

SM/01/72
Correction 1

CONTAINS CONFIDENTIAL
INFORMATION

March 19, 2001

To: Members of the Executive Board
From: The Acting Secretary
Subject: **Botswana—Selected Issues and Statistical Appendix**

The following corrections have been made in SM/01/72 (2/27/01):

Page 11: Unit statements and footnote 1 added to read “For each age...median age.”

Page 15, upper panel: corrected

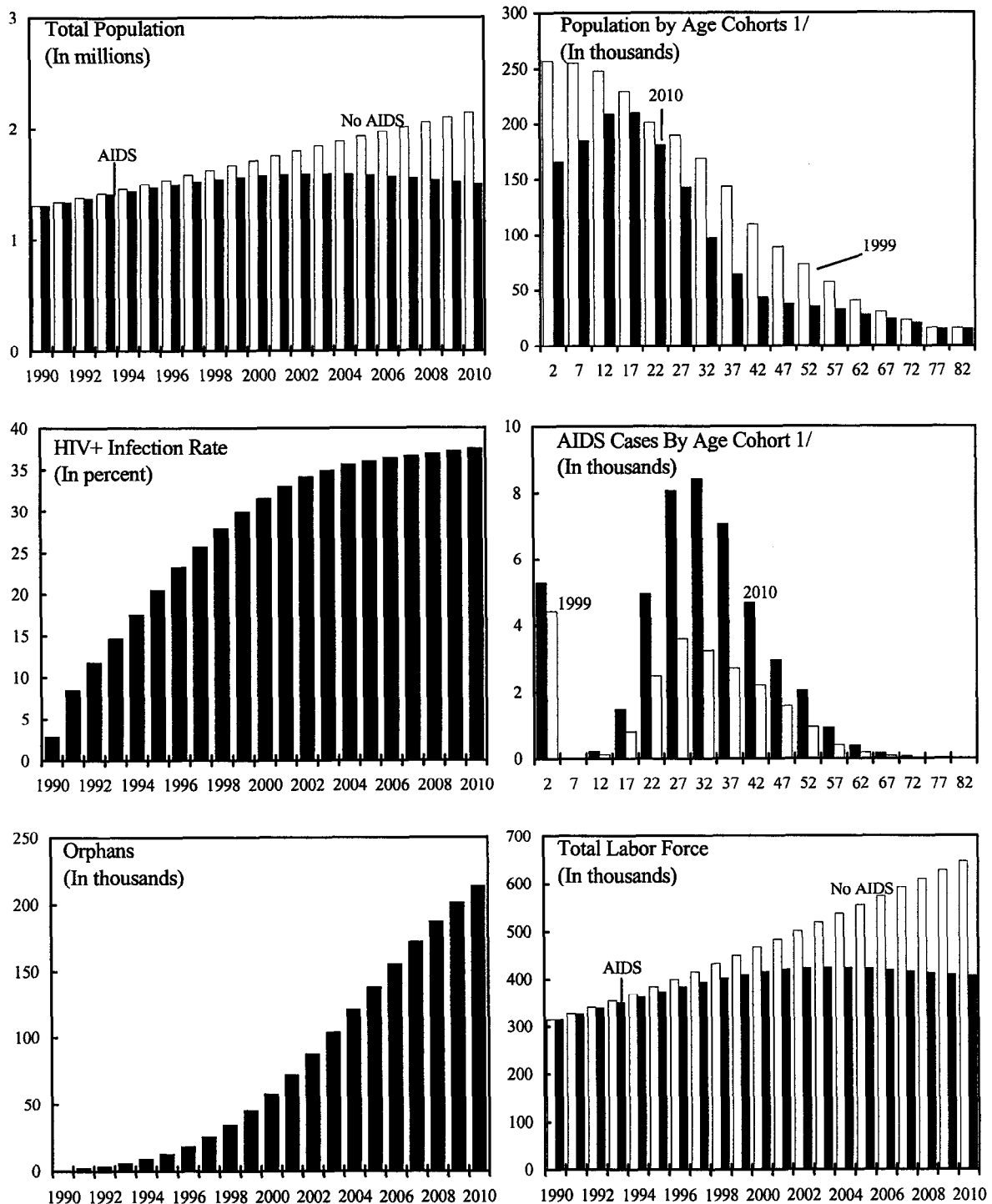
Page 32, under description, line 7: for “% AIDS costs transfers”
read “rate of AIDS costs transfers”
under symbol, last line: for “K/Y_I” read “K/Y_i”

Corrected pages are attached.

Att: (3)

Other Distribution:
Department Heads

Figure 1. Botswana: Selected Demographic Indicators, 1990-2010



Source: ABT Associates, South Africa; and Fund staff estimates.

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

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 productivity and foreign investment.

The no-AIDS counterfactual scenario

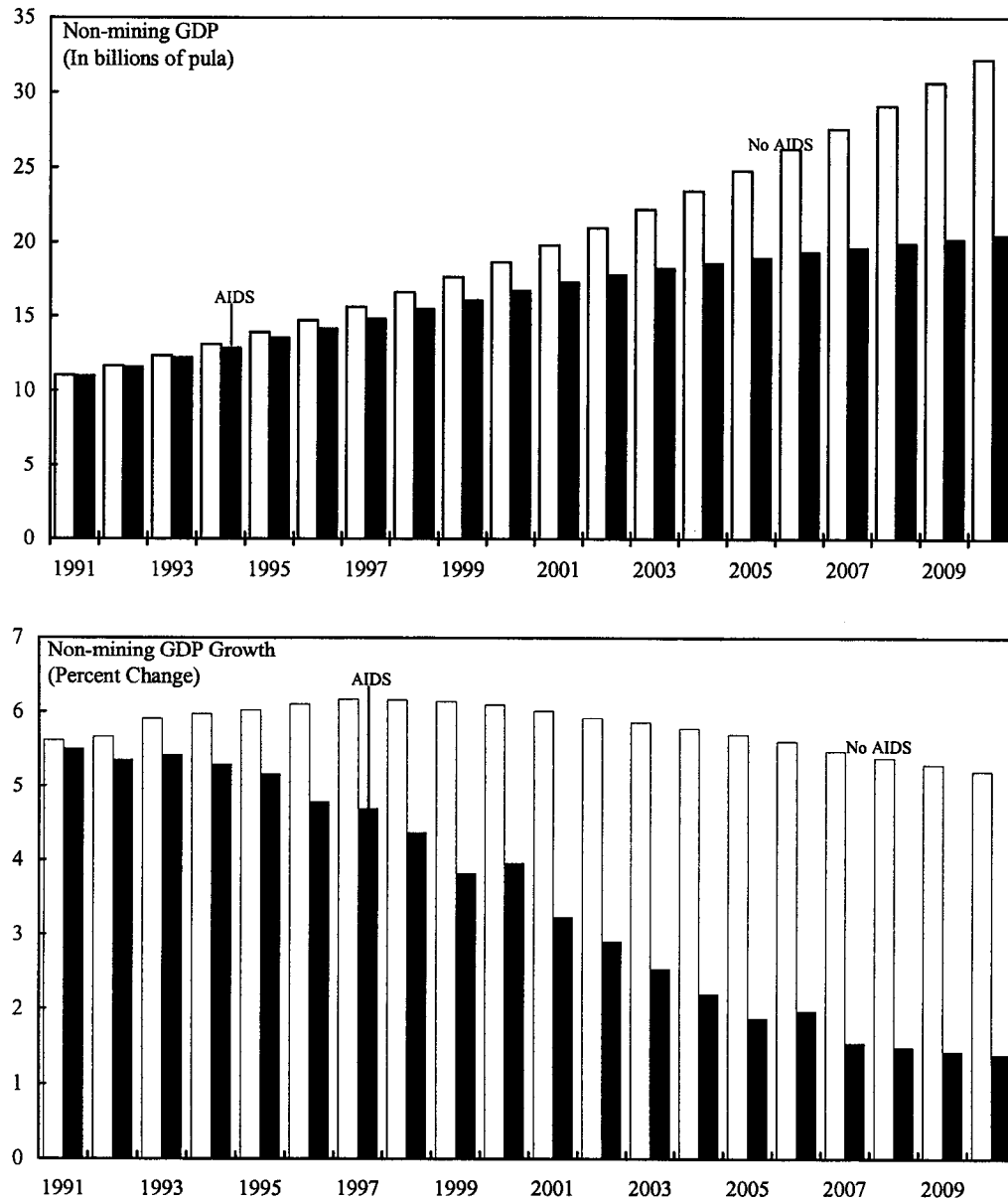
25. Under the assumption of no AIDS, nonmining GDP would grow at an annual rate of 5.7 percent between 1999 and 2010 (or 2.2 percent in per capita terms), leveling off at a rate of 5.2 percent toward the end of the simulation horizon (Table 1, Table 2, and Figure 2). Capital accumulation is the main contributor to output growth over the period, reflecting the large capital share that is assumed to characterize the formal sector and this sector's 92 percent share of the nonmining economy.¹³ Labor's contribution to growth diminishes over the period because growth of the working-age population would have slowed even without the AIDS crisis.

The AIDS baseline scenario

26. The AIDS baseline incorporates the projected effects of AIDS on the population and labor force. With AIDS, growth in the nonmining economy would slow to 2.4 percent a year over the period 1999-2010 and stabilize at 1.4 percent in 2010, compared with 5.2 percent in the no-AIDS scenario (Table 1, lower panel and Table 3). This reduction in economic growth comes mainly through two channels. First, 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 slow and its contribution to growth would diminish to about 1.2 percent a year—almost 3 percentage points below the no-AIDS counterfactual. Second, the direct impact of AIDS on Botswana's labor force would cut nonmining growth by about 1 percent, compared with the no-AIDS counterfactual. The overall projected reduction in economic growth due to AIDS—around 4 percentage points—is larger than in the BIDPA (2000) study because the estimated prevalence of HIV/AIDS in Botswana has increased since

¹³ Whereas the formal sector features a capital-output ratio close to 2 and a capital share parameter of 0.80, the informal sector is assumed to be highly labor intensive, with a capital-output ratio around 0.97 and a capital share parameter of 0.05. Total factor productivity (TFP) is also assumed to grow at different rates in the two sectors: 0.4 percent in the formal sector and 0.05 percent in the informal sector. This seems to be broadly consistent with the duality of the Botswana economy and the binding labor constraints characterizing its formal sector.

Figure 2. Botswana: AIDS and No AIDS Scenarios, 1991-2010



Source: ABT Associates, South Africa; and Fund staff estimates.

Table 3. Botswana: AIDS Baseline Scenario
(Percentage change, unless otherwise stated)

	2000	2002	2004	2006	2008	Average
Macroeconomic Impact						
GDP (billions of pula) 1/						
Nonmining economy	16.7	17.7	18.6	19.3	19.9	18.6
Formal sector	15.4	16.5	17.3	18.1	18.7	17.3
Informal sector	1.3	1.3	1.3	1.2	1.2	1.2
GDP growth						
Nonmining economy	4.0	2.9	2.2	2.0	1.5	2.4
Formal sector	4.2	3.1	2.4	2.2	1.6	2.6
Informal sector	1.1	0.1	-0.7	-0.9	-1.1	-0.3
Capital Stock growth						
Nonmining economy	3.3	2.5	2.0	1.8	1.4	2.1
Formal sector	3.6	2.7	2.1	1.9	1.4	2.2
Informal sector	0.1	0.0	0.0	0.0	0.0	0.0
AIDS-related health spending (percent of GDP)						
Nonmining economy	1.1	1.3	1.5	1.6	1.6	1.5
Formal sector	0.8	0.9	1.1	1.1	1.1	1.0
Informal sector	5.1	6.6	8.0	9.0	9.6	7.9
Distribution Effects						
Output per worker (pula)						
Nonmining economy	40,170	41,938	43,865	46,044	48,116	44,558
Formal sector	56,436	59,140	62,052	65,293	68,322	63,025
Informal sector	8,927	8,846	8,766	8,714	8,687	8,780
Output per worker growth						
Nonmining economy	2.5	2.2	2.3	2.6	2.2	2.3
Formal sector	2.7	2.4	2.4	2.7	2.3	2.4
Informal sector	-0.3	-0.5	-0.4	-0.2	-0.1	-0.3
Labor Market						
Employment growth						
Nonmining economy	0.4	0.2	0.0	-0.2	-0.2	0.0
Formal sector	0.3	0.1	0.0	-0.1	-0.2	0.0
of which:						
Skilled	0.2	0.1	0.0	-0.1	-0.1	0.0
Unskilled	0.1	0.1	0.0	0.0	0.0	0.0
Informal sector	1.4	0.6	-0.2	-0.7	-0.9	0.0
Wages (pula)						
Skilled wages	22,845	24,005	25,301	26,786	28,218	25,800
Unskilled wages (F)	6,591	6,898	7,225	7,583	7,914	7,327
Unskilled wages (I)	3,600	3,561	3,519	3,483	3,455	3,515
Unskilled wage ratio	1.8	1.9	2.1	2.2	2.3	2.1

Source: Fund staff estimates.

1/ Constant prices 1998.

A. Theoretical Model

Here we provide analytical details of the theoretical model used in section C. Parameters are given in Table 9.

Health spending allocation

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 number of adult AIDS cases, L is labor force, and N^c is the population below 15 years. Subscript f and i denote formal and informal sector, respectively, whereas superscript c stands for children whose parents are working in either sector¹⁹.

Capital accumulation and consumption

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 medical insurance. 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 fixed share of real national GDP, and δ is the depreciation rate. Note that x represents the proportion of AIDS-related medical costs that are paid for by reducing saving in either sector, whereas ω is the

¹⁹ Note that children and child AIDS-related health costs are allocated across formal and informal sectors in the same proportion as the adult population.

Table 9. Botswana: Initial Model Parameters

<i>Symbol</i>	<i>Description</i>	<i>Value</i>	<i>Symbol</i>	<i>Description</i>	<i>Value</i>
Formal Sector			Informal Sector		
m_f	Yearly medical cost per adult AIDS cases	14,495	m_i	Yearly medical cost per adult AIDS cases	14,495
m_{cf}	Yearly medical cost per children AIDS cases	14,495	m_{ci}	Yearly medical cost per children AIDS cases	14,495
σ_f	saving rate	0.4	σ_i	saving rate	0.4
σ_{ff}	rate of capital inflow	0.4			
x_f	AIDS costs met by reducing saving	0.8	x_i	AIDS costs met by reducing saving	0.8
ω	rate of AIDS costs transfers	0.8	$1-\omega$	rate of AIDS costs transfers	0.2
δ_f	depreciation rate	0.07	δ_i	depreciation rate	0.07
α_f	constant - production function	4.1	α_i	constant - production function	1,110
γ_f	exogenous technological trend	0.004	γ_i	exogenous technological trend	0.0005
β_s	skilled labor share of output	0.12			
β_u	unskilled labor share of output	0.08	β_i	unskilled labor share of output	0.95
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
$\rho1_s$	constant - age efficiency	6.2			
$\rho2_s$	linear term - age efficiency	0.067			
$\rho3_s$	quadratic term - age efficiency	-0.0012			
$\rho1_u$	constant - age efficiency	5.6	$\rho1_u$	constant - age efficiency	5.6
$\rho2_u$	linear term - age efficiency	0.027	$\rho2_u$	linear term - age efficiency	0.027
$\rho3_u$	quadratic term - age efficiency	-0.0006	$\rho3_u$	quadratic term - age efficiency	-0.0006
w_s	wage - skilled	21,245			
w_u	wage - unskilled	6,281	w_i	real wage - unskilled	3,538
Y_f/Y	share of total output - formal	0.92	Y_i/Y	share of total output - informal	0.08
K/Y_f	capital-output ratio	1.95	K/Y_i	capital-output ratio	0.97