflation expectations and the effects of financial liberalization combined to ensure that in the first half of the 1990s the demand for domestic money fell more rapidly than the money supply. The data seem to corroborate the hypothesis that inflationary pressures arising in Zambia during the first half of the 1990s were driven by strong adjustments in inflation expectations. Because of low policy credibility and poor reputation, the speed of revision of inflation expectations and the elasticity of

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[45] Forecasted values for 2001 take into account actual data for CPI and narrow money up to June 2001. Out-of-sample CPI and real balances forecasts up to December 2001 are based on the assumptions that the tax rates and the real interest rate remain constant at the 2000:Q4 and 2001:Q2 levels, respectively; real GDP grows at 1.25 percent per quarter; and the nominal effective exchange rate depreciates by 3.5 percent over the second half of the year.

Table II.5: Zambia: Inflation, Seigniorage, and Revenue-Maximizing Inflation, 1981:Q1-2001:Q4

Period	1981:Q1-2000:Q4	1981:Q1-1989:Q3	1989:Q4-1991:Q2	1991:Q3-1993:Q3	1993:Q4-2000:Q4	End-2001 (Projections)
Average real growth	0.39	0.90	-0.81	-0.14	0.25	5.0 1/
Average inflation	59.2	39.0	119.2	157.9	38.5	17.5 2/
Seigniorage-maximizing inflation 3/	64.9	64.4	66.1	65.4	65.0	60.3
Average narrow money growth	47.3	34.9	77.9	68.7	48.2	22.3 4/
Narrow money (percent of GDP)	10.8	15.6	10.7	5.8	6.5	7.1 4/
Calculated seigniorage (percent of GDP) 5/	4.8	5.5	8.1	5.5	3.0	1.0

Sources: IMF, *International Financial Statistics*; Bank of Zambia; and Fund staff calculations.

1/ Targeted real GDP growth for 2001.

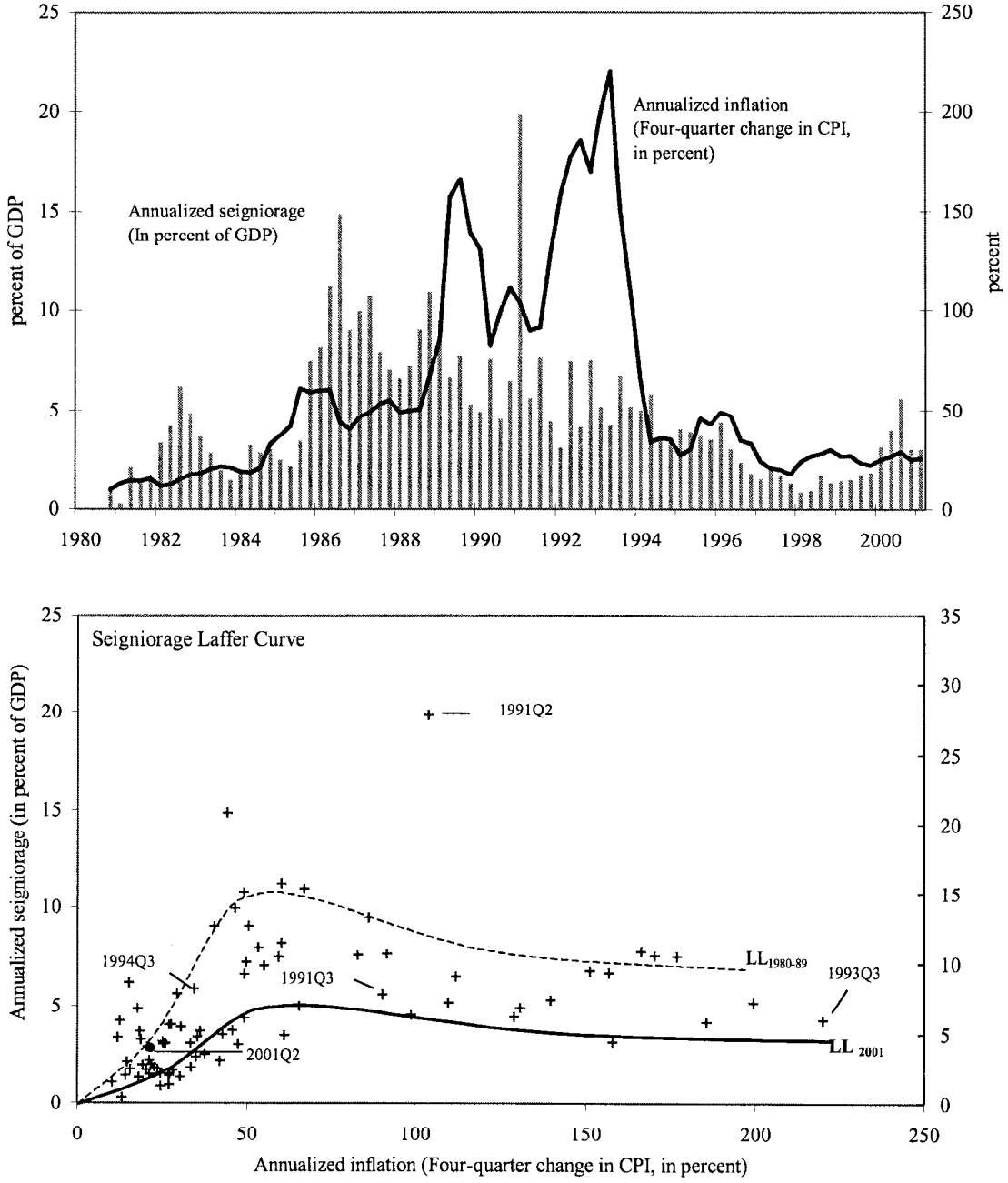
2/ Targeted 12-month inflation rate for end-2001.

3/ Calculated using equation (28) and narrow money demand elasticity estimated as in last column of Table II.3.

4/ End-of-2001 projections for narrow money take into account actual data until June, and out-of-sample forecasts for real balances and CPI until December (Tables II.2 and II.3 and footnote 34).

5/ Calculated using equation (26) for narrow money.

Figure II.6. Zambia: Seigniorage and Inflation, 1980:Q4-2001:Q1



Source: IMF, *International Financial Statistics*; and Fund staff calculations.

money demand increased. As a result, inflation expectations had a stronger impact in shaping the evolutionary pattern of money demand and actual inflation.

108. Conversely, neither evidence of a causal relationship running from money growth to actual inflation nor support to the hypothesis of stable adaptive expectations dynamics has been found in the data. While these facts do not dispute the relevance of monetary policy for containing inflationary pressures, they seem to confirm the view that anticipation of future policy changes may induce fluctuations in the rate of inflation that have no past or contemporaneous correlation with the rate of monetary growth, even though excessive money deficit financing **is** the ultimate cause of inflation. The finding that changes in narrow money do not Granger cause changes in prices is indeed consistent with the hypothesis that regime changes (such as abandoning stabilization programs or implementing cash budgeting) changed expectations of inflation **before** variations in money growth occurred.

109. In spite of the fact that in the short run—and before stabilization has been achieved—the increased financial liberalization may have reduced money demand and resulted in rising inflation and lower seigniorage, the deregulation policies implemented in Zambia since the second half of the 1990s have recently succeeded in feeding back into lower inflation and higher income growth. Indeed, on the basis of recent monetary developments and according to our model forecasts, annualized inflation is expected to average around 20 percent over the year 2001, falling as low as 11.1 percent on an end-of-period basis. These predictions seem to be in line with the objectives of the monetary program for 2001, targeting end-of-period CPI inflation at 17.5 percent.

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Table 1. Zambia: Gross Domestic Product by Sector of Origin at Constant Prices, 1994-2000

	1994	1995	1996	1997	1998	1999	2000 Est.
			(In billions of kwacha)				
Agriculture, forestry, and fishing	302	403	400	380	387	423	430
Mining and quarrying	374	271	279	285	213	160	160
Manufacturing	220	219	231	243	247	254	263
Electricity, gas, and water	72	71	67	70	68	72	73
Construction	112	108	96	124	111	116	124
Wholesale and retail trade	332	297	395	413	429	446	457
Transport and communications	134	125	135	134	146	154	158
Community, social, and personal services 1/	179	177	182	183	179	194	193
Financial institutions and insurance	183	218	200	201	202	207	205
Real estate and business services	113	122	141	159	179	204	238
Restaurants and hotels	36	38	41	44	46	45	48
Plus: import duties	290	262	276	286	271	259	272
Less: imputed banking service charges	105	125	115	115	116	119	122
Total GDP	2,241	2,185	2,330	2,405	2,361	2,415	2,499
Memorandum items:							
Nonagricultural GDP	1,938	1,783	1,929	2,026	1,974	1,992	2,069
Nonmining GDP	1,867	1,915	2,051	2,120	2,148	2,255	2,339
			(Percentage change)				
Agriculture, forestry, and fishing	-18.9	33.4	-0.6	-5.1	1.9	9.3	1.7
Mining and quarrying	-16.8	-27.6	3.0	2.2	-25.3	-24.9	0.0
Manufacturing	-8.6	-0.4	5.5	5.1	1.6	2.8	3.5
Electricity, gas, and water	3.5	-1.6	-5.6	4.2	-2.9	6.0	1.4
Construction	-20.8	-3.4	-10.9	29.2	-10.5	4.5	6.9
Wholesale and retail trade	-14.4	-10.6	33.0	4.6	3.9	4.0	2.5
Transport and communications	-4.9	-6.6	8.0	-0.7	9.0	5.5	2.6
Community, social, and personal services 1/	3.0	-1.2	3.4	0.3	-2.2	8.4	-0.5
Financial institutions and insurance	3.2	19.3	-8.3	0.3	0.4	2.7	-1.0
Real estate and business services	3.1	8.2	15.6	12.3	12.8	14.0	16.7
Restaurants and hotels	-11.8	5.3	7.9	7.3	3.4	-1.1	6.7
Plus: import duties	-32.3	-9.4	5.2	3.5	-5.1	-4.4	5.0
Less: imputed banking service charges	-3.1	-19.3	8.3	-0.4	-0.3	-2.8	-2.5
Total GDP	-8.6	-2.5	6.6	3.3	-1.8	2.3	3.5
Memorandum items:							
Nonagricultural GDP	-12.3	-8.0	8.2	5.0	-2.5	0.9	3.9
Nonmining GDP	-12.5	2.6	7.1	3.4	1.3	5.0	3.7

Source: Central Statistical Office.

1/ Includes public administration, defense, sanitary services, education, health, recreation, and personal services.

Table 2. Zambia: Gross Domestic Product by Sector of Origin at Current Prices, 1994-2000

	1994	1995	1996	1997	1998	1999	2000 Est.
			(In billions of kwacha)				
Agriculture, forestry, and fishing	302	487	612	845	1,132	1,614	2,002
Mining and quarrying	374	433	476	511	378	281	416
Manufacturing	220	298	466	598	693	808	1,027
Electricity, gas, and water	72	94	129	215	220	246	328
Construction	112	123	139	227	265	320	500
Wholesale and retail trade	332	438	692	854	1,052	1,380	1,880
Transport and communications	134	179	232	272	342	430	636
Community, social, and personal services 1/	179	251	282	412	512	667	902
Financial institutions and insurance	183	309	348	451	547	677	982
Real estate and business services	113	155	220	294	382	496	661
Restaurants and hotels	36	52	87	111	134	146	207
Plus: import duties	290	359	469	612	692	802	1,097
Less: imputed banking service charges	105	178	200	259	314	389	564
Total GDP	2,241	2,999	3,952	5,142	6,035	7,478	8,978
			(In percent of GDP)				
Agriculture, forestry, and fishing	13.5	16.2	15.5	16.4	18.8	21.6	22.3
Mining and quarrying	16.7	14.4	12.0	9.9	6.3	3.8	4.6
Manufacturing	9.8	9.9	11.8	11.6	11.5	10.8	11.4
Electricity, gas, and water	3.2	3.1	3.3	4.2	3.6	3.3	3.7
Construction	5.0	4.1	3.5	4.4	4.4	4.3	5.6
Wholesale and retail trade	14.8	14.6	17.5	16.6	17.4	18.5	20.9
Transport and communications	6.0	6.0	5.9	5.3	5.7	5.8	7.1
Community, social, and personal services 1/	8.0	8.4	7.1	8.0	8.5	8.9	10.0
Financial institutions and insurance	8.2	10.3	8.8	8.8	9.1	9.1	10.9
Real estate and business services	5.0	5.2	5.6	5.7	6.3	6.6	7.4
Restaurants and hotels	1.6	1.7	2.2	2.2	2.2	2.0	2.3
Plus: import duties	12.9	12.0	11.9	11.9	11.5	10.7	0.0
Less: imputed banking service charges	4.7	5.9	5.1	5.0	5.2	5.2	6.3
Total GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Central Statistical Office.

1/ Includes public administration, defense, sanitary services, education, health, recreation, and personal services.

Table 3. Zambia: Gross Domestic Product by Type of Expenditure, 1994-2000 1/

	1994	1995	1996	1997	1998	1999	2000 Est.
	(At current prices, in billions of kwacha)						
Total consumption	2,074	2,633	3,742	4,659	5,799	7,566	10,402
Government consumption	294	464	722	898	952	966	1,206
Private consumption	1,781	2,169	3,020	3,761	4,847	6,600	9,196
Total investment	185	478	507	749	986	1,313	1,929
Gross fixed capital formation	254	373	444	672	891	1,196	1,786
Public	235	198	239	278	482	532	794
Private	18	176	206	394	409	664	992
Changes in stocks	-69	105	63	77	95	117	143
Net exports of goods and services	-18	-113	-298	-267	-752	-1,399	-2,257
Exports of goods and services	807	1,082	1,237	1,548	1,610	1,674	1,741
Of which : exports of goods	714	1,027	1,200	1,565	1,626	1,803	1,875
Imports of goods and services	-825	-1,195	-1,536	-1,815	-2,362	-3,073	-3,998
Of which : imports of goods	-671	-1,034	-1,275	-1,601	-1,907	-2,312	-3,008
Total GDP	2,241	2,999	3,951	5,141	6,033	7,480	10,074
	(In percent of GDP)						
Total consumption	92.6	87.8	94.7	90.6	96.1	101.1	103.3
Government consumption 2/	13.1	15.5	18.3	17.5	15.8	12.9	12.0
Private consumption	79.5	72.3	76.4	73.2	80.3	88.2	91.3
Total investment	8.2	15.9	12.8	14.6	16.3	17.6	19.1
Gross fixed capital formation	11.3	12.5	11.2	13.1	14.8	16.0	17.7
Public	10.5	6.6	6.0	5.4	8.0	7.1	7.9
Private	0.8	5.9	5.2	7.7	6.8	8.9	9.8
Changes in stocks	-3.1	3.5	1.6	1.5	1.6	1.6	1.4
Net exports of goods and services	-0.8	-3.8	-7.6	-5.2	-12.5	-18.7	-22.4
Exports of goods and services	36.0	36.1	31.3	30.1	26.7	22.4	17.3
Of which : exports of goods	31.9	34.2	30.4	30.4	27.0	24.1	18.6
Imports of goods and services	-36.8	-39.8	-38.9	-35.3	-39.2	-41.1	-39.7
Of which : imports of goods	-29.9	-34.5	-32.3	-31.1	-31.6	-30.9	-29.9
Gross domestic savings	7.4	12.2	5.3	9.4	3.9	-1.1	-3.3
Public 3/	6.1	3.6	2.6	3.2	2.4	2.4	...
Private	1.3	8.6	2.7	6.2	1.5	-3.5	...
Gross national savings 4/	9.6	11.7	9.1	8.5	8.1	3.7	...
Balance on current account	1.4	-4.2	-3.7	-6.1	-8.2	-13.9	...

Source: Central Statistical Office.

1/ The methodology for estimating saving and investment is different from that used by Fund staff.

2/ Series have been revised beginning in 1994.

3/ Total revenue (excluding grants) minus government consumption.

4/ Gross domestic savings plus net factor income and net current transfers from abroad.

Table 4. Zambia: Index of Industrial Production, 1994-2000
(1980 = 100)

	Weight	1994	1995	1996	1997	1998	1999	2000 Est.
Mining and quarrying	57.2	60.9	54.5	62.3	62.9	57.6	50.6	52.4
Manufacturing	36.7	101.1	98.5	84.4	96.9	84.0	86.2	94.0
Food, beverages, and tobacco	10.4	154.3	161.0	111.0	94.0	79.0	87.9	88.5
Textiles and clothing	7.4	90.2	80.0	103.0	187.0	150.0	146.4	149.6
Wood and wood products	1.3	91.6	83.0	36.0	40.0	33.0	23.8	23.7
Paper and paper products	2.1	120.9	95.0	93.0	85.0	84.0	76.4	78.4
Chemicals, rubber, and plastics	6.7	75.1	68.0	70.0	72.0	65.0	81.1	114.5
Nonmetallic mineral products	1.9	71.5	76.0	81.0	83.0	91.0	82.9	86.7
Basic metal industries	0.9	55.9	54.0	41.0	34.0	35.0	41.7	43.4
Metal products and other	6.0	62.7	66.0	48.0	49.0	52.0	38.3	42.7
Electricity	6.1	88.3	89.7	75.5	89.8	78.9	83.4	84.8
Total industrial production	100.0	77.3	73.1	71.3	77.1	68.6	65.7	69.6

Source: Central Statistical Office.

Table 5. Zambia: Volume of Mineral Production, 1994-2000
(In thousands of metric tons)

	Coal 1/	Cobalt	Copper	Lead 2/	Zinc 2/
1994	160.9	2.5	353.5	0.0	0.0
1995	151.9	2.9	307.9	0.0	0.0
1996	128.1	4.7	313.9	0.0	0.0
1997	164.4	4.1	314.7	0.0	0.0
1998	194.0	4.9	277.4	0.0	0.0
1999	147.7	3.8	265.9	0.0	0.0
2000	169.7	4.1	259.4	0.0	0.0

Sources: Central Statistical Office; and the Bank of Zambia.

1/ The 1998 volume of coal production is for the period January-August.
2/ ZCCM, the mining parastatal stopped producing lead and zinc in 1994.

Table 6. Zambia: Marketed Production of Selected Agricultural Crops, 1993/94 - 1999/2000 1/

	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
				(In metric tons)			
Maize	476,288	344,676	668,123	314,608	182,384	250,003	191,592
Tobacco (Virginia)	5,015	2,240	1,950	3,504	3,892	...	5,726
Tobacco (burley)	1,083	1,560	1,892	939	5,099	3,706	3,328
Sugarcane	1,222,037	...	...	...	...	...	...
Mixed beans	13,755	13,792	13,006	6,930	7,467	8,768	4,061
Groundnuts	13,711	13,198	14,669	17,559	24,151	20,854	11,825
Sunflower seeds	15,517	19,285	37,962	7,983	5,888	8,934	5,420
Seed cotton	33,093	16,578	40,834	74,647	100,000	140,024	27,377
Wheat	53,607	31,816	49,402	...	...	...	79,493
Paddy rice	3,553	6,388	7,475	8,216	1,568	8,277	3,194
Soya beans	20,698	17,382	37,580	23,073	13,098	25,848	...
Sorghum	3,722	7,751	7,017	5,129	3,917	4,027	1553
				(1990/91 = 100)			
Maize	79.0	57.2	110.8	52.2	30.3	41.5	31.8
Tobacco (Virginia)	580.4	259.3	225.7	405.6	450.5	...	...
Tobacco (burley)	133.7	192.6	233.6	115.9	629.5	...	...
Sugarcane	108.5	...	...	...	...	...	...
Mixed beans	228.6	229.2	216.1	115.2	124.1	145.7	67.5
Groundnuts	154.9	149.1	165.8	198.4	272.9	235.6	133.6
Sunflower seeds	102.0	126.7	249.5	52.5	38.7	58.7	35.6
Seed cotton	67.9	34.0	83.8	153.2	205.3	287.5	56.2
Wheat	104.6	62.1	96.4	...	...	...	...
Paddy rice	39.9	71.7	83.9	92.3	17.6	92.9	35.9
Soya beans	84.9	71.3	154.1	94.6	53.7	106.0	...
Sorghum	369.6	769.7	696.8	509.3	389.0	399.9	154.2

Source: Central Statistical Office.

1/ Crop years run from May 1 to April 30.

Table 7. Zambia: Area Under Cultivation for Selected Crops, 1993/94-1999/2000 1/

	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
				(In hectares)			
Maize	679,914	520,165	675,565	649,069	510,374	598,181	605,608
Groundnuts	105,737	100,431	89,488	126,573	154,682	119,945	69,532
Sunflower seeds	31,079	32,433	47,621	20,745	15,692	14,280	13,947
Cotton	50,067	35,200	66,217	89,879	...	70,692	36,947
Soya beans	25,447	21,612	25,489	17,273	11,681	11,716	2,651
Wheat	13,656	11,566	7,821	10,327	11,251	12,682	14,113
Virginia tobacco	1,900	1,353	1,594	...	5,400	...	4,060
Paddy rice	7,177	9,746	9,888	12,412	9,065	13,346	10,532
Sugarcane	11,497	...	...	...	...	...	...
Sorghum	55,245	40,365	47,839	40,237	35,864	36,405	37,388
Millet	82,302	73,809	76,930	78,639	90,047	77,292	61,277
Mixed beans	48,599	41,462	43,240	41,541	35,379	30,780	20,947
				(Percentage change)			
Maize	9.1	-23.5	29.9	-3.9	-21.4	17.2	1.2
Groundnuts	48.1	-5.0	-10.9	41.4	22.2	-22.5	-42.0
Sunflower seeds	-21.2	4.4	46.8	-56.4	-24.4	-9.0	-2.3
Cotton	-34.5	-29.7	88.1	35.7	...	...	-47.7
Soya beans	28.1	-15.1	17.9	-32.2	-32.4	0.3	-77.4
Wheat	24.6	-15.3	-32.4	32.0	8.9	12.7	11.3
Virginia tobacco	-46.6	-28.8	17.8	...	...	...	...
Paddy rice	-48.0	35.8	1.5	25.5	-27.0	47.2	-21.1
Sugarcane	1.7	...	...	...	...	...	...
Sorghum	18.6	-26.9	18.5	-15.9	-10.9	1.5	2.7
Millet	56.3	-10.3	4.2	2.2	14.5	-14.2	-20.7
Mixed beans	26.3	-14.7	4.3	-3.9	-14.8	-13.0	-31.9

Sources: National Commission for Development Planning; and Central Statistical Office.

1/ Crop years run from May 1 to April 30.

Table 8. Zambia: Paid Employment by Economic Sector, 1994-2000
(In number of employees)

	1994	1995	1996	1997	1998	1999	2000 Est.
Agriculture, forestry, and fishing	79,300	69,079	68,300	58,898	58,630	58,300	57,800
Mining and quarrying	51,200	52,215	47,700	44,498	39,160	38,521	36,780
Manufacturing	57,100	55,654	47,400	47,118	46,685	46,000	45,600
Electricity and water	5,100	5,067	4,400	5,009	5,237	5,300	5,400
Construction	17,500	10,518	13,100	17,106	13,459	12,895	12,100
Transport and communications	29,000	36,542	46,800	48,893	45,840	45,000	44,850
Distribution and trade (wholesale and retail)	49,900	41,398	38,300	45,963	48,964	50,200	52,320
Finance and insurance	34,100	41,890	37,600	37,862	35,276	34,684	34,200
Public administration	173,800	172,604	175,800	169,814	173,764	174,800	171,210
All sectors	497,000	484,967	479,400	475,161	467,015	465,700	460,260

Source: Central Statistical Office.

Table 9. Zambia: Index of Retail Prices, 1994-2000

	Weights	1994	1995	1996	1997	1998	1999	2000
				(1994 = 100, annual averages)				
Metropolitan group								
Low income	261	100.0	135.8	192.8	237.8	295.9	372.3	462.7
High income	295	100.0	135.3	188.3	235.1	292.3	373.5	482.5
Nonmetropolitan group	444	100.0	134.2	196.3	244.7	305.1	386.6	483.3
Composite index	1,000	100.0	134.9	193.0	240.1	298.9	379.0	477.7
				(Average annual percentage change)				
Metropolitan group								
Low income		53.1	35.8	42.0	23.3	24.5	25.8	24.3
Food, beverages, and tobacco		52.4	38.4	42.8	20.7	24.3	22.7	21.9
Clothing and footware		49.0	29.2	51.0	33.8	22.9	30.5	26.1
Rent, fuel, and lighting		56.5	39.6	40.0	34.0	28.9	31.2	31.8
Furniture and household goods		49.0	22.2	29.4	20.2	29.2	36.8	29.3
Medical care		127.3	65.8	22.2	30.9	23.8	25.2	33.0
Transport and communications		40.1	25.3	43.0	35.0	15.0	28.6	40.1
Recreation and education		84.2	29.8	48.5	27.5	26.2	43.3	22.1
All other goods and services		50.2	24.5	36.0	21.8	20.1	24.0	19.6
High income		57.5	35.3	39.2	24.9	24.3	27.8	29.2
Food, beverages, and tobacco		52.2	32.6	42.1	21.5	21.8	22.6	22.3
Clothing and footware		52.9	34.2	51.3	29.3	22.8	30.3	28.3
Rent, fuel, and lighting		58.0	52.1	39.4	34.7	29.6	24.7	24.6
Furniture and household goods		71.2	23.2	29.5	24.4	24.3	47.0	38.9
Medical care		120.3	60.7	23.0	33.8	25.1	27.8	33.0
Transport and communication		57.5	37.3	33.6	21.5	26.1	28.4	47.0
Recreation and entertainment		83.2	33.2	49.6	31.4	26.1	43.2	20.5
Other goods and services		52.2	24.4	32.9	22.7	20.8	24.0	18.9
Nonmetropolitan group		53.6	34.2	46.3	24.7	24.7	26.7	25.0
Food, beverages, and tobacco		49.7	34.3	42.6	21.9	26.0	22.5	23.2
Clothing and footware		48.6	27.6	48.4	33.2	22.4	30.7	26.6
Rent, fuel, and lighting		52.7	27.8	45.8	39.5	30.6	35.1	36.2
Furniture and household goods		52.7	25.3	32.0	21.1	25.2	34.6	28.0
Medical care		95.7	52.1	16.1	28.7	24.6	28.2	32.7
Transport and communications		62.9	67.3	83.8	15.7	15.7	23.5	30.5
Recreation and education		120.8	35.6	71.5	46.6	23.0	45.8	20.0
All other goods and services		49.5	23.8	35.5	21.3	20.0	24.0	20.2
Composite index		54.6	34.9	43.1	24.4	24.5	26.8	26.0

Source: Central Statistical Office.

Table 10. Zambia: Summary of Central Government Operations, 1994-2000
(In billions of kwacha)

	1994	1995	1996	1997	1998	1999	2000 Est.
Revenue and grants	676	871	1,058	1,283	1,529	1,921	2,528
Revenue	450	596	817	1,023	1,131	1,324	1,953
Tax revenue	419	546	751	967	1,094	1,289	1,931
Company income tax	43	38	49	60	90	92	125
Personal income tax	86	134	173	236	291	377	505
Excise taxes	70	85	127	168	211	222	278
sales tax/value-added tax (VAT)	76	108	137	184	200	248	230
Trade taxes 1/	139	163	243	288	285	337	597
Extraction royalty	5	18	23	31	17	13	4
Clearance of ZESCO tax arrears	0	0	0	0	0	0	191
Nontax revenue	31	50	65	56	38	34	22
Grants	227	275	242	260	398	597	575
Total expenditures and net lending	854	1,000	1,214	1,407	1,943	2,345	3,030
Current expenditure	625	727	869	1,017	1,263	1,404	1,608
Wages and salaries	115	178	221	324	327	402	538
Public service retrenchment	2	1	0	2	77	51	74
Recurrent departmental charges	63	101	120	137	161	192	300
Transfers and pensions	90	107	96	127	149	181	219
Interest due 2/	260	259	322	326	421	482	307
Other current expenditure	62	56	79	98	112	78	160
Agricultural expenditure	32	26	30	3	15	17	10
Capital expenditure	230	273	345	390	680	789	1,009
Net lending 3/	0	0	0	0	0	152	413
Overall balance (accrual)	-178	-129	-155	-124	-414	-424	-502
Financing	178	129	155	124	414	424	502
Domestic	53	8	-43	-93	150	-73	-29
Nonbanks	3	-4	1	-14	-3	37	38
Banking system	25	-4	12	10	224	35	139
Domestic arrears	27	2	-51	-69	-117	-121	-92
Change in balances and other	-3	14	-6	-21	46	-24	-114
Foreign 4/	125	122	199	217	265	496	531
Memorandum items:							
Domestic balance (cash) 5/ 6/	-29	8	50	57	25	31	-335
Overall balance (cash) 6/	-153	-114	-212	-213	-485	-568	-708

Sources: Zambian authorities; and staff estimates.

1/ Including sales tax/VAT on imported goods.
2/ Figure for 2000 gives interest paid, after all forms of debt relief.
3/ Figure for 1999 was foreign financed and thus was not counted toward the domestic balance.
4/ Including interest arrears and debt relief.
5/ Fiscal balance excluding grants, interest payments on foreign debt, and foreign-financed capital expenditures.
6/ To approximate a cash-based presentation, an adjustment is made for line ministries' payments of arrears and changes in balances.

Table 11. Zambia: Summary of Central Government Operations, 1994-2000
(In percent of GDP)

	1994	1995	1996	1997	1998	1999	2000 Est.
Revenue and grants	30.2	29.0	26.8	24.9	24.9	25.5	25.7
Revenue	20.1	19.9	20.7	19.9	18.4	17.6	19.8
Tax revenue	18.7	18.2	19.0	18.8	17.8	17.1	19.6
Company income tax	1.9	1.3	1.2	1.2	1.5	1.2	1.3
Personal income tax	3.8	4.5	4.4	4.6	4.8	5.0	5.1
Excise taxes	3.1	2.8	3.2	3.3	3.4	2.9	2.8
Sales tax/value-added tax (VAT)	3.4	3.6	3.5	3.6	3.3	3.3	2.3
Trade taxes 1/	6.2	5.4	6.1	5.6	4.7	4.5	6.1
Extraction royalty	0.2	0.6	0.6	0.6	0.3	0.2	0.0
Clearance of ZESCO tax arrears	0.0	0.0	0.0	0.0	0.0	0.0	1.9
Nontax revenue	1.4	1.7	1.6	1.1	0.6	0.5	0.2
Grants	10.1	9.2	6.1	5.1	6.5	6.1	4.8
Total expenditures and net lending	38.1	33.4	30.7	27.4	31.6	31.2	30.6
Current expenditure	27.9	24.2	22.0	19.8	20.5	18.6	16.2
Wages and salaries	5.1	5.9	5.6	6.3	5.3	5.3	5.5
Public service retrenchment	0.1	0.0	0.0	0.0	1.3	0.7	0.8
Recurrent departmental charges	2.8	3.4	3.0	2.7	2.6	2.5	3.0
Transfers and pensions	4.0	3.6	2.4	2.5	2.4	2.4	2.2
Subsidies	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Interest due 2/	11.6	8.6	8.1	6.3	7.0	6.5	3.0
Other current expenditure	2.8	1.9	2.0	1.9	1.8	1.0	1.6
Agricultural expenditure	1.4	0.9	0.8	0.1	0.2	0.2	0.1
Capital expenditure	10.3	9.1	8.7	7.6	11.1	10.5	10.2
Net lending 3/	0.0	0.0	0.0	0.0	0.0	2.0	4.2
Overall balance (accrual)	-7.9	-4.3	-3.9	-2.4	-6.7	-5.7	-4.9
Financing	7.9	4.3	3.9	2.4	6.7	5.7	4.9
Domestic	2.5	0.3	-1.1	-1.8	2.3	-1.0	-0.4
Nonbanks	0.1	-0.1	0.0	-0.3	-0.1	0.5	0.4
Banking system	1.2	-0.1	0.3	0.2	3.6	0.5	1.4
Domestic arrears	1.3	0.1	-1.3	-1.3	-1.9	-1.6	-0.9
Change in balances	-0.1	0.5	-0.2	-0.4	0.7	-0.3	-1.2
Foreign 4/	4.3	4.1	5.0	4.2	4.4	6.6	5.4
Memorandum items:							
Domestic balance (cash) 5/ 6/	-1.3	0.3	1.3	1.1	0.4	0.4	-3.4
Overall balance (cash) 6/	-6.8	-3.8	-5.4	-4.1	-8.0	-7.6	-7.0

Sources: Zambian authorities; and staff estimates.

1/ Including sales tax/VAT on imported goods.

2/ Figure for 2000 gives interest paid, after all forms of debt relief.

4/ Including interest arrears and debt relief.

5/ Fiscal balance excluding grants, interest payments on foreign debt, and foreign financed capital expenditures.

6/ To approximate a cash-based presentation, an adjustment is made for line ministries' payments of arrears and changes in balances.

Table 12. Zambia: Summary of Central Government Revenues and Grants, 1994-2000
(In billions of kwacha)

	1994	1995	1996	1997	1998	1999	2000
Revenue and grants	676	871	1,058	1,283	1,529	1,921	2,528
Revenue	450	596	817	1,023	1,131	1,324	1,953
Tax revenue	419	546	751	967	1,094	1,289	1,931
Company income tax	43	38	49	60	90	92	125
Personal income tax	86	134	173	236	291	377	505
PAYE 1/	70	105	129	180	249	322	434
Withholding tax and other	16	29	44	56	42	55	71
Excise taxes	70	85	127	168	211	222	278
Sales tax/value-added tax (VAT)	76	108	137	184	200	248	230
Trade taxes 2/	139	163	243	288	285	337	597
Extraction royalty	5	18	23	31	17	13	4
Clearance of ZESCO arrears	0	0	0	0	0	0	191
Nontax revenue	31	50	65	56	38	34	22
User fees and charges	12	17	12	39	17	18	28
Privatization receipts 3/	...	12	27	2	1	7	-7
Other exceptional receipts	18	20	26	15	20	10	1
Grants	227	275	242	260	398	597	575

Sources: Zambian authorities; and staff estimates.

1/ Pay-as-you-earn.

2/ Including sales tax/VAT on imported goods.

3/ Net of direct privatization costs.

Table 13. Zambia: Summary of Central Government Expenditures, 1994-2000
(In billions of kwacha)

	1994	1995	1996	1997	1998	1999	2000 Est.
Total expenditures and net lending	854	1,000	1,214	1,407	1,943	2,345	3,030
Current expenditure	625	727	869	1,017	1,263	1,404	1,608
Wages and salaries	115	178	221	324	327	402	538
Personal emoluments	92	151	201	270	262	344	...
Nondefense	69	124	170	226	209	265	...
Defense	23	27	32	45	54	79	...
Wage adjustment	23	27	20	54	65	58	...
Public service retrenchment	2	1	0	2	77	51	74
Recurrent departmental charges	63	101	120	137	161	192	300
Nondefense	60	91	112	127	135	138	...
Defense	3	9	7	9	27	54	...
Transfers and pensions	90	107	96	127	149	181	219
Grants and payments 1/	80	94	83	105	130	162	...
Pensions	10	13	13	22	19	19	...
Interest due 2/	260	259	322	326	421	482	307
Domestic debt	103	77	122	115	80	105	140
Foreign debt 2/	158	182	200	211	341	377	167
Other current expenditure	62	56	79	98	112	78	78
Defense	13	8	5	0	0	0	...
Awards and compensation	0	0	23	14	6	8	...
Contingency	0	0	15	21	22	12	...
Zambia Revenue Authority funding	0	0	24	33	49	54	...
Bank of Zambia capitalization	0	0	4	0	0	0	...
Other	49	48	9	30	35	4	...
Agricultural expenditure	32	26	30	3	15	17	10
Drought relief	0	7	1	0	4	4	...
Strategic food reserve	28	3	15	3	11	14	...
Input financing	4	9	3	0	0	0	...
Other	0	7	12	0	0	0	...
Contingency	...	...	...	...	...	...	82
Capital expenditure	230	273	345	390	680	789	1,009
Financed by the government of Zambia	37	58	41	70	113	124	228
Non defense	34	54	39	69	109	123	...
Defense	3	4	2	1	4	1	...
Foreign financed	193	215	304	320	567	666	781
Net lending	...	...	...	...	...	152	413

Sources: Zambian authorities; and staff estimates.

1/ Including K16 billion of grants to the Ministry of Defence in 1998.
2/ Figure for 2000 gives interest paid, after all forms of debt relief.

Table 14. Zambia: Expenditures by Functional Classification (Domestic Budget), 1994-2000 1/

	1994	1995	1996	1997	1998	1999	2000 2/
				(In billions of kwacha)			
General public services	145	157	95	135	167	248	...
Defense	42	48	46	55	94	130	...
Public order and safety	6	8	14	13	19	69	...
Education	50	68	96	139	149	137	...
Primary education	23	25	43	71	63	49	...
Secondary education	7	8	10	22	21	22	...
Tertiary education	10	19	21	13	26	27	...
Other	9	17	22	32	39	40	...
Health	44	56	66	97	112	116	...
Social security and welfare	20	24	29	66	20	38	...
Housing and community services	6	13	20	22	21	22	...
Recreational, cultural, and religious affairs	10	12	17	44	40	41	...
Energy	17	32	35	29	27	31	...
Agriculture, forestry, and fishing	53	51	18	53	32	35	...
Mining, manufacturing, and construction	5	7	12	16	14	17	...
Transport and communications	3	3	13	17	26	24	...
Debt service	103	77	122	115	80	105	...
Other 3/	0	48	128	76	234	136	...
Total	504	603	709	876	1,035	1,150	...
				(In percent of total)			
General public services	28.9	25.9	13.4	15.4	16.1	21.6	...
Defense	8.4	7.9	6.4	6.3	9.1	11.3	...
Public order and safety	1.2	1.4	2.0	1.5	1.8	6.0	...
Education	9.9	11.3	13.5	15.8	14.4	12.0	...
Primary education	4.6	4.1	6.1	8.1	6.1	4.2	...
Secondary education	1.4	1.4	1.4	2.5	2.1	1.9	...
Tertiary education	2.0	3.1	3.0	1.5	2.5	2.3	...
Other	1.9	2.7	3.1	3.7	3.8	3.4	...
Health	8.8	9.2	9.4	11.1	10.8	10.1	...
Social security and welfare	3.9	3.9	4.0	7.5	2.0	3.3	...
Housing and community services	1.2	2.2	2.9	2.5	2.0	1.9	...
Recreational, cultural, and religious affairs	1.9	2.0	2.4	5.0	3.8	3.6	...
Energy	3.3	5.3	5.0	3.3	2.6	2.7	...
Agriculture, forestry, and fishing	10.6	8.5	2.5	6.0	3.1	3.0	...
Mining, manufacturing, and construction	1.0	1.2	1.6	1.8	1.4	1.4	...
Transport and communication	0.7	0.5	1.8	1.9	2.5	2.1	...
Debt service	20.4	12.8	17.2	13.1	7.7	9.1	...
Other 3/	...	7.9	18.0	8.7	22.6	11.8	...
Total	100.0	100.0	100.0	100.0	100.0	100.0	...

Sources: Ministries of Finance, Education and Health; and staff estimates.

1/ Total expenditures and net lending (Table 13), excluding interest payments on foreign debt, and foreign-financed capital expenditures.

2/ Figures for 2000 are not available.

3/ Including unclassified expenditures.

Table 15. Zambia: Zambia Consolidated Copper Mines Ltd. (ZCCM) Consolidated Profit and Loss Account, 1993/94 - 1999/2000 1/
(In millions of kwacha)

	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/2000
Sales	574,957	1,121,301	1,591,158	1,504,730	1,301,797	1,094,907	...
Of which: copper	390,579	598,245	1,236,300	1,111,300	949,338	765,385	...
Cost of sales	570,039	1,007,392	1,473,157	1,555,370	1,537,337	1,390,384	...
Profit/loss (-) on sales	4,918	113,909	118,001	-50,640	-235,540	295,477	...
Other costs (net) 2/	76,327	79,086	128,638	143,356	230,180	290,646	...
Profit/loss (-) before taxation	-71,409	34,823	-10,637	-193,996	-465,720	259,625	...
Profit/loss (-) after taxation 3/	-72,733	3,436	-29,981	-198,722	-468,108	260,385	...

Source: Zambia Consolidated Copper Mines, Ltd.

1/ The ZCCM financial year runs from April 1 to March 31.

2/ Includes net interest, exchange losses, and share of associated companies' profits.

3/ Including taxation recoveries from the carryover of losses against profits for the previous year.

Table 16. Zambia: Monetary Survey, 1994-2000

	1994 1/	1995 1/	1996	1997	1998	1999	2000 Est.
			(In billions of kwacha; end of period)				
Net foreign assets	-965	-985	-1,217	-1,129	-2,261	-2,424	-1,512
Monetary authorities	-1,012	-1,092	-1,394	-1,335	-2,677	-2,893	-2,440
Commercial banks	47	107	176	206	415	469	927
Net domestic assets	1,314	1,526	1,944	2,031	3,367	3,852	3,998
Net domestic credit	248	398	542	579	1,132	1,505	2,173
Net claims on government 2/	85	92	113	122	581	693	952
Monetary authorities	13	-58	-46	-37	508	597	1,053
Commercial banks	72	150	159	159	73	96	-101
HIPC account (IMF)	...	...	...	...	...	...	-401
Claims on nongovernment	163	306	429	457	551	812	1,221
Private sector	...	...	378	415	427	555	862
Public enterprises	...	...	51	42	124	257	359
Other items (net)	1,066	1,128	1,402	1,451	2,235	2,346	2,226
Broad money	348	541	727	901	1,105	1,428	2,486
Narrow money	144	228	270	355	398	504	761
Currency outside banks	57	79	106	137	170	212	288
Demand deposits	82	140	163	217	226	290	457
Bank of Zambia deposits	6	9	1	1	1	2	16
Quasi money	204	312	457	546	708	924	1,725
Savings deposits	67	74	114	141	146	190	289
Time deposits	109	151	182	197	167	201	266
Foreign currency deposits	28	88	161	207	394	534	1171
			(Twelve-month percentage change)				
Net foreign assets	-29.9	-2.1	-23.6	7.2	-100.2	-7.2	37.6
Net domestic assets	37.3	16.2	27.4	4.4	65.8	14.4	3.8
Net domestic credit	...	60.3	36.3	6.9	95.4	33.0	44.3
Net claims on government	...	7.5	22.7	8.4	374.8	19.4	37.3
Claims on nongovernment	...	88.1	40.4	6.5	20.6	47.4	50.3
Other items (net)	...	5.9	24.3	3.5	54.0	5.0	-5.1
Broad money	62.8	55.3	34.4	24.0	22.6	29.2	74.1
Narrow money	50.0	58.1	18.3	31.5	11.9	26.7	51.0
Quasi money	73.2	53.2	46.3	19.5	29.6	30.6	86.7
			(Twelve-month change as percentage of beginning-period broad money)				
Net foreign assets	-103.9	-5.7	-43.0	12.1	-125.6	-14.7	63.8
Net domestic assets	166.7	60.9	77.4	11.9	148.2	43.9	10.3
Net domestic credit	...	43.0	26.7	5.1	61.3	33.8	18.7
Net claims on government	...	1.8	3.9	1.3	50.3	10.2	18.1
Claims on nongovernment	...	41.1	22.8	3.8	10.4	23.6	28.6
Other items (net)	...	18.0	50.7	6.7	100.0	10.1	-8.5
Broad money	62.8	55.3	34.4	24.0	22.6	29.2	74.1
Narrow money	22.5	24.1	7.7	11.7	4.7	9.6	18.0
Quasi money	40.3	31.2	26.7	12.3	17.9	19.6	56.1
Memorandum items:							
Velocity (GDP/average M2)	7.1	6.4	6.0	6.3	6.4	6.2	5.5
Money multiplier 2/	2.5	5.1	4.3	4.2	3.8	4.2	4.5

Sources: Bank of Zambia; and staff estimates.

1/ Since January 1995, balance sheet of the Bank of Zambia has been compiled on the basis of the new chart of accounts. Complete historical data go back to December 1994 only.

2/ Ratio of broad money to reserve money. The increase in the multiplier in 1995 resulted from the reduction in the required reserve ratio from 30 percent to 3 percent.

Table 17. Zambia: Accounts of the Monetary Authorities, 1994-2000

	1994	1995 1/	1996	1997	1998	1999	2000 Est.
			(In millions of kwacha)				
Net foreign assets	-1,012	-1,092	-1,394	-1,335	-2,677	-2,893	-2,440
Gross reserves	192	200	271	337	159	266	772
Liabilities	-1,204	-1,293	-1,664	-1671	-2,835	-3,159	-3,212
Net domestic assets	1,154	1,197	1,562	1,547	2,965	3,231	2,996
Net domestic credit	26	79	139	121	687	757	825
Net claims on government	13	-58	-46	-37	491	597	638
Claims on government	52	102	181	224	691	841	1,100
Government deposits	-39	-160	-226	-260	-199	-243	-463
HIPC account (IMF)	...	...	...	...	...	...	-401
Claims on nongovernment	13	137	185	158	196	160	187
Of which: claims on banks	11	122	160	131	161	121	82
Other items (net)	1,128	1,118	1,423	1,426	2,278	2,474	2,571
Reserve money	142	105	169	212	288	338	556
Currency in circulation	64	92	127	158	196	251	331
Liabilities to commercial banks	77	11	40	54	92	85	223
Liabilities to nonbanks	1	2	2	1	1	2	2
			(Twelve-month percentage change)				
Net foreign assets	...	-7.9	-27.6	4.2	-100.5	-8.1	15.7
Net domestic assets	...	3.7	30.5	-1.0	91.6	9.0	-7.3
Net domestic credit	...	203.4	76.9	-13.3	469.1	10.2	8.9
Net claims on government	...	-540.8	-20.7	-19.8	-1,434.6	21.6	6.8
Claims on nongovernment	...	966.8	35.5	-14.9	24.4	-18.2	16.7
Other items (net)	...	-0.8	27.2	0.2	59.7	8.6	3.9
Reserve money	46.8	-26.0	60.7	25.9	35.7	17.3	64.4
			(Twelve-month change as percentage of beginning-period broad money)				
Net foreign assets	...	-56.5	-287.1	34.9	-631.8	-75.1	134.1
Net domestic assets	...	30.4	347.8	-9.0	667.5	92.4	-69.7
Net domestic credit	...	37.2	57.6	-10.9	266.7	24.4	19.9
Net claims on government	...	-50.0	11.4	5.4	248.6	36.8	12.0
Claims on nongovernment	...	87.2	46.2	-16.3	18.1	-12.4	7.9
Other items (net)	...	-6.8	290.2	2.0	400.8	68.0	28.7
Reserve money	46.8	-26.0	60.7	25.9	35.7	17.3	64.4

Source: Bank of Zambia.

1/ Since January 1995, the balance sheet of the Bank of Zambia has been compiled on the basis of the new chart of accounts. Complete historical data go back to December 1994 only.

Table 18. Zambia: Accounts of Commercial Banks, 1994-2000
(In billions of kwacha)

	1994	1995	1996	1997	1998	1999	2000 Est.
Net foreign assets	47	107	176	206	415	469	927
Gross assets	57	117	191	225	457	530	996
Liabilities	-11	-9	-14	-19	-42	-61	-68
Net domestic assets	241	344	441	557	518	743	1,253
Net position with the Bank of Zambia	93	-26	-23	5	113	97	283
Currency	16	14	20	21	26	39	43
Other balances and money market placements	8	20	3	17	46	55	90
Statutory reserves (kwacha)	69	9	29	33	36	48	88
Statutory reserves (foreign exchange)	2	0	11	16	27	34	101
Credit from Bank of Zambia	3	69	87	82	21	79	39
Net domestic credit	225	441	563	589	583	869	1,348
Net claims on government	72	150	159	159	68	96	314
Claims	85	194	216	223	156	232	360
Treasury bills	81	142	164	189	142	187	228
Other assets	4	53	52	34	13	45	132
Deposits	-12	-45	-58	-64	-88	-136	-46
Claims on nongovernment	153	291	404	430	515	773	1,034
Other items (net)	-77	-71	-98	-37	-178	-223	-378
Private sector liabilities	288	451	618	763	933	1,212	2,180
Demand deposits	99	203	344	443	595	783	1,573
Savings and time deposits	189	248	274	320	338	430	606

Source: Bank of Zambia.

Table 19. Zambia: Structure of Interest Rates, 1994-2000
(In percent; end of period)

	1994	1995	1996	1997	1998	1999	2000 Est.
Bank rate	24.8	51.5	69.8	23.3	42.1	46.0	44.1
Treasury bill rate 1/ 2/	23.1	51.3	59.6	18.8	32.5	36.1	33.8
One-year government bond 3/	32.2	43.6	37.0	23.3	43.9	48.6	38.7
18-month government bond 3/	36.3	...	...	...	43.0	49.3	43.3
24-month government bond 3/	...	...	...	...	...	...	45.8
Kwacha deposit rates 4/							
Savings	13.3	30.6	30.2	16.5	7.4	9.4	11.5
Short-term deposits	16.4	40.9	47.0	27.2	15.0	19.5	17.9
3 months	14.4	36.7	44.6	25.4	16.5	21.0	20.0
6 months	13.3	33.1	32.0	24.3	13.4	19.8	12.7
12 months and over	...	...	...	...	...	...	...
24-hour call rate	9.9	31.1	30.5	14.6	7.3	7.9	6.5
Notice (7-90 days)	14.0	36.7	44.6	25.4	9.8	18.1	19.3
Fixed deposit (30-365 days)	13.3	33.1	32.0	24.3	...	...	...
Lending rates 4/							
Bank overdraft (minimum)	45.8	66.7	69.0	37.2	37.9	44.8	54.9

Source: Bank of Zambia.

1/ Annualized (weighted by maturity).
2/ Treasury bill rates became market determined in 1993.
3/ One-year bond introduced in December 1989; 18-month bond introduced in January 1991.
4/ Commercial bank rates were liberalized in 1992.

Table 20. Zambia: Balance of Payments, 1994-2000
(In millions of U.S. dollars, unless otherwise indicated)

	1994	1995	1996	1997	1998	1999	2000 Est.
Current account	47	-146	-122	-158	-371	-379	-430
Trade balance	64	-8	-62	54	-153	-149	-221
Exports	1,066	1,186	993	1,110	816	756	746
Metals	910	984	754	806	520	468	497
Other	157	202	239	304	296	288	249
Imports	-1,003	-1,194	-1,055	-1,056	-969	-905	-967
Metals	-287	-271	-237	-289	-221	-121	-177
Other	-716	-923	-818	-768	-748	-784	-790
Services (net)	-99	-194	-141	-189	-179	-211	-224
Transfers (net)	319	298	287	182	176	137	135
Interest on official debt	-233	-252	-198	-195	-215	-156	-120
Other factor transactions (net)	-4	10	-8	-10	0	0	0
Capital account	-12	-77	49	166	118	346	25
Official disbursements	212	234	206	190	91	343	278
Official amortization	-309	-338	-255	-181	-136	-162	-290
Private capital (net)	85	27	98	157	163	165	37
Errors and omissions	-106	-13	-8	-135	-200	-124	217
Overall balance	-70	-236	-80	-127	-453	-157	-188
Financing	70	236	80	127	453	157	188
IMF (net)	-18	0	0	14	0	14	26
Purchases	0	1,264	0	14	0	14	26
Repurchases (scheduled)	-18	-1,264	0	0	0	0	0
Change in overdue obligations	0	0	0	0	0	0	0
Other foreign assets (net)	-63	23	-53	-46	246	-49	-45
Central bank (net)	-141	69	-31	-38	246	-49	-45
Assets	-80	90	-3	-27	194	-2	-38
Liabilities	-61	-21	-27	-11	52	-47	-7
Commercial banks (net)	78	-46	-22	-8	0	0	0
Net change in arrears (decrease -)	-76	176	-176	0	85	-251	-10
Debt reduction/rescheduling received	227	37	310	159	122	443	217
Memorandum items:							
Current account, excluding interest obligations and official transfers	-58	-213	-228	-242	-359	-376	-311
Copper export volume (in thousands of metric tons)	366	341	327	302	256	240	234
Copper price (U.S. dollars per lb.)	0.90	1.13	0.79	0.93	0.72	0.70	0.82
Average exchange rate (Kwacha per U.S. dollar)	669	866	1,208	1,315	1,862	2,388	3,111

Sources: Bank of Zambia; and staff estimates.

Table 21. Zambia: Merchandise Exports, 1994-2000
(In millions of U.S. dollars, unless otherwise indicated)

	1994	1995	1996	1997	1998	1999	2000 Est.
Total exports, f.o.b.	1,107.4	1,198.0	994.9	1,160.0	815.9	756.2	746.4
Metal exports, f.o.b.	952.1	983.6	760.0	856.0	519.9	468.2	497.4
Copper							
Value	772.2	850.9	568.8	669.3	365.0	371.7	425.2
Volume (thousands of metric tons)	366.4	344.3	327.5	302.5	255.9	239.6	233.6
Price (U.S. dollars per lb.) 1/	0.96	1.12	0.79	1.00	0.65	0.70	0.83
Cobalt							
Value	179.9	132.7	191.2	186.7	154.9	96.5	72.2
Volume (thousands metric tons)	4.3	2.5	3.9	4.6	4.9	3.7	3.1
Price (U.S. dollars per lb.) 1/	19.14	24.53	22.59	18.27	14.20	11.60	11.60
Lead							
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volume (thousands of metric tons)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Price (U.S. dollars per lb.)	...	...	...	...	...	...	...
Zinc							
Value	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Volume (thousands of metric tons)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Price (U.S. dollars per lb.) 1/	...	...	...	...	...	...	...
Nonmetal exports, f.o.b.	155.3	214.4	234.9	304.0	296.0	288.0	249.0

Sources: Bank of Zambia; and staff estimates.

1/ Net of freight and insurance.

Table 22. Zambia: Foreign Trade Volume and Unit Value, 1994-2000
(Percentage change from the preceding year, unless otherwise indicated)

	1994	1995	1996	1997	1998	1999	2000 Est.
Volume							
Exports	-2.7	-9.4	9.4	7.0	-8.7	-3.6	-6.4
Imports	-3.9	8.4	-10.9	25.3	-1.6	-6.9	4.5
Unit value 1/							
Exports	10.7	22.7	-23.5	12.0	-19.5	-3.9	5.4
Imports	2.4	9.9	-0.8	-7.9	-6.6	2.1	1.4
Terms of trade	8.1	11.7	-22.8	21.6	-13.9	-5.9	3.9
Terms of trade index (1990=100)	89.1	99.5	76.8	93.4	80.4	75.7	78.6

Source: Staff estimates.

1/ In U.S. dollar terms.

Table 23. Zambia: Net Foreign Assets of the Banking System, 1994-2000
(In millions of U.S. dollars)

	1994	1995	1996	1997	1998	1999	2000
Net foreign assets of the Bank of Zambia	-1,039	-1,143	-1,087	-943	-1,164	-1,099	-864
Assets	268	210	211	238	69	101	293
Gold	10	0	0	0	0	0	...
Other	258	210	211	238	69	101	...
Liabilities	-1,307	-1,352	-1,298	-1,181	-1,233	-1,200	-1,157
IMF	-1,168	-1,235	-1,210	-1,139	-1,197	-1,171	-1,135
Other	-138	-117	-88	-43	-37	-29	-22
Net foreign assets of commercial banks	68	112	137	145	181	178	223
Assets	84	122	149	159	199	201	239
Liabilities	-16	-10	-11	-13	-18	-23	-16
Net foreign assets of the banking system	-1,017	-1,030	-949	-798	-984	-921	-641
Assets	366	331	360	397	268	303	533
Liabilities	-1,383	-1,362	-1,309	-1,195	-1,252	-1,223	-1,173

Sources: Bank of Zambia; and staff estimates.

Table 24. Zambia: Scheduled External Debt-Service Payments, 1994-2000

	1994	1995	1996	1997	1998	1999	2000 Est.
	(In millions of U.S. dollars)						
Scheduled debt service	541	590	453	437	355	328	523
Interest	233	252	198	256	219	166	233
Of which: Fund charges/interest	30	39	10	7	7	7	7
Amortization	309	338	255	181	136	162	290
Of which: Fund repurchases	0	0	0	0	0	0	0
	(In percent of exports of goods and services, unless otherwise indicated)						
Scheduled debt service	46.2	46.1	39.6	33.5	36.1	39.0	60.7
Interest	19.8	19.6	17.3	19.6	22.3	19.7	27.1
Of which: Fund charges/interest	2.6	3.1	0.9	0.5	0.7	0.8	0.8
Amortization	26.3	26.4	22.3	13.9	13.8	19.2	33.7
Of which: Fund repurchases	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Memorandum item:							
Exports of goods and services (in millions of U.S. dollars)	1,173	1,281	1,143	1,305	983	842	861

Sources: Bank of Zambia; and staff estimates.

Table 25. Zambia: External Debt, 1994-2000 1/ 2/

	1994	1995	1996	1997	1998	1999 3/	2000 Est.
	(In millions of U.S. dollars)						
Total external debt	6397	7041	7085	6971	6613	5670	5669
Medium- and long-term debt	6156	6817	6880	6924	6613	5389	5669
Multilateral	3127	3325	3381	3397	3412	3474	3431
IMF	1216	1239	1198	1138	1132	1172	...
Other	1911	2086	2182	2259	2280	2302	...
Bilateral official	2945	3272	3345	3431	3141	1915	1888
Paris Club	2361	2863	2936	3022	2732	1750	1732
Other	584	409	409	409	409	165	156
Suppliers	78	215	149	92	60	...	...
Financial institutions 2/	6	5	6	3	...	...	...
Suppliers and other	84	220	155	95	60	37	30
Short-term debt	241	224	205	47	0	281	0
	(In percent of exports of goods and services, unless otherwise indicated)						
Total external debt	545.2	549.6	619.8	570.0	720.4	673.3	658.4
Medium- and long-term debt	524.7	532.2	601.9	566.1	720.4	640.0	658.4
Multilateral	266.5	259.6	295.8	277.8	371.7	412.5	398.5
IMF	103.6	96.7	104.8	93.0	123.3	139.2	...
Other	162.9	162.8	190.9	184.7	248.4	273.3	...
Bilateral official	251.0	255.4	292.6	280.5	342.2	227.4	219.3
Paris Club	201.2	223.5	256.9	247.1	297.6	207.8	201.2
Other	49.8	31.9	35.8	33.4	44.6	19.6	18.1
Suppliers	6.6	16.8	13.0	7.5	6.5	0.0	0.0
Financial institutions 2/	0.5	0.4	0.5	0.2	0.0	0.0	0.0
Suppliers and other	7.2	17.2	13.5	7.8	6.5	4.4	3.5
Short-term debt	20.5	17.5	17.9	3.8	0.0	33.4	0.0
Memorandum item:							
Exports of goods and services (in millions of U.S. dollars)	1,173	1,281	1,143	1,223	918	842	861

Sources: Bank of Zambia; and staff estimates.

1/ Including arrears.

2/ Excludes "dormant" commercial debt not tendered in 1994 buyback, which the authorities estimate to amount to US$85 million.

3/ After rescheduling under the traditional mechanism.

Table 26. Zambia: Nominal, Nominal Effective, and Real Effective Exchange Rates, 1994: Q1-2001: Q2
(Index, 1995=100, unless otherwise indicated)

	Official Kwacha-U.S. Dollar Exchange Rate	Official U.S. Dollar-Kwacha Exchange Rate	Nominal Effective Exchange Rate	Real Effective Exchange Rate
1994 Q1	661.92	0.00151	143.86	99.62
Q2	687.27	0.00146	135.59	102.65
Q3	677.13	0.00148	132.86	106.03
Q4	677.93	0.00148	131.17	109.55
1995 Q1	759.28	0.00132	116.41	105.49
Q2	849.76	0.00118	99.76	93.41
Q3	940.33	0.00106	91.40	92.46
Q4	943.65	0.00106	92.43	108.64
1996 Q1	1,053.24	0.00095	84.81	106.40
Q2	1,238.30	0.00081	73.15	99.70
Q3	1,264.57	0.00079	70.90	103.11
Q4	1,273.75	0.00079	70.99	109.37
1997 Q1	1,289.52	0.00078	73.44	119.74
Q2	1,295.92	0.00077	73.81	122.46
Q3	1,315.47	0.00076	74.85	128.26
Q4	1,357.43	0.00074	72.59	130.90
1998 Q1	1,544.18	0.00065	66.57	124.56
Q2	1,825.86	0.00055	56.32	113.27
Q3	1,941.18	0.00052	53.69	114.12
Q4	2,135.97	0.00047	47.20	105.98
1999 Q1	2,288.10	0.00044	44.95	107.03
Q2	2,377.86	0.00042	44.48	110.85
Q3	2,403.87	0.00042	43.91	115.54
Q4	2,480.57	0.00040	42.22	114.15
1999 Q1	2,288.09	0.00044	44.91	107.36
Q2	2,377.86	0.00042	44.53	110.98
Q3	2,403.64	0.00042	43.93	115.18
Q4	2,482.49	0.00040	42.27	114.25
2000 Q1	2,714.39	0.00037	39.60	112.44
Q2	2,866.36	0.00035	38.81	116.89
Q3	3,177.56	0.00031	36.00	115.27
Q4	3,701.41	0.00027	32.29	108.44
2001 Q1	3,408.63	0.00030	34.44	121.93
Q2	3,323.67	0.00030	36.41	129.13

Source: IMF, Information Notice System.

Table 27. Zambia: Summary of Consolidated Foreign Exchange Market, 1999-2000
(In millions of U.S. dollars)

	1999					2000				
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
	(In millions of U.S. dollars)									
Interbank purchases	15.5	19.5	24.8	9.1	68.9	9.4	15.0	12.3	6.7	80.2
Interbank sales	15.5	19.5	24.8	9.1	68.9	9.4	15.0	12.3	6.7	80.2
Bureau purchases	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Bureau sales	0.0	0.0	0.0	0.0	0.1	0.0	0.0	20.0	0.0	0.1
Commercial purchases	302.5	244.7	353.2	322.2	1,222.6	248.4	281.3	304.4	287.6	1955.8
Commercial sales	335.4	237.8	341.1	327.8	1,242.1	268.2	269.8	300.4	280.2	1957.1
Forward purchases	1.1	5.2	0.0	3.5	9.7	25.8	1.5	0.0	0.3	54.9
Forward sales	2.3	2.1	0.9	0.8	6.1	1.1	15.9	1.1	0.3	36.3
Net commercial demand	-34.7	16.2	11.4	7.6	0.5	4.9	-2.9	2.9	7.4	17.4
BoZ net dealing window sales 1/	18.9	-8.3	-5.9	0.6	5.3	-10.6	14.0	-17.7	-1.5	-3.7
Memorandum items: 2/										
Interbank market rate (k/US$) 3/										
Bureau market rate (k/US$) 3/	2,503.6	2,539.9	2,514.6	2,609.6	2,541.9	2,849.5	3,062.4	3,348.4	4,323.0	
Retail sell rate (k/US$) 3/	2,407.8	2,487.2	2,469.0	2,571.7	2,483.9	2,785.8	2,970.0	3,272.4	4,148.8	
BoZ dealing rate (k/US$) 3/ 4/	2,302.5	2,396.5	2,422.1	2,503.0	2,406.1	2,754.8	2,939.9	3,244.1	4,108.8	

Sources: Bank of Zambia; and staff estimates.

1/ Financed by balance of payments assistance and foreign exchange purchases by the mining parastatal (ZCCM).

2/ All exchange rates are end-of-period.

3/ Weighted-average sell rate.

4/ BoZ dealing window opened on December 23, 1993.

Zambia. Summary of the Tax System as of August 24, 2001

	Tax	Name of Tax	Exemptions and Deductions 1/	Rate	
1.	Taxes on income and profits (Income Tax Act of 1966 and amendments)				
1.1	Corporate profit tax	A flat rate on profits of corporations; profits are defined as revenues minus depreciation, production costs and wages. Fringe benefits paid are non deductible.	As of April 1, 1997 losses may be carried forward for up to five years only, except for successor companies of ZCCM who have a 20 year carry-forward. Depreciation schedules: 2 years for machinery, plants and equipment used in farming and tourism industry; 4 years for plans and machinery (all business other than farming and tourism industry and for assets used wholly for commercial purposes); 5 years for vehicles; 10 years for housing; 20 years for industrial building; and 50 years for commercial buildings. Tax credit for tax paid abroad on dividends and interest. Deductions of K 240,000 for each handicapped employee. All prospecting and exploration expenditures for mining companies are deductible immediately.	Category General Companies listed on the Lusaka Stock Exchange Profits of (unlisted) banks above K 250 million Profits from agriculture, non-traditional exports, and chemical fertilizer. Successor companies of ZCCM	35 percent 30 percent 45 percent 15 percent 25 percent
1.2	Personal income tax	A progressive tax on global personal income. (Tax on salaries is withheld at source under the pay-as-you-earn system. Withholding tax on income.	Income paid into pension funds up to K 180,000 per annum. Some capital gains not taxable. Contributions to charitable organizations deductible up to 15 percent of taxable income. Lump sum payments made to an employee on loss of employment on medical grounds.	Taxable income. Under K 1,600,000 K 1,600,000–K 2,200,000 Over K 2,200,000 A tax credit of K 144,000 applies.	10 percent 20 percent 30 percent
1.3	Withholding tax on capital income	Tax withheld at source for interest, dividends, capital gains, and rents. Withholding tax on interest and dividends paid by former ZCCM companies.	K 240,000 per annum is exempt (interest only).		15 percent 10 percent
1.4	Mineral resource levy (Mines and Mineral Act of 1997)	Royalty levied upon the net smelter value of the natural resource.	The Minister of Finance can exempt companies from payment. Successor companies of ZCCM liable to a reduced rate of 0.6 percent of gross value.	Product. Base or precious metals Industrial minerals Gemstones	2 percent 2 percent 2 percent

Zambia. Summary of the Tax System as of August 24, 2001

Tax		Name of Tax	Exemptions and Deductions 1/		Rate
2.	Taxes on property				
2.1	Property transfer tax	Levied upon the selling price of transferred property and shares.	Shares listed on the Lusaka Stock Exchange are exempt.		2.5 percent
2.2	Property tax	Specific tax levied by local authorities.			Varies across districts.
3.	Taxes on goods and services				
3.1	Value-added (VAT of 1995)	Multistage tax on the value added	Books, educational material, health care expenditure, financial and insurance services, water and sewerage services and residential rents are exempt. Agricultural products, tourist activities, exports and supplies to diplomats are zero rated.		17.5 percent
3.2	Excise taxes (Customs and Excise Act of 1986 and amendments	A tax levied on products in second schedule of the act.	Purchase by diplomats and allowable losses.		
3.2.1	Tobacco and tobacco products	Ad valorem excise	Purchases by diplomats.	Product	
3.2.2	Alcoholic beverages	Ad valorem excise	Fermented liquor, other than opaque beer, containing more than 3 percent of proof spirits when for own use and not for sale.	Clear beer, ale and stout Wine Opaque beer Spirits, liquor	85 percent 125 percent 35 percent 125 percent
3.2.3	Hydrocarbon oils	Ad valorem excise	Sales to the military. Embassies and approved foreign organizations are exempt.	Petroleum Diesel Kerosene Household use Industrial use Light oil Fuel oil Gases and other gaseous hydrocarbons	45 percent 45 percent 15 percent 30 percent 15 percent 15 percent 30 percent
3.2.4	Mineral water and soft drinks	Ad valorem excise			10 percent
3.2.5	Fuel levy	Specific on gasoline, applied on wholesale price.	Sales to military.		15 percent
4	Taxes on international trade				
4.1	Customs tariffs	Ad valorem customs	Goods originating in Common Market for Eastern and Southern Africa		0, 5, 15, and

Zambia. Summary of the Tax System as of August 24, 2001

Tax	Name of Tax	Exemptions and Deductions 1/	Rate
	tariffs on the c.i.f. value of imports.	countries come in duty free on reciprocal basis.	25 percent

Source: Zambian authorities.

1/ The Minister of Finance has power to grant exemptions under the Customs and Excise, Income Tax, and Value-Added Tax Act. On May 31, 1996, the government published a notice that no new exemptions would be granted in 1996 apart from those referred to in the January 26, 1996 budget address.