

**FOR  
AGENDA**

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December 26, 2007

To: Members of the Executive Board

From: The Acting Secretary

Subject: **Burkina Faso—Selected Issues**

This paper provides background information to the staff report on the 2007 Article IV consultation discussions with Burkina Faso (EBS/07/153, 12/21/07), which is tentatively scheduled for discussion on **Wednesday, January 9, 2008**. At the time of circulation of this paper to the Board, the Secretary's Department has received a communication from the authorities of Burkina Faso indicating that they consent to the Fund's publication of this paper.

Questions may be referred to Mr. Petri (ext. 38429), Mr. Gottschalk (ext. 35876), and Mr. Yartey (ext. 37713) in AFR.

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INTERNATIONAL MONETARY FUND

BURKINA FASO

**Selected Issues**

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Approved by the African Department

December 21, 2007

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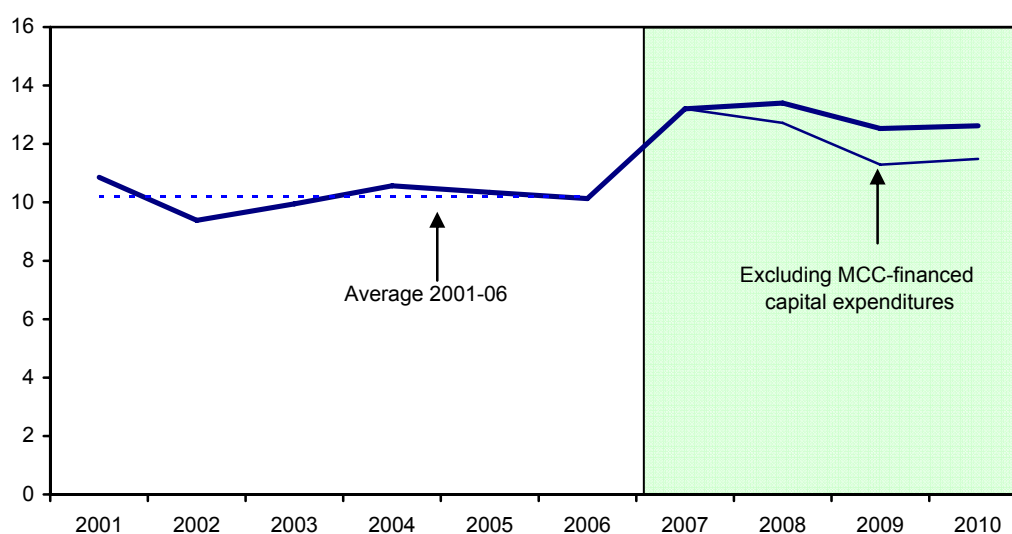
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# I. PUBLIC INVESTMENT AND GROWTH IN BURKINA FASO<sup>1</sup>

## A. Introduction

1. This paper assesses the link between public investment and economic growth in Burkina Faso, where the authorities plan to significantly increase public investment in the medium term. In 2007–10, the public investment-to-GDP ratio is expected to increase by about 2 percentage points from its 2000–06 average (Figure I.1). The paper first explores the role of public investment in growth using a standard neoclassical growth model. It then reviews the empirical evidence of the growth effect of public investment and provides an assessment of the likely growth impact for Burkina Faso.

Figure I.1: Burkina Faso: Capital Expenditures and Net Lending, 2001–10  
(Percent of GDP)



Sources: Burkinabè authorities; and IMF staff estimates.

2. The theoretical analysis shows that the role of public investment in growth depends on the nature of the growth process. In a neoclassical framework, there are essentially two types of growth: (i) steady-state growth, where the economy is in steady state and growth occurs as productivity shocks shift the steady state outward; and (ii) growth through a convergence process, whereby the economy starts at a low base and converges toward a given higher-income steady state. Determining which of these growth processes applies more to a low-income country like Burkina Faso matters greatly, because in the former the impact of investment on growth is likely to be limited whereas in the latter it could have large

<sup>1</sup> Prepared by Jan Gottschalk.

effects. The paper argues that the steady-state growth process is probably more relevant for Burkina Faso.

3. The theoretical analysis is complemented by a review of empirical evidence on the effect of public investment on growth. While there is considerable uncertainty, overall the empirical evidence points to a modest impact of public investment on growth; an increase in the public investment-to-GDP ratio by 1 percentage point appears to raise output growth by about 0.2 percentage points. Applying this to the proposed increase in Burkina Faso's public investment ratio would suggest a growth impact of about 0.4 percentage points for as long as the higher investment rate is maintained. This would be a noticeable contribution, but far from a dominant influence on Burkina Faso's growth performance.

### B. A Neoclassical Model with Public Investment<sup>2</sup>

4. The model used here is a standard neoclassical model with an endogenous savings decision. Consumers maximize utility,

$$(1) \quad \sum_{t=0}^{\infty} \beta^t U(c_t),$$

where  $\beta$  is a discount factor and  $c_t$  consumption; the utility function is given by

$U(c_t) = \frac{c_t^{1+\gamma}}{1+\gamma}$ .<sup>3</sup> Consumers also hold capital, produce, and pay taxes. The government uses the tax revenue to create public capital, which enters into the private sector production function:

$$(2a) \quad F(K_t, L_t, A_t, Q_t) = \left( K_t^\alpha (A_t L_t)^{1-\alpha} \right)^\theta Q_t^{1-\theta},$$

where  $K_t$  is capital,  $L_t$  is labor,  $A_t$  is productivity, and  $Q_t$  is public capital. Both labor and productivity are assumed to grow at constant rates  $g_1$  and  $g_2$ ; expressing other variables in efficiency labor terms (i.e., rescaling them by  $A_t L_t$ <sup>4</sup>) to ensure that they are constant in steady state, yields for the production function:

$$(2b) \quad f(k_t, q_t) = k_t^{\alpha\theta} q_t^{1-\theta}.$$

5. The government is assumed to tax aggregate output at a constant rate  $\tau$ , so that government revenue and investment is given by  $\tau f(k_t, q_t)$ . Assuming depreciation rates of  $\delta_1$  for private capital and  $\delta_2$  for public capital, capital accumulation equations are given by:<sup>5</sup>

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<sup>2</sup> This model has been developed by Tokhir Mirzoev.

<sup>3</sup> The parameter  $\gamma$  represents the (inverse) of the intertemporal elasticity of substitution in consumption.

<sup>4</sup> For example, private capital in efficiency labor terms is defined as  $k_t = \frac{K_t}{A_t L_t}$ . Efficiency labor terms are denoted by small letters.

<sup>5</sup> Equations (3) to (5) are all expressed in efficiency labor terms.

$$(3) \quad k_{t+1} = \frac{(1-\delta_1)k_t + (1-\tau)f(k_t, q_t) - c_t}{(1+g_1)(1+g_2)}, \text{ and}$$

$$(4) \quad q_{t+1} = \frac{(1-\delta_2)q_t + \tau f(k_t, q_t)}{(1+g_1)(1+g_2)}.$$

The Euler equation, derived from utility maximization subject to the above budget constraints, is:

$$(5) \quad c_t^\gamma = \frac{\beta c_{t+1}^\gamma}{(1+g_2)^\gamma} ((1-\delta_1) + (1-\tau)f'(k_{t+1})).$$

6. Equations (2b) to (5) are sufficient to simulate the model, after choosing appropriate parameter values. The simulations below are based on the following choices:  $\alpha = 0.35$ ,  $\beta = 0.98$ ,  $\delta_1 = \delta_2 = 0.05$ ,  $\gamma = -0.9$ ,  $\theta = 0.8$ ,  $g_1 = 0.02$ ,  $g_2 = 0.01$ , and  $\tau = 0.08$ . Most of these values are standard parameters in the literature; the parameters for population growth, productivity growth, and the tax rate have been broadly aligned with values for Burkina Faso.<sup>6</sup>

### C. Steady-State Growth

#### Growth through productivity shocks—a baseline scenario

7. In neoclassical growth theory, the steady-state growth rate of the economy is typically determined by the underlying growth of labor force and productivity.<sup>7</sup> If one considers per-capita income as a proxy of development, productivity becomes the key factor in determining growth. While the neoclassical model introduced above incorporates a constant growth rate for productivity, it is useful to consider a one-time, permanent, upward shift in productivity—resulting, for example, from the introduction of a new technology—to illustrate the underlying transmission mechanism of the model, as well as to introduce a baseline scenario with “typical” growth from a neoclassical viewpoint. To this end, the production function in the model is modified to include a stochastic productivity shock,  $\varepsilon_t$ :

$$(2c) \quad f(k_t, q_t) = k_t^{\alpha\theta} q_t^{1-\theta} \varepsilon_t.$$

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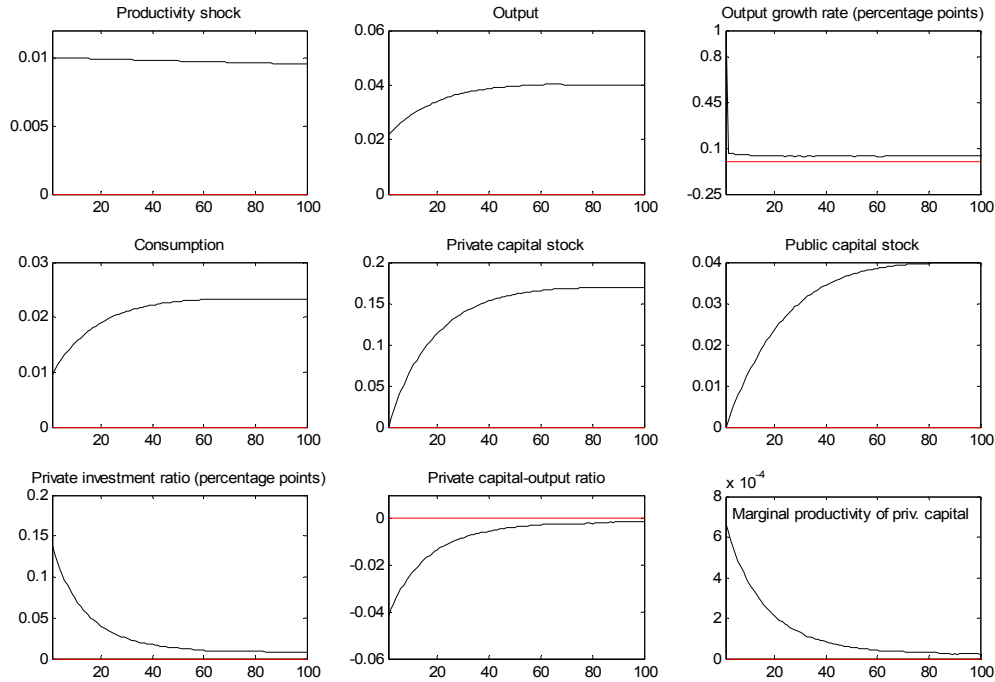
<sup>6</sup> Given that all tax revenue in this model is used for investment, the tax rate has been set equal to the share of government investment in GDP over past years, using the national accounts definition of government investment.

<sup>7</sup> In the model outlined above, the steady state growth rate is given by the sum of  $g_1$  and  $g_2$ , representing labor force and productivity growth respectively. The fact that both growth rates are exogenous—i.e., they are determined outside the neoclassical growth model—implies that the model’s steady state growth rate is exogenous as well; consequently, the model’s main analytical contribution is not an explanation of the steady state growth rate, but the economic adjustment processes that occur if the economy is outside its steady state, as shown in the model simulations above. While a large strand of literature has been developed to endogenize the steady state growth rate, a review of the endogenous growth literature is outside the scope of this paper.



8. Figure I.2 displays the model's response to a positive productivity shock using impulse-response functions, which depict the deviation of variables from their baseline (i.e., steady-state value) in response to the shock.<sup>8</sup> The shock is permanent, i.e., an innovation  $x$  occurring at  $t_1$  would raise productivity in all future years:  $\varepsilon_{1+j} = \varepsilon_0 + x$ , for  $j = 0, 1, 2, \dots \infty$ .<sup>9</sup>

Figure I.2. Response to Productivity Shock  
(Deviation from baseline)



Source: IMF staff estimates

9. The increase in productivity owing to the productivity shock directly raises output; moreover, it raises the marginal productivity of capital, which induces higher private investment and a buildup of the private capital stock, leading to further output gains over time. Higher output also raises tax revenues, which leads public capital to build up at the same time. Once the economy has reached its new steady state—consistent with its permanently higher productivity level—output, consumption, and capital stocks have converged at new, higher levels; meanwhile, the marginal productivity of private capital, the

<sup>8</sup> Note that the baseline deviations cannot be interpreted as deviations in percent, unless otherwise indicated, because the model variables are not expressed in logarithms; the absolute deviations have no meaningful economic interpretation. Thus, the focus should be on the qualitative response.

<sup>9</sup> In the actual simulations, the shock is highly persistent but not permanent because of computational problems.

private investment-to-GDP ratio, and the private capital-to-output ratio return to their original steady state.

10. The growth process through productivity shocks has two defining characteristics:
- Individual shocks raise the output level, but have no long-run effect on economic growth. Consequently, sustained output growth requires continuous innovations that raise productivity—i.e., a stream of productivity shocks. Given the nature of technical progress, though, it is plausible to assume that there is an infinite supply of productivity shocks. This distinguishes it from other sources of growth that are inherently finite in supply (e.g., public or private investment).
  - Growth through productivity shocks represents growth through shifts in the steady state. That is, the economy is initially in steady state, but once a productivity shock occurs, the steady state of the economy is shifted outwards—i.e., the economy can sustain a higher output level in steady state—and the economy converges to its new steady state, growing in the process.

### **Growth through private sector capital deepening**

11. Given that public investment leads to a crowding-in of private investment, it is useful to consider first the role of private capital accumulation for growth. Private investment is endogenous in the neoclassical model outlined above, with the investment/savings decision determined by intertemporal utility maximization. Nevertheless, there are essentially two ways to simulate an exogenous increase in private investment:

- First, an exogenous shock,  $\omega_t$ , could be added to the equation for private capital accumulation (3) in order to simulate an exogenous increase in the capital stock:

$$(3a) \quad k_{t+1} = \frac{(1 - \delta_1)k_t + (1 - \tau)f(k_t, q_t) - c_t + \omega_t}{(1 + g_1)(1 + g_2)}.$$

This shock would simulate an increase in the capital stock outside the budget constraint of the model, i.e., it would correspond to an exogenous capital transfer. However, it is not clear to what real-world scenario this shock would correspond. In any event, simulations show that a large part of such a transfer would be offset by a reduction in other private investment (i.e., economic agents would use the “free” addition to their capital stock to reduce their own investment effort). Given that the economy was initially in steady state and the original private capital stock optimal, using the freed-up resources for increasing consumption appears sensible.<sup>10</sup> Consequently, in this scenario the effect on output (and growth) is small.

- Second, one could simulate an increase in investment through higher savings by exogenously increasing the private capital stock, as above, while simultaneously

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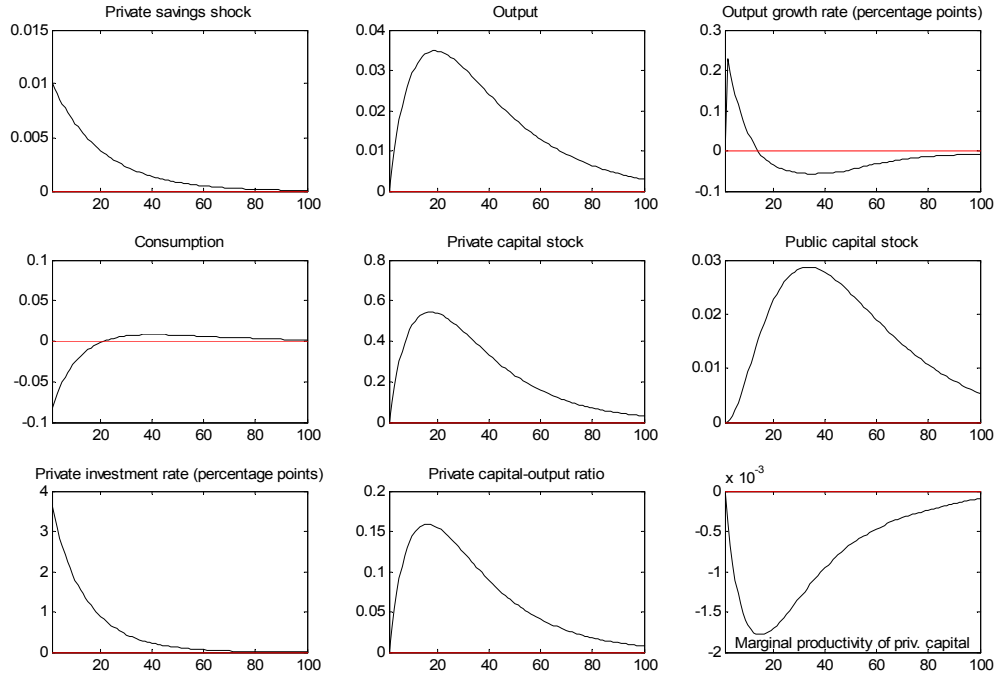
<sup>10</sup> Results available upon request.

decreasing consumption by the same amount. That is, equation (3) would be substituted with (3a), and the Euler equation (5) would become:

$$(5a) \quad (c_t + \omega_t)^\gamma = \frac{\beta c_{t+1}^\gamma}{(1 + g_2)^\gamma} ((1 - \delta_1) + (1 - \tau) f'(k_{t+1}))$$

12. The results for a fairly persistent private savings shock are shown in Figure I.3. By design, the private savings shock increases the private investment-to-GDP ratio at the expense of lower consumption; the resulting buildup of the private capital stock leads to higher output, and, through the increase in tax revenue, to a higher public capital stock. This process is characterized by capital deepening (i.e. the private capital-output ratio increases), whereas the marginal productivity of capital declines. In the long run, when the private savings shock dissipates, all variables return to their previous steady state.

Figure I.3. Response to Private Savings Shock  
(Deviation from baseline)



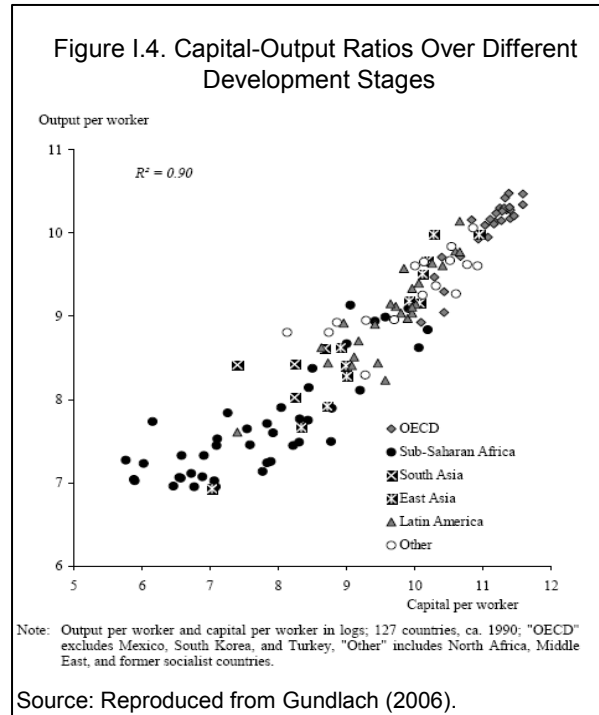
Source: IMF staff estimates.

13. Relying on capital deepening for growth is likely to be problematic for a number of reasons:

- First, the simulations show that a permanent increase in the investment (and savings) rate-to-GDP would permanently raise the output level, but have only a temporary impact on the growth rate; a permanent increase in growth through capital deepening

would require continuous increases in the investment-to-GDP ratio, which is infeasible.<sup>11</sup>

- Second, if the economy starts out from steady state, raising the savings rate is unlikely to be optimal, because though output increases, it comes at the expense of lower consumption, at least initially, and distorts the savings/investment decision of economic agents.<sup>12</sup>
- Third, there is little evidence that real-world economies grow through capital deepening, which would imply that capital-output ratios are much higher in developed than developing economies. Figure I.4 compares output per working-age person and capital per working-age person across 127 countries; labor productivity and capital intensity are clearly strongly correlated, but the capital-output ratio—which is given by the inverse of the slope of an imaginary regression line through the observed data points—appears to be relatively constant over different development stages.<sup>13</sup> This is consistent with growth through productivity shocks, where the capital-output ratio returns to its original baseline value, but not with growth through capital deepening. Moreover, a detailed growth-accounting analysis by Young (1995) for fast-growing Asian economies shows that physical capital accumulation accounted for only a small part of their growth performance.



<sup>11</sup> In fact, the decline in the marginal productivity of private capital—which reflects the diminishing returns characteristic of neoclassical models—implies that for maintaining a given growth rate, ever-larger increases in the investment-to-GDP ratio would be needed.

<sup>12</sup> Raising the savings rate may be optimal if this overcomes distortions that keeps the savings rate suboptimal low; such mechanisms can be present in poverty-trap models, but a recent review by Kraay and Raddatz (2005) finds little evidence that these distortions are empirically relevant.

<sup>13</sup> This analysis, and the chart, have been reproduced from Gundlach (2006).

### Growth through grant-financed public investment

14. An increase in public investment can be simulated in the model considered here either through an exogenous increase in the public capital stock or through raising the tax rate. Beginning with the former, a stochastic public capital shock is added to the equation for public capital accumulation, (4), which becomes:

$$(4a) \quad q_{t+1} = \frac{(1 - \delta_2)q_t + \tau f(k_t, q_t) + v_t}{(1 + g_1)(1 + g_2)}.$$

15. This shock increases the public capital stock outside the model's budget constraint, i.e., without recourse to tax financing, which could correspond to public investment financed through external project grants.

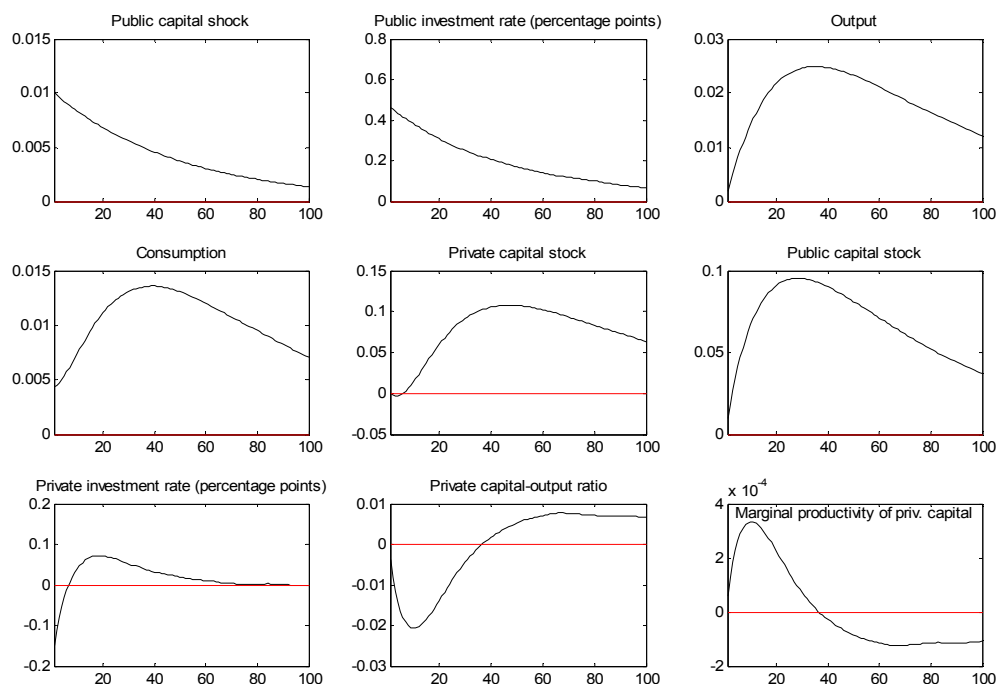
16. The simulation results in Figure I.5 show that an increase in public capital raises both output and the marginal productivity of private capital on impact, which—after a short delay—leads to crowding in of private investment.<sup>14</sup> Private capital accumulation induces further output gains over time; public capital accumulation is supported by gains in tax revenue owing to output gains.

17. These simulations show that externally-financed capital accumulation is clearly beneficial to the economy in this model; if project grant inflows were to raise the public investment-to-GDP ratio permanently, both output and consumption levels would rise permanently as well. However, relying on project grants for a growth strategy would probably be unworkable, because, as in the case of private sector capital deepening, it would require the public investment ratio to continuously increase to generate a permanent increase in the growth rate; the necessary ever-larger grant inflows are unlikely to materialize. Moreover, once aid inflows are phased out, output gains would be lost and the economy would return to its original baseline.

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<sup>14</sup> Consumption also increases on impact; initially, the increase in public capital substitutes to some extent for private capital accumulation, and the resulting decrease in private investment facilitates the increase in consumption. Over the medium term, though, private investment increases to take advantage of the rise in the marginal productivity of private capital.

Figure I.5: Response to Public Capital Shock  
(Deviation from baseline)



Source: IMF staff estimates.

18. These results can be attributed to two defining characteristics of the model used here:

- The fact that output returns to its baseline after aid is phased out reflects the assumption that the economy is initially in steady state: the steady-state public capital stock is already optimal, and the economy will return to this level once the external stimulus disappears. The stimulus is still beneficial, but mostly because it enables temporarily higher consumption than would otherwise have been possible.
- The fact that a permanent increase in public investment raises the output level, but has no permanent effect on growth is due to the assumption of diminishing returns to capital accumulation inherent in neoclassical models. In contrast, in an endogenous growth-type model without diminishing returns, an increase in the public investment ratio could lead to a permanent increase in the growth rate.<sup>15</sup> In both models, public investment leads to a virtuous circle, where higher public investment leads to higher private capital accumulation, higher output, and higher tax revenue, further supporting public investment. In a neoclassical model with diminishing returns, the

<sup>15</sup> See Glomm and Ravikumar (1997).

effects of additional public investment become smaller with each round, until the economy settles in a new equilibrium with higher output levels.

- In the absence of diminishing returns, the effects of public investment do not fade out as the public capital stock becomes larger, and the virtuous circle is self-sustaining over time. Thus, the output effects of public investment always remain the same, regardless of how many cycles have passed. While a model without diminishing returns predicts a much more powerful effect of public investment on growth, it requires a specific parameter constellation to hold—the neoclassical model is much more robust in this regard—and empirical evidence does not point to particularly strong effects of public investment on growth, as shown below.

### **Growth through tax-financed public investment**

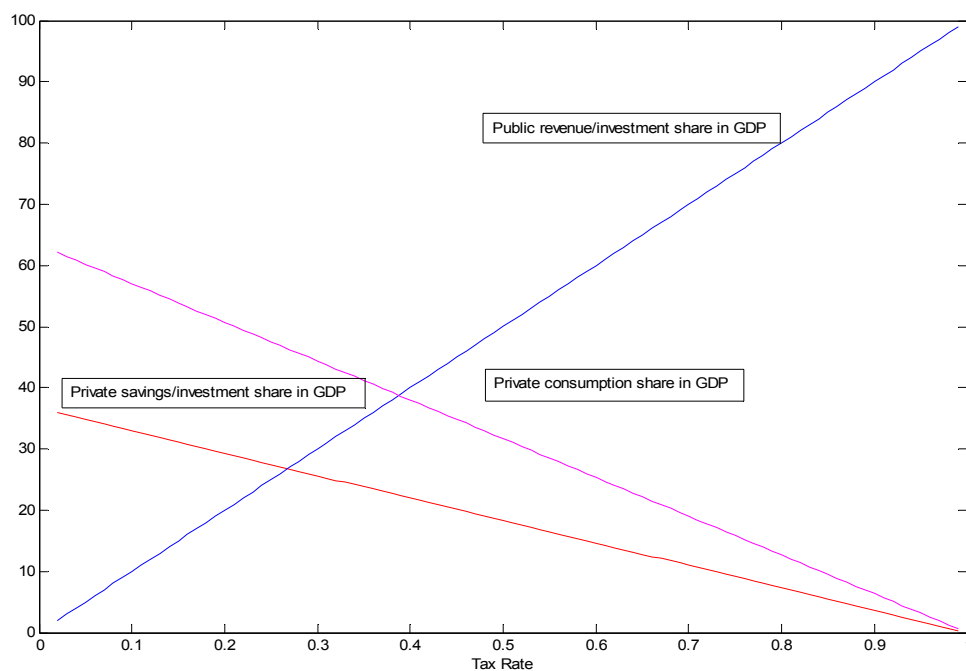
19. Given that in the model all tax revenue is used to finance public investment, the tax rate and the public investment-to-GDP ratio are identical. Consequently, increasing the tax rate increases also the public investment-to-GDP ratio. Unlike grant-financed public investment, however, tax financing crowds out private investment and consumption (Figure I.6). The result is a Laffer-curve type relationship between tax rates on the one hand and output, disposable income, and tax revenue on the other (Figure I.7):<sup>16</sup>

- At tax rates below 20 percent in the model, the benefits of higher tax rates in the form of higher public investment—i.e., higher output and private capital accumulation—outweigh the disadvantage of transferring purchasing power to the government.
- At higher tax rates—between 20 and 40 percent in the model—an increase in the tax rate raises output through additional public capital accumulation, but the output gain is smaller than the increase in the tax burden, and disposable income, together with consumption and private investment, declines.
- At tax rates above 40 percent, the crowding out of private investment through higher taxes outweighs the benefits of additional public investment, and output declines. Tax revenue, though, continues to increase.
- At tax rates above 70 percent, the disincentive effects of higher taxation are so large that even tax revenue begins to decline.

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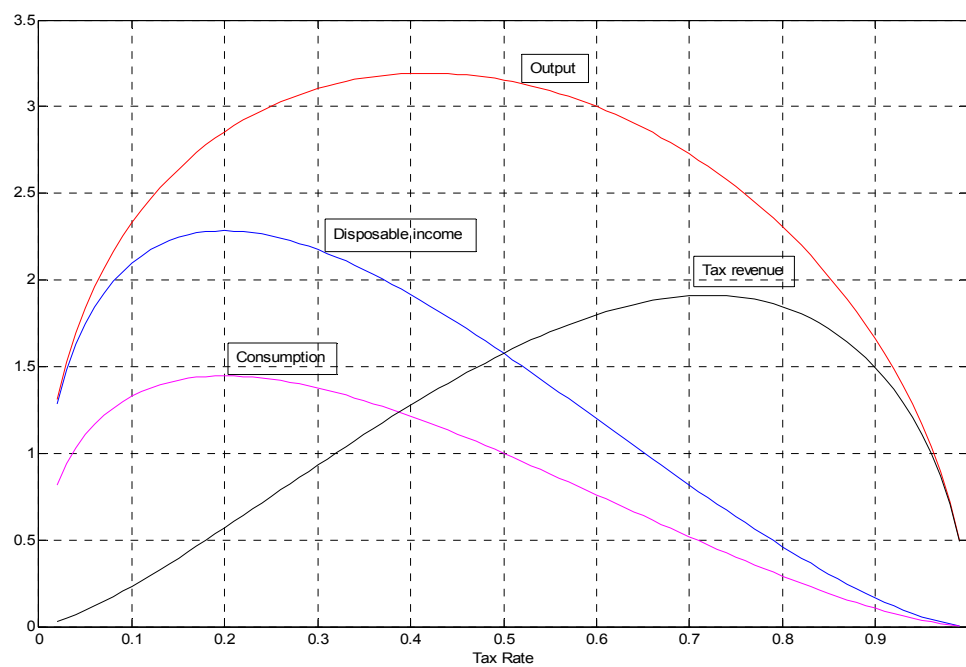
<sup>16</sup> The location of the Laffer curves depends on the parameter choices for the model. The simulations here are meant to illustrate the general economic principles, and not to identify the numerical values for tax rates that maximize disposable income, output, or tax revenue.

Figure I.6. Savings and Investment Shares in GDP as Function of Tax Rate



Source: IMF staff estimates.

Figure I.7. Selected Steady-State Variables as Function of Tax Rate



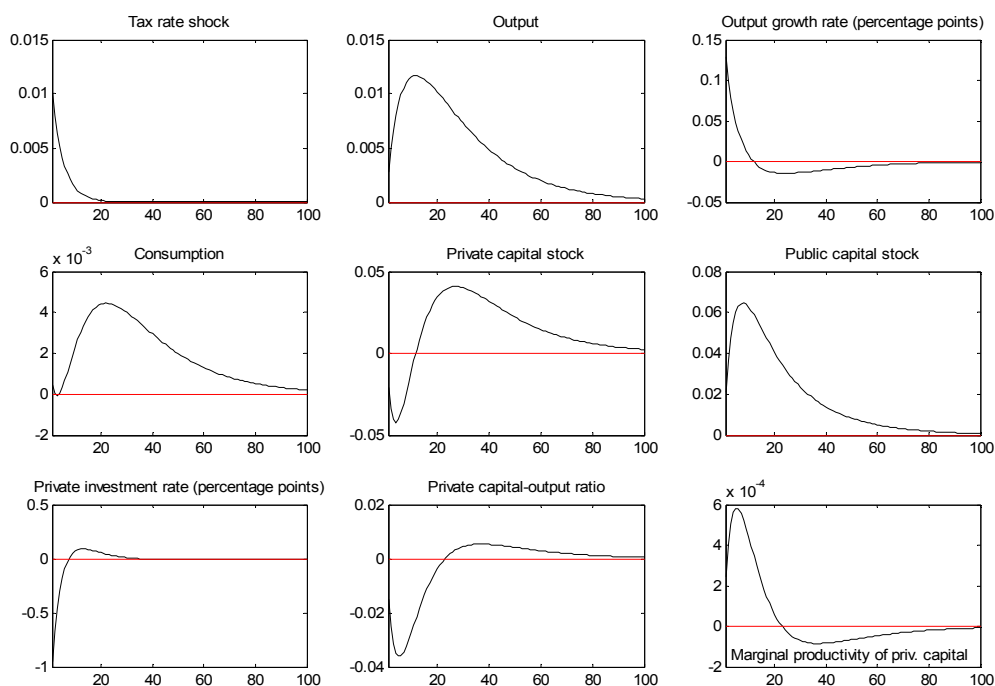
Source: IMF staff estimates.



20. Figure I.8 shows in more detail the effect of an increase in the tax rate (i.e., a temporary increase from 8 percent in the baseline to 9 percent in the simulation). At this low rate, the tax increase has a clear positive impact on the economy. As with grant-financed public investment, output and the marginal productivity of private capital increase on impact. The key difference is that tax financing leads to an initial crowding out of private investment, and, to a much lesser extent, private consumption. Over time, though, the increase in the marginal productivity of private capital leads to a crowding in of private investment, and both private capital stock and consumption rise above their baseline values.

21. The result that tax-financed increases in public investment can be beneficial when the tax rate is initially low, is likely to be relevant to Burkina Faso, because its tax ratio is well below the regional average. In fact, raising the revenue effort is a major objective of the Poverty Reduction and Growth Facility-supported program, partly to create fiscal space for higher public investment, in line with the simulations here, but also to lower external borrowing requirements.

Figure I.8. Response to Tax Rate Shock  
(Deviation from baseline; baseline tax rate: 8 percent)

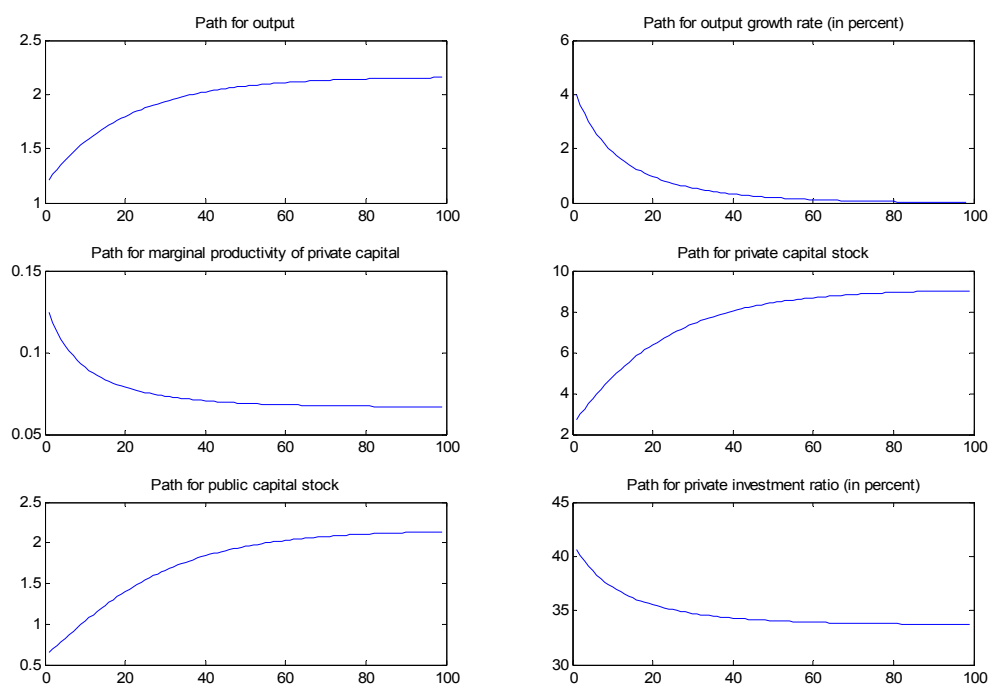


Source: IMF staff estimates.

### D. Growth as Convergence to Steady State

22. In contrast to the above steady-state simulations, public investment (and capital accumulation in general) is likely to be very effective in stimulating growth if the economy is initially below its steady state, and short of capital. Figure I.9 simulates the convergence to steady state with output and capital stocks initially about 70 percent below their steady state. Given the low levels of capital, the marginal productivity of private capital is high, which fuels strong private investment; the accumulation of private capital that results causes output to increase rapidly—leading to sustained high output growth rates—and the public capital to build up through tax revenue gains. As the economy nears its steady state, the process of capital accumulation and output growth gradually ebbs. In this situation, increasing public investment would yield sizeable payoffs, because it would hasten the transition to the steady state. Even a temporary increase in public investment would have large, permanent output effects. This contrasts sharply with previous steady-state simulations where temporary increases in public investment have no permanent output effects.

Figure I.9. Convergence to Steady State



Source: IMF staff estimates.

### **E. Which Growth Process is more Relevant for a Country like Burkina Faso?**

23. The above simulations show that, from a theoretical perspective, the key question for judging the role of public investment in growth is the nature of the growth process itself. If growth is characterized by shifts in the steady state (i.e., steady-state growth), the effect of public investment on growth is likely to be limited. But if growth for low-income countries is mostly a process of converging toward a higher-income steady state, public investment can make a large contribution to speeding up the transition toward steady state. Both views of the growth process have plausible real-world narratives.

#### **Steady-state growth and its application to Burkina Faso**

24. With steady-state growth, the growth process is driven by productivity shocks. To apply to a country like Burkina Faso, an extensive view of what constitutes productivity shocks needs to be taken (i.e. the underlying productivity concept should encompass a broad array of factors that affect development). For example, private and public sector institutions that govern the degree of economic openness and the quality of governance are likely to be important determinants of the economy's overall productivity level, and so are attainments regarding public health and education. Another aspect may be what Hausmann and Rodrik (2002) term economic "self-discovery", which describes a country's process of learning what goods and services it is good at producing (i.e., allowing it to create a market niche in the international economy).

25. For a given level of productivity, a country can support a certain level of output, capital stock, and consumption, which constitutes its steady state. In the absence of shocks, the country is close to its steady-state level. By this view, Burkina Faso's low-income level would reflect a steady state characterized by, inter alia, weak institutions (consistent with its near-bottom rankings on the World Bank's Doing Business and governance indicators), poor health and education outcomes, and the establishment of only few internationally competitive businesses (consistent with Burkina Faso's low share of exports).

26. Growth occurs through discoveries or improvements that raise the country's productivity level; recent examples of such developments for Burkina Faso would include the discovery of gold deposits that can be commercially mined; improvements to the land title regime, which will help foster financial intermediation; or improvements to the commercial-law judicial system. Past innovations like the introduction of mobile phone networks, broadband internet access, or the rapid expansion in cotton as a profitable export niche, are likely to have long-lasting effect growth effects as economic agents find new ways to exploit the productivity potential of these innovations.

#### **Growth through convergence in the case of Burkina Faso**

27. Here, the main factor for Burkina Faso's low income level is the country's small stocks of physical and human capital. Productivity—which is viewed here as a more narrow, technology-oriented concept—is less of a constraint because Burkina Faso is well inside the

world-technology frontier and can draw on a large range of already existing technologies. Capital accumulation should help with the adaptation of new technologies to the extent these are embodied in capital goods. The fact that Burkina Faso is relatively rich in labor but poor in capital implies that returns to capital accumulation should be high and stimulate investment, including foreign investment. From this viewpoint, Burkina Faso's relatively strong growth process over the past 10 years would reflect Burkina Faso's convergence process, starting from a very low base, toward a higher income steady state, resulting in the interim in high growth rates.

### **Which of the two views is more relevant for Burkina Faso?**

28. The view of growth as a convergence process is attractive, because it would suggest a certain inevitability of Burkina Faso's development process and quasi-guaranteed strong growth for many years to come. However, this view has a major disadvantage: there is little cross-country empirical evidence to support it. On the face of it, if low levels of capital stocks are a main driver of growth through the convergence process, one would expect that African countries are among the fastest growing countries in the world, but they clearly are not; Africa dummies in many growth regressions are significant and have a negative sign, which implies they are actually growing slower than suggested by other determinants of growth. Barro and Sala-i-Martin (2004) consider also more formal empirical evidence for the hypothesis of absolute convergence—i.e., that poorer countries tend to grow faster than richer—and find that “this proposition fares badly in terms of the cross-country data: for the 112 countries with the necessary data, the growth rate from 1960 to 2000 is virtually unrelated to the log of per capita GDP in 1960.”<sup>17</sup> Empirical evidence points more toward conditional convergence, i.e., once one controls for country characteristics, there is a tendency for countries with similar characteristics to converge to similar income levels.<sup>18</sup>

29. In contrast, steady-state growth does not predict absolute convergence if the likelihood of (broadly defined) productivity gains is independent of a country's income level. If technology diffuses easily among countries with similar characteristics, steady-state growth would be consistent with conditional convergence.

30. There is also a major difference on the role of productivity gains. With growth as a convergence process, the implicit assumption is that productivity gains can be relatively easily achieved through adopting “off-the-shelf”-technology, which is facilitated by capital investments that embody new technologies. However, in a survey of the absorption of

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<sup>17</sup> See Barro and Sala-i-Martin (2004), p. 515.

<sup>18</sup> From an empirical viewpoint, the convergence process has another drawback: the high marginal rate of productivity of private capital for countries with low capital stocks would suggest that the real interest rate in these economies is initially high and then declines over the development process, but there is little evidence for substantial changes of the real interest rate through this process. This drawback could be addressed, however, by modifying the theoretical model to include human capital with a fairly large income share, which would dampen the real interest rate movements implied by the model.

foreign technology, Hausmann and Rodrik (2002) find that doing so entails a process of experimentation and learning, and investors may not be able to predict if, when, and how they would become fully competitive, even when the technology is mature elsewhere. In short, they argue that there is no such thing as off-the-shelf technology. If this is the case, productivity gains might be harder to achieve and could become a serious constraint for the convergence growth process: countries that have difficulties in adopting foreign technologies would lack in productivity, which would adversely affect the returns on capital and weaken the incentives for private (and foreign) investment, effectively undermining the convergence process. In contrast, the notion that absorption of foreign technologies is generally difficult is fully consistent with the steady-state growth view; success or failure doing so would be just another factor defining the country's steady state.

31. Overall, the steady-state growth view appears to fit the empirical evidence better than the alternative view of growth as a convergence process. However, steady-state growth should be considered more as a working hypothesis than established fact, because the empirical evidence reviewed here does not make an explicit case for this hypothesis, and other theories not considered here may fit the data as well or better.

#### **F. Empirical Evidence on the Growth Effects of Public Investment**

32. Turning to the direct empirical evidence on the growth effects of public investment, there appears to be little consensus. For example, Devarajan et al. (2003) state flatly that public investment is not correlated with growth in Africa. In contrast, a World Bank (2007) survey argues that there is robust evidence that public capital spending has strong growth effects. A recent FAD survey (IMF 2004), on the other hand, finds that existing studies do not give clear-cut results.

33. Part of the reason for the uncertainty about the link between public investment and growth may be that—at least within a neoclassical context—public investment has a strong impact on the output *level*, whereas the effect on the *growth rate* is at best transitory, which standard growth regressions may have difficulties picking up.

34. Another reason may be that the growth effect of public investment depends critically on how it is financed: grant-financed public investment, for example, would be expected to have a larger growth effect than tax-financed public investment. One of the earliest empirical studies to take the importance of the general budget constraint (GBR) into account is Bose et al. (2003), who find that an increase in the public investment-to-GDP ratio has a positive impact on real per capita growth if it is financed by a corresponding reduction in current expenditures or higher tax revenue, but not if it is deficit financed.

35. Table I.1 summarizes the results from a number of recent studies; the notation *GBR* indicates whether the government budget constraint has been taken into account, and the growth impact denotes the effect of a one-time increase in the public investment rate by one percentage point on the long-run output level, which is equivalent to a one-time increase in the output growth rate. Overall, it appears that the long-run output effect is about

0.2 percent (see Figure I.10).<sup>19</sup> This is, in fact, larger than expected from a neoclassical model where the economy is initially in steady state, because in this type of model the long-run effect would be zero. Nevertheless, the point estimates are still relatively small. It should be noted, though, that these results imply a sizeable internal rate of return: a one-time investment of \$100 would lead to a future payment stream of \$20 each year, which is equal to an internal rate of return of 20 percent.

Text Table I.1: Summary of Studies on the Growth Effect of Public Investment

| Study                   | Growth effect <sup>1</sup>                      | BGR | Sample characteristics   |
|-------------------------|---|-----|--|
| Khan and Kumar (1997)   | 1970–90: 0.40<br>1970–80: 0.21<br>1980–90: 0.13 | No  | Sample: 95 developing countries; sample period: varying (see growth effects); time period: decade averages |
| Aschauer (2000)         | Approx. 0.15 <sup>2</sup>                       | No  | Sample: 46 LICs and MICs; sample period: 1970–90; time period: change over 1970–90                         |
| Devajaran et al. (2003) | Not significant.                                | No  | Sample: 29 African countries; sample period: 1970–97; time period: annual data                             |
| Milbourne et al. (2003) | Approx. 0.15 <sup>2, 3</sup>                    | No  | Sample: 74 countries; sample period: 1960–85; time period: change over 1960–85.                            |
| Bose et al. (2003)      | Approx. 0.15                                    | Yes | Sample: 30 developing countries; sample period: 1970–90; time period: decade averages                      |
| Clements et al. (2004)  | Approx. 0.2                                     | No  | Sample: 55 LICs; sample period: 1970–99; time period: 3-year averages                                      |
| Gupta et al. (2004)     | Approx. 0.6                                     | Yes | Sample: 39 ESAF and PRGF countries; sample period: 1990–2000; time period: annual                          |
| Adam and Bevan (2005)   | 0.1 <sup>4</sup>                                | Yes | 45 non-OECD countries; sample period: 1970–99; time period: 5-year averages                                |

Source: Referenced research papers.

<sup>1</sup> Effect of a one-time increase in the public investment-to-GDP ratio by one percentage point on the long-run level of output (in percent).

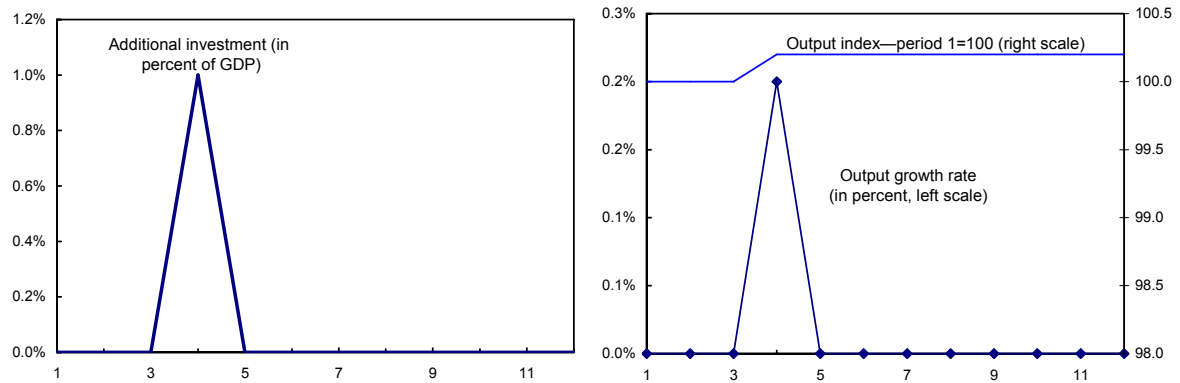
<sup>2</sup> Growth effect for definition used here had to be approximated from empirical results in study.

<sup>3</sup> Estimation produced mixed results, e.g., some aspects of model specification were rejected by data.

<sup>4</sup> Refers to effect of productive expenditures, grant financed.

<sup>19</sup> A noticeable exception is the much higher estimate by Gupta et al. (2004). However, this study uses annual data and has a relatively short sample period, which together could suggest that the estimate is more influenced by short-run effects than the other studies considered here.

Figure I.10. Growth Effect of Public Investment—Summary of Empirical Evidence

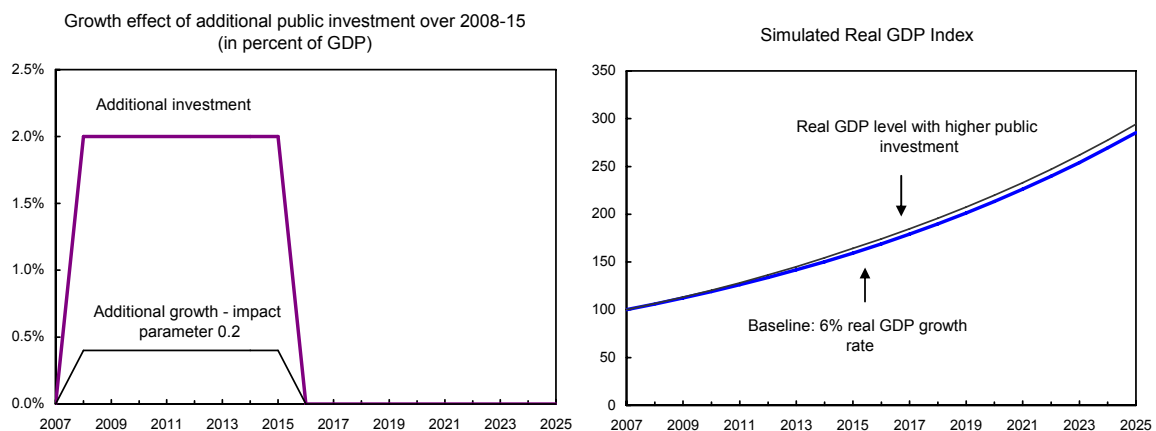


Source: IMF staff estimates.

### G. Conclusion and Implications for Burkina Faso

36. The above empirical estimates imply that an increase in the public investment-to-GDP ratio by 2 percentage points in the medium term, as currently projected, would raise the real GDP growth rate by about 0.4 percentage points a year for as long as public investment is held at that rate. Compared with an underlying growth rate of about 6 percent—based on historical averages—the additional investment will have a noticeable but modest impact on future growth and output levels (Figure I.11). Output could be some 10 percentage points of GDP higher by 2025—a respectable number, but not nearly as large as the overall increase in GDP of almost 200 percent by that year based on underlying growth.

Figure I.11: Burkina Faso: Growth Effect of Higher Public Investment



Source: IMF staff estimates.

37. The considerations above suggest that a growth strategy for Burkina Faso should not count on public investment alone. If growth is characterized by steady-state growth, than

continuous improvements across a broad array of development factors are required to sustain it. Consequently, government policies to improve institutions, or risk taking by the private sector to create viable international market niches, would likely be as important, if not more so, than increasing public investment. These policies could contribute to raising productivity in the economy, which is the ultimate source of growth in all economies. Thus, improving Burkina Faso's external and overall competitiveness—the topic of the next chapter—will likely do most to raise growth over time.



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## II. ASSESSING COMPETITIVENESS IN BURKINA FASO<sup>20</sup>

### A. Introduction

38. This paper evaluates Burkina Faso's external competitiveness by using a comparison of the real effective exchange rate (REER) to its equilibrium levels, and a survey-based assessment of overall competitiveness. Some indicators suggest that Burkina Faso's real exchange rate is overvalued. These include some estimates of the equilibrium REER (although the results are quite ambiguous); large and persistent current account deficits; sluggish export performance; and low ratings for structural competitiveness. Also, recent losses in the cotton sector, which stem partly from the appreciation of the euro, could indicate that the REER is overvalued. While there are indications of a real overvaluation, Burkina Faso's membership in the WAEMU—whose REER was deemed in line with fundamentals at the last Article IV consultation—gives it ready access to foreign exchange. Moreover, Burkina Faso's fiscal policies have generally been sound.

39. The paper follows the fundamental equilibrium exchange rate (FEER) in assessing whether the REER is aligned with economic fundamentals in Burkina Faso. The fundamentals approach is particularly appropriate in assessing whether a movement of the REER represents a misalignment or whether the REER itself has shifted because of changes in the economic fundamentals. We also look at the sustainability of the external current account and employ survey-based measures of competitiveness such as the World Economic Forum's Global Competitiveness Index and the World Bank's Doing Business Indicators to analyze competitiveness more broadly over the long term.

40. The recent appreciation of the CFA franc against the U.S. dollar has raised some concerns about the competitiveness of the cotton sector and the sustainability of growth. The 30 percent depreciation of the dollar against the euro since 2003 is estimated to have reduced the profits of ginning firms by some CFAF 45 billion, about 1½ percent of GDP (Figure II.1). The largest ginning company, SOFITEX, became insolvent. Although the crisis was averted after a large capital injection and credit guarantee by the government, cotton output and exports are expected to decline significantly in 2007. Thus, the issue of the appropriateness of the real exchange rate in Burkina Faso is particularly relevant for the cotton sector.

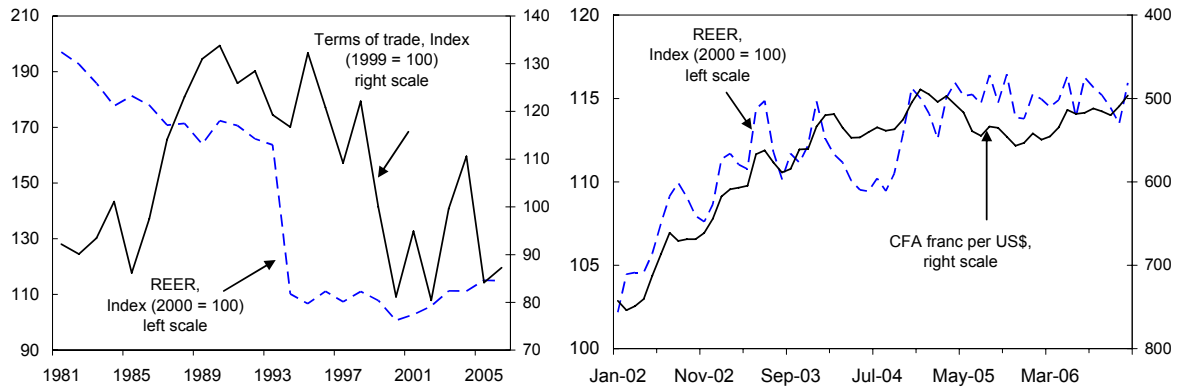
41. Regression results do not give much support to the proposition that the REER is misaligned. Fundamentals are seen to account for most of the fluctuations of the REER. In particular, movements in the terms of trade, trade openness, productivity and government consumption can explain most of the long run behavior of the real effective exchange rate. On the basis of these fundamentals, the REER at the end of 2006 was found to be very close to its estimated equilibrium level. The results also suggest that, in the absence of further

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<sup>20</sup> Prepared by Charles Amo Yartey, Jian Guang Shen, and Jan Gottschalk.

shocks about half of the deviations from the equilibrium path are eliminated within 16 months.

Figure II.1. Burkina Faso: Terms of Trade and Selected Real and Nominal Exchange Rates, 1980–2006



Source: IMF staff estimates.

42. Analysis of the survey-based indicators of competitiveness suggests the need for continued structural reforms to improve competitiveness. The major indicators rank Burkina Faso among the least competitive countries in the world. Its competitiveness has been limited by poor infrastructure, limited access to finance, and low quality institutions. The survey-based indicators suggest that action is urgent, particularly where the government interfaces with the business community. In particular, boosting basic and advanced education and training, improving infrastructure, improving regulation, making labor market more flexible, and improving security should be priorities.

43. The remainder of the paper is organized as follows. The next section reviews the literature on external competitiveness and the REER with a view to selecting a model to be estimated. Section C describes the data and discusses the empirical model to be estimated. The results of the regression are presented in section D. Section E discusses alternative approaches for assessing external sustainability. Section F analyzes Burkina Faso's overall competitiveness using survey-based indicators. Section G concludes the paper.

## B. Assessing External Competitiveness: The Literature

44. There are two main approaches to assessing external competitiveness. The first uses measures of the REER based on CPI, PPI, and unit labor cost, and the ratio of tradable to nontradable prices. The second, based on current account flows, relies on both traditional and non traditional competitiveness indicators. The traditional indicators are export growth, market shares, and overall current account position. Increasingly, nontraditional competitiveness indicators, which aim at assessing the quality of the business climate and hence the country's attractiveness to international investors, are also used to assess competitiveness.

## Modeling the REER

45. This paper follows the FEER approach as pioneered by Edwards (1989) in assessing whether the REER is aligned with economic fundamentals in Burkina Faso. Conceptually, the equilibrium real effective exchange rate (EREER) is defined as the exchange rate that is compatible with the economy at both internal and external equilibrium. However, operationally it is very difficult to define precisely what constitutes internal and external equilibrium. For example, Edwards (1989) considers internal equilibrium to have been achieved when the market for non-tradable goods clears in present and future; most others regard it as being attained when there is no output gap or persistent structural employment in the economy.

46. Studies by IMF authors using panel data methods find that Burkina Faso's real exchange rate is either close to its equilibrium level or is undervalued. Roudet et al (2007) used a panel of eight WAEMU countries and find some undervaluation of the REER. They find that single-country estimators and the panel estimators give different results for Burkina Faso. For example, the single country results find evidence of an overvaluation of 6 to 15 percent before the devaluation in 1994. Moreover, both the Johansen and the autoregressive distributed lag (ARDL) model indicate that the EREER continued to depreciate later, to the extent that the overvaluation caused by the devaluation is no longer a problem. However, they find that the REER may have been overvalued by about 9 percent in 2006. This is in sharp contrast with the results obtained using the panel estimators, which suggest an undervaluation ranging from 1 to 24 percent.

47. Chudik and Mongardini (2007) used a panel of non-oil exporting countries in Africa, and find that the REER was undervalued by about 20 percent in 2002. They find that the devaluation resulted in an undervaluation that persisted until 2003. They acknowledge, however, that the difference between their results and other studies may be due to an inadequate intercept for Burkina Faso resulting from their panel estimation, which could bias the results toward undervaluation. As Roudet et al (2007) point out, because the panel results are an average of the individual cointegrating vectors, some countries could differ significantly from the average.<sup>21</sup> Moreover, the Chudik and Mongardini (2007) panel may suffer from the heterogeneity problem because these countries may differ in important respects. The Roudet et al (2007) panel could suffer from the problem of a small panel.

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<sup>21</sup> The averaging problem is also relevant for the single country estimators. This methodology implicitly assumes that the EREER was equal to the actual REER during the sample period, which might not be the case.

### C. Methodology

#### The model

48. The REER is assumed to be a function of macroeconomic fundamentals:

$$REER = f(TOT, OPEN, INV, GCON, PROD) \quad (1)$$

where REER is the real effective exchange rate, TOT is the terms of trade, OPEN is trade relative to GDP, GCON is government consumption relative to GDP, and PROD is productivity relative to other countries.

#### The data

49. This paper uses the following variables to explain the behavior of REER in Burkina Faso—terms of trade, trade openness, investment, government consumption, and productivity (Figure II.2).<sup>22</sup> The dataset consists of annual observations from 1980 to 2006.<sup>23</sup> REER is from the IMF Information Notice System (INS). Openness, investment, and government consumption are computed with data from the Burkinabè authorities. Productivity was computed by the authors using the real per capita GDP in US dollars for Burkina Faso relative to its trading partners. The trade weights from the trading partners were derived from the IMF's Effective Exchange Rate Facility. The REER is an index with 2000=100 and TOT is an index with 1999=100.

50. *The terms of trade* is defined as the ratio of the price of exports to the price of imports. This “external” definition affects the REER through the wealth effect. A positive terms of trade shock induces an increase in the domestic demand, hence an increase in the relative price of non-tradable goods, which leads the REER to appreciate.<sup>24</sup> An alternative “internal” concept of the terms of trade is the ratio of tradable to nontradable prices. An increase in the internal terms of trade leads to an increase in real wages in the export sector and a trade surplus. To restore external balance the REER must appreciate. Thus, both external and internal concepts of the terms of trade suggest a positive relationship between the terms of trade and the REER.

51. *Openness to trade* is proxied by total trade of goods and services as a share of GDP. More openness is typically associated with real exchange rate depreciation because increased exposure to international markets is expected to lower domestic prices. However, if changes in openness are dictated by changes in exports, more openness may capture positive effects

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<sup>22</sup> Other variables such as aid inflows, workers remittances, and capital inflows have been documented as influencing the EREER. We do not include them in analysis due to data limitation and the short time series.

<sup>23</sup> We limit the period of analysis to 1980-2006 because the quality of pre-1980 data for Burkina Faso is poor.

<sup>24</sup> Following the IMF convention, an increase in the REER is defined as an appreciation.

of the improved trade balance or increased domestic activity, which would lead the REER to appreciate.

Figure II.2. Burkina Faso: Data Patterns, 1980–2006



Source: IMF staff estimates.

52. *Investments* in developing countries tend to have high import content and thus a direct negative impact on the trade balance. An increase in the *investment as a share of GDP* could shift spending toward tradable goods and thus lead the REER to depreciate.

53. An increase in *government consumption as a share of GDP* that is biased toward nontradables creates higher demand for them relative to tradables. This would raise the relative prices of nontradable goods, causing the REER to appreciate. On the other hand, if the increase in government consumption is biased toward the tradable sector, increased spending will cause the REER to depreciate.

54. *Productivity* is often proxied by real per capita GDP relative to the country's trading partners. This captures the well-known Balassa-Samuelson effect. Countries with higher productivity growth in the tradable sector can sustain an REER appreciation without losing competitiveness. An increase in the productivity of the tradable versus the nontradable sector raises its relative wages. This increases the relative price of nontradables to tradables causing REER appreciation.<sup>25</sup>

### **Estimating techniques**

55. The relatively short sample period presents challenges to estimating the EREER. The cointegration relationship cannot be reliably estimated unless it is limited to at most four potential EREER determinants. The short sample period of 27 years makes the variables' order of integration uncertain, as it is well known that unit root tests for short samples perform very poorly. Thus, less independent variables should be used for reliable statistical inference.

56. To address the problem of short time series, this paper applies the bound testing approach and an Autoregressive Distributed Lag (ARDL) technique to estimate the regression model. The bound testing approach developed by Pesaran, Shin and Smith (1999) is used to estimate the long-run relationship between the fundamentals and the real effective exchange rate. As Chudik and Mongardini (2007) point out, this methodology is independent of whether the variables are stationary, integrated of order one, or a mixture of the two. Furthermore, small sample performance of the bound testing approach has been shown to be superior to the conventional Johansen cointegration approach.

57. The ARDL approach is used to estimate the long-run elasticities. This methodology has superior small sample performance and provides correct inference regardless of the order of cointegration of the variables (Pesaran and Shin, 1999). The ARDL approach is relatively simple compared with the Johansen cointegration technique. Once the existence of cointegration relationship has been established and the appropriate number of lags determined, the model can be estimated with OLS. The underlying model is a single equation ARDL, rather than a VAR as in the Johansen methodology, thus reducing the number of

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<sup>25</sup> The variable could suffer from measurement problems for a number of reasons. First, the proxy is a rather different concept from the original variable that captures the Balassa-Samuelson effect. Second, the proxy is sensitive to exchange rate movement and thus prone to endogeneity problems. Third, the variable is sensitive to the selection of trade partners and the year on which the weights were based.



parameters to be estimated and improving efficiency in small samples (Pesaran, Shin and Smith, 2001).

#### **D. Regression Results**

58. In testing level relationships and estimating coefficients, we used five variables that have been documented as influencing the REER in the WAEMU region (terms of trade, trade openness, investment, government consumption, and productivity, all expressed in logs). We set the maximum lags to two for all of them. Using four regressors at a time regressions were estimated for all possible combinations.<sup>26</sup> For each specification, the optimal lag structure is also determined through a search procedure. The best model consists of four fundamental variables: terms of trade, openness, government consumption, and productivity.

59. The result of the FEER model shows that fundamentals account for most of the fluctuation of the REER. In particular, movements in the terms of trade, trade openness, productivity and government consumption can explain most of the long run behavior of the REER. Thus, the REER at the end of 2006 was found to be very close to its estimated equilibrium level.<sup>27</sup>

60. The results are consistent with the predictions from economic theory and with earlier analysis except the sign of government consumption (Text Table II.1). The results suggest that the terms of trade are positively correlated with the REER indicating that an improvement in terms of trade would cause the long-run EREER to appreciate. In particular, a 1 percent increase in the terms of trade raises the EREER by 1 percentage point. Openness also has a positive effect on the EREER. Government consumption has a negative impact on the EREER suggesting that most government spending is directed towards imports—a somewhat counterintuitive result. Productivity is positively correlated with the EREER confirming the hypothesis that the EREER would appreciate with an improvement in productivity. A 1 percent increase in productivity raises the EREER by 0.6 percentage points. Overall, movements in the EREER have largely been driven by changes in the terms of trade, trade openness, the share of the government consumption in GDP, and productivity.

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<sup>26</sup> This significantly increases the reliability of our choice of the best model. Regressions were estimated with the help of an econometric template developed by Chudik and Mongardini (2007).

<sup>27</sup> Many analysts believe that the 1994 CFA devaluation should be considered a structural break. There is, however, no consensus in the literature about how to correct for structural breaks.

Text Table II.1. Burkina Faso: Estimated Coefficients, ARDL Approach, Best Model  
(Dependent Variable: REER<sup>1</sup>)

|                              | Coefficient | Standard deviation | T-ratio |
|------------------------------|-------------|--------------------|---------|
| Terms of trade               | 1.016       | 0.23               | 4.45**  |
| Openness                     | 0.255       | 0.11               | 2.25**  |
| Government consumption       | -0.447      | 0.14               | -3.26** |
| Productivity                 | 0.559       | 0.19               | 3.02**  |
| Error correction coefficient | -0.518      | 0.08               | -6.17** |
| Half life (months)           | 16.06       | ...                | ...     |
| F-statistics <sup>2</sup>    | 10.96       | ...                | ...     |

Source: IMF staff estimates.

<sup>1</sup> All variables in logarithms. Asterisks (\*\*) denote statistically significant.

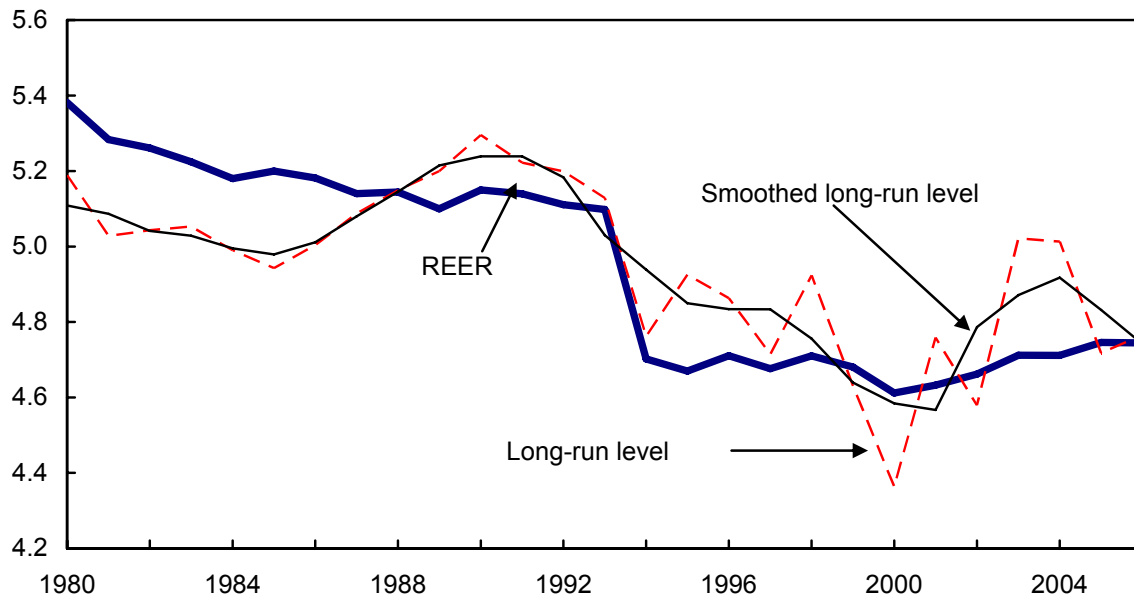
<sup>2</sup> This approach tests for the existence of a level relationship using the F-test.

61. The estimated long-run relationship between the REER and its determinants allows us to derive estimates of the EREER from the best model. In principle, this involves applying the long-run elasticities to the actual values of the macroeconomic fundamentals in a given period to obtain a consistent long-run equilibrium value for the REER. However, the explanatory variables may exhibit a substantial degree of short-term response to business cycle fluctuations, whereas the long-run equilibrium REER should not do so. Thus, some amount of smoothing may seem appropriate. We present the actual and smoothed EREER in Figure II.3.

62. We estimate that at the end of 2006 the REER was close to its equilibrium level. Its appreciation in the 1980 led to an overvaluation of the exchange rate until 1988. The REER, according to our analysis was slightly undervalued before the CFA devaluation in 1994. Most analysts believe, however, that the REER was overvalued before the 1994 devaluation. According to our analysis, the devaluation led to an undervaluation which persisted until 1998. The recent appreciation of the REER can be seen as a move toward its long-run equilibrium value.

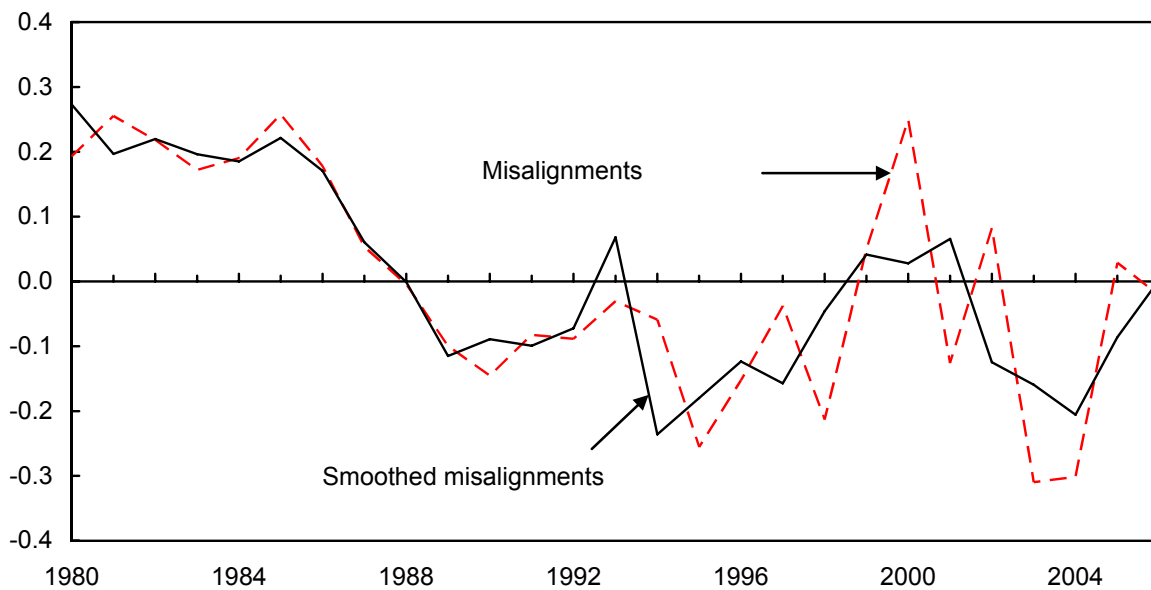
63. In the absence of further shocks, about half of any given deviations from the equilibrium path are eliminated within one year and four months. When there is a deviation from the long-run equilibrium the variables respond together to move the system back to equilibrium (Figure II.4). The error-correction coefficient is negative and statistically significant suggesting that the error-correction mechanism is stable.

Figure II.3. Burkina Faso: REER and EREER Estimates, 1980–2006



Source: IMF staff estimates.

Figure II.4. Burkina Faso: Misalignment Estimates, 1980–2006



Source: IMF staff estimates.

64. To test the robustness of our estimated results we apply the Johansen cointegration approach on the best model. The results also suggest that the long-run behavior of the REER

can be explained by fundamentals—terms of trade, trade openness, government consumption, and productivity. The feedback coefficient for the cointegrating vectors for the Johansen method, though negative, is not significantly different from zero, suggesting that the error-correction mechanism is unstable. The Johansen cointegration approach suggest a slight overvaluation of the REER of about 3 percent in 2006, but the instability of the error-correction mechanism cast doubts on the reliability of this result, which in any case is not significantly different from the ARDL approach.

65. Estimates for the equilibrium REER for Burkina Faso are not absolute, but are subject to statistical uncertainty and conditioned on the estimated regression model. Small deviations from the estimated equilibrium values may well be statistically insignificant. Furthermore, estimation of alternative equilibrium REER models may lead to different conclusions about the evolution of the REER relative to its equilibrium values. This calls for caution when using the results from this study in choosing policies and underlines the need for further research. However, it does appear that Burkina Faso has lost competitiveness after 2003, a period when the EREER was depreciating, whereas the REER was appreciating. The developments of the REER during 2007 linked to the appreciation of the euro suggest that this tendency might have continued recently.

### **E. Other Approaches to Assessing External Sustainability**

66. External equilibrium could also be considered attained when the current account balance is judged sustainable. Conceptually, the EREER is defined as the exchange rate that is compatible with the economy simultaneously at internal and external equilibrium. Operationally it is very difficult to define precisely what constitutes internal and external equilibrium. In this section, external equilibrium is defined as being attained when the current account balance is considered sustainable.<sup>28</sup>

67. Two approaches are normally used to determine what constitutes a sustainable current account balance. The macroeconomic balance approach considers external sustainability to be a current account balance norm that is consistent with economic fundamentals. This approach first determines a current account balance norm for each country as a function of its medium-term fundamentals. Then the norm is compared to the current account balance in the country, and the adjustment of REER that is necessary to align the current account balance to its norm is calculated.<sup>29</sup> The external sustainability approach considers external stability to be the current account balance that can stabilize net foreign assets at some benchmark value. This approach look at the inter-temporal budget constraint linking the current account

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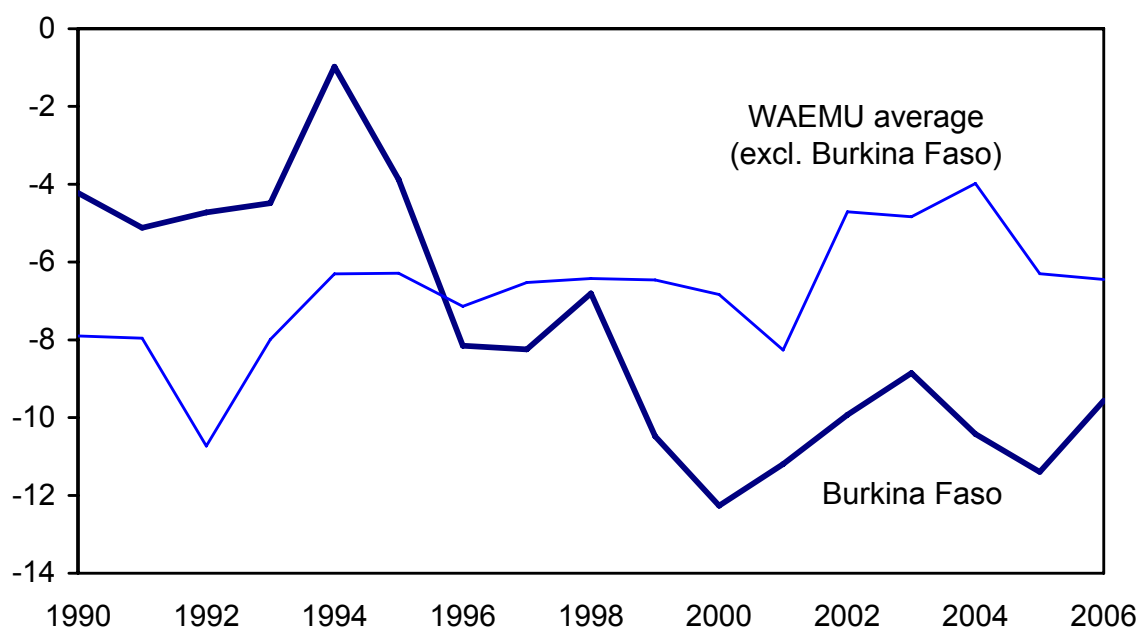
<sup>28</sup> The evolution of exports as a share of world exports is an alternative measure for assessing external imbalances. In Burkina Faso, this ratio has been relatively stable over the past 10 years; however, this might not be a reliable indicator because cotton production was shielded from the movements in the RER.

<sup>29</sup> Under this approach, it is vital to calculate the export and import elasticity with regards to REER. The elasticity of current account balance to REER also reflects the degree of openness.

balance with net foreign assets, the economic growth rate, and the rate of return on external assets.

68. The large current account deficits in past years may point to an external imbalance, but the evidence is ambiguous. The economy seems to be suffering from a chronic external imbalance: the current account deficit as a share of GDP has been widening in recent years (Figure II.5). This reflects a narrow export base and an increase in the savings-investment gap. The current account deficit including official transfers averaged 10 percent of GDP for 2002–06. If that deficit were maintained over the long term and financed entirely through borrowing, the net present value (NPV) of debt-to-exports ratio would exceed 600 percent by 2025. That would clearly be unsustainable.

Figure II.5. Burkina Faso: Current Account Balance (Including Grants), 1990–2006  
(Percent of GDP)



Source: IMF staff estimates.

69. However, the current account deficit of the past five years was only partially financed through borrowing. Only about 3.5 percent of GDP of the 10 percentage point deficit was financed using borrowing. This amount does not particularly threaten debt sustainability, and is consistent with baseline borrowing projections. Still, with more conservative assumptions about private sector inflows, annual net borrowing of 5.5 percent of GDP would be necessary to keep the current account deficit at 10 percent of GDP. That is too high to stabilize the NPV of debt-to-exports ratio at a reasonable level. To do so the current account deficit should probably be not much larger than 7.5 percent of GDP—using conservative assumptions for private sector inflows—and would require further adjustment.

70. The reduction in the current account deficit required to meet this norm of external balance over time could result from tighter fiscal policy and/or private-sector adjustment.<sup>30</sup> Assuming that fiscal policies shrink the current account deficit by 1 percent of GDP, the required private-sector contribution to reducing the current account deficit would be approximately 1.5 percent of GDP. If this were to be achieved through a change in the real exchange rate, a real depreciation of about 15 percent may be necessary because of Burkina Faso's relatively low openness and its dependence on commodity exports.

## **F. Survey Based Indicators of Overall Competitiveness**

71. For a comprehensive picture of a country's general competitiveness, it is important to consider the long-term aspects of structural competitiveness. To complement the analysis of the REER we employ survey-based indicators of structural competitiveness: the Global Competitiveness Index and the Doing Business Indicators. We complement these with indicators of governance quality and an investment climate assessment.<sup>31</sup>

### **The Global Competitiveness Index**

72. Burkina Faso is ranked among the least competitive countries in the world. The World Economic Forum assessment shows that Burkina Faso did improve its ranking from 116 out of 122 in 2006 to 112 out of 131 in the 2007 Global Competitiveness Index (Text Table II.2). But it compares poorly even with other WAEMU countries; only Mali did worse in the 2007 rankings. Burkina Faso also ranks poorly in the basic requirements sub-index (112 out of 131), which attempts to measure the fundamentals for achieving sustained growth in factor-driven economies. However, relative to its overall rank, Burkina Faso does well on macroeconomic stability (68); institutions (74); and market efficiency (89).

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<sup>30</sup> The present level of the current account deficit does not pose a significant problem, because Burkina Faso's membership in the WAEMU currency union implies ample access to foreign exchange to finance its balance-of-payment needs.

<sup>31</sup> There are substantial caveats related to the methodology of the survey-based indicators of competitiveness. These studies ignore differences in the level of development among countries. Developed countries by nature have superior institutions, infrastructures and innovative capability than developing countries and are likely to be ranked higher than developing countries. The Global Competitiveness Index is closely correlated with GDP per capita.

Text Table II.2. Burkina Faso: Indicators of Non-Price Competitiveness, 2006–07

|                        | Doing Business Indicators |      |                               | Global Competitiveness Index |      |
|------------------------|---------------------------|------|-------------------------------|------------------------------|------|
|                        | 2006                      | 2007 |                               | 2006                         | 2007 |
| Overall ranking        | 163                       | 161  | Overall ranking               | 116                          | 112  |
| Starting a business    | 130                       | 105  | Health and primary education  | 124                          | 125  |
| Dealing with licenses  | 169                       | 161  | Higher education and training | 116                          | 125  |
| Employing workers      | 151                       | 152  | Macroeconomy                  | 116                          | 68   |
| Registering property   | 170                       | 170  | Infrastructure                | 110                          | 111  |
| Getting credits        | 111                       | 115  | Technological readiness       | 103                          | 116  |
| Protecting investors   | 139                       | 138  | Business sophistication       | 98                           | 100  |
| Paying taxes           | 131                       | 133  | Market efficiency             | 87                           | 89   |
| Trading across borders | 167                       | 170  | Innovation                    | 69                           | 90   |
| Enforcing contracts    | 114                       | 109  | Institutions                  | 62                           | 74   |
| Closing a business     | 90                        | 91   |                               |                              |      |
| Number of countries    | 175                       | 178  |                               | 128                          | 131  |

Sources: World Bank, *Doing Business 2007*; and World Economic Forum, *Global Competitiveness Index 2007*.

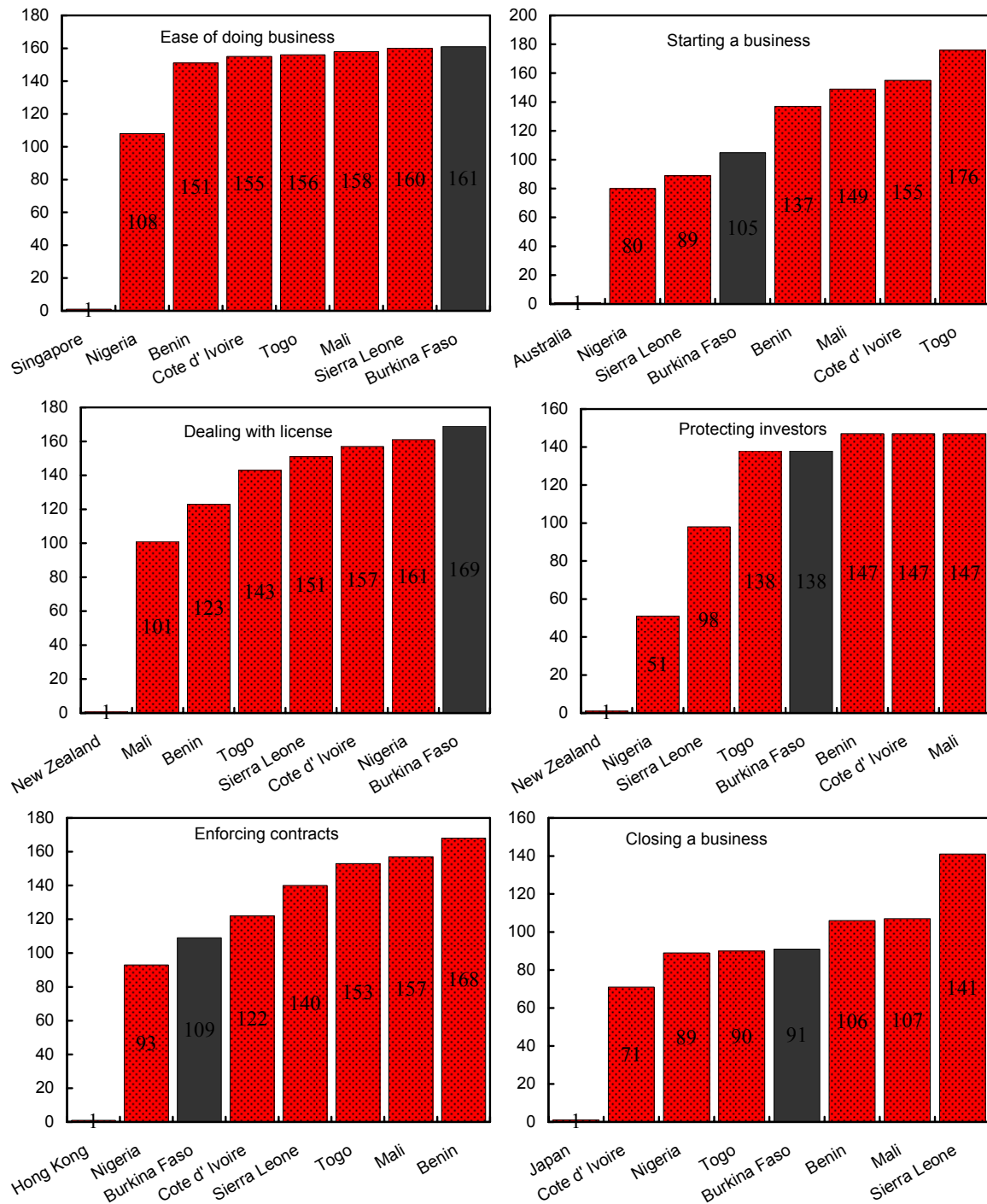
### The Doing Business Indicators

73. On the World Bank's Doing Business Indicators Burkina Faso improved its rankings from 154 out of 154 in 2005 to 161 out of 178 economies in 2007. Burkina Faso was one of the countries in Sub-Saharan Africa to have implemented three or more reforms in 2007. The country implemented three reforms making it easier for entrepreneurs and businesses to operate:

- It introduced specialized commercial chambers in the general courts and lowered the cost of enforcing a judgment by cutting the related registration tax from 4 to 2 percent of the judgment amount.
- It reduced the cost of property registration to 12.2 percent of the property value.
- A one-stop shop for company registration cut the time for business start-up to 18 days.

74. Other areas in particular need of improvements to improve competitiveness and stimulate economic growth are the costs and delays in opening a business, dealing with licenses, protecting investors, registering property, and labor market restrictions (Figure II.6).

Figure II.6. Burkina Faso: Doing Business Indicators, 2007

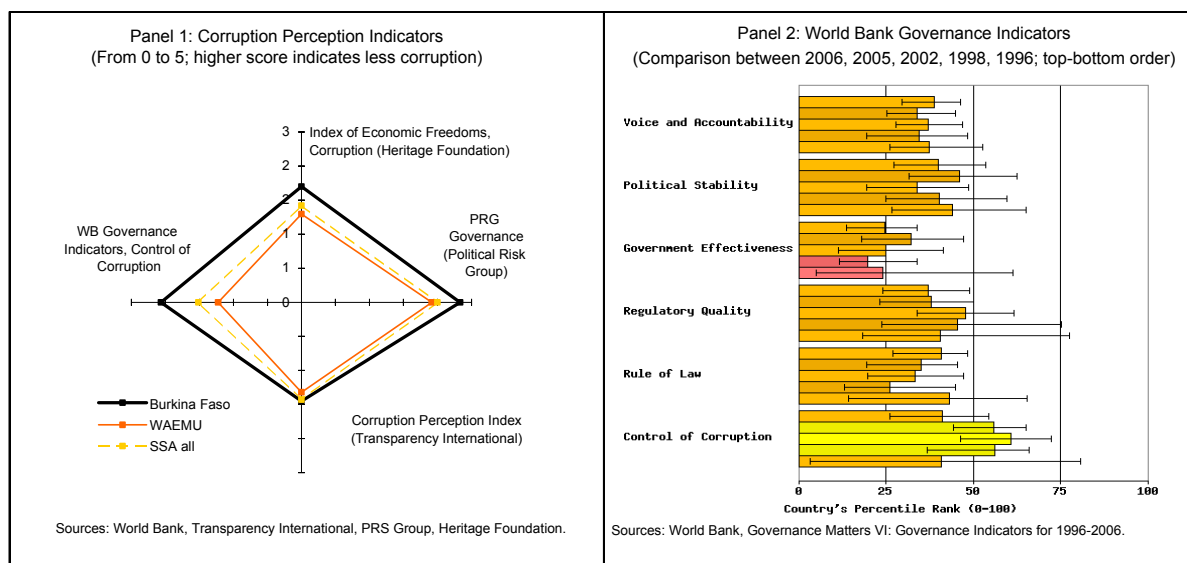
Source: World Bank, *Doing Business Indicators*, 2007.



## Indicators of governance quality

75. Burkina Faso ranks relatively well on many indicators of the quality of governance and corruption even though it has seen its rankings fall recently. In the 2007 edition of Transparency International's Corruption Perception Index (CPI), Burkina Faso dropped 26 places from 79 out of 163 in 2006 to 105 out of 179 countries in 2007 (Figure II.7). Its score declined from 3.2 in 2006 to 2.9 in 2007. Nevertheless, Burkina Faso is currently ranked the same as Argentina and Egypt and higher than most African countries (17 out of 52). Like most other countries in Africa, it scored below 5—commonly seen as the threshold for serious corruption. Still, caution is needed in interpreting the decline in the CPI score because it may partly be due to technical factors like the inclusion of a new survey. Also, the confidence interval for the 2007 score is relatively wide, ranging from 2.6 to 3.4, which encompasses the better 2006 score.

Figure II.7. Burkina Faso: Governance Indicators



76. Burkina Faso compares favorably with other WAEMU countries on the World Bank's Governance Indicators. On the broad-based World Bank governance indicators—these cover government effectiveness, corruption, voice and accountability, and more—Burkina Faso ranks above the average for WAEMU, Sub-Saharan Africa as a whole, and other low-income countries. It does relatively well on the rule of law, regulatory quality, and control of corruption. Regarding the control of corruption, Burkina Faso's good performance is confirmed by multiple sources. Nevertheless, improvement in most indicators has been limited in recent years and there has even been some slippage with respect to control of corruption.

### **Investment climate assessment**

77. A World Bank survey of enterprises shows that from an international perspective the investment climate in Burkina is not favorable to the private sector, which is subject to many constraints. The most striking are linked to corruption (perceived as high), inconsistency in the application of regulations; an inefficient judiciary, poor infrastructure, a relatively heavy tax burden, and problems with access to and the costs of finance.

78. Corruption is a major concern for private sector development. It is a major concern for almost 57 percent of the entrepreneurs in the formal sector and is perceived as a binding constraint to operations for managers of firms surveyed in other sectors of the economy.

79. Deficiencies in infrastructure are a significant burden on the private sector. Problems linked to the supply of electricity and to transportation are major issues for 62 percent of firms surveyed. They have a heavy impact on firm performance; almost 5 percent of manufacturing firm annual turnover is lost due to electricity shortages.

80. The investment climate assessment found weaknesses in factor markets. Serious constraints in the formal labor market are a poorly educated workforce, inadequate professional training programs, and losses from absenteeism due to ill health. The financial system is characterized by limited access to and a high cost of finance. Many companies particularly among the smallest, do not even try to obtain formal financing, which is mainly determined by the size of the company, the use of auditor to certify accounts, the ownership structure, and access to export markets.

81. Regulation is poor. Managers have little confidence in the consistency of regulation and in the court system. Almost 63 percent of the managers of manufacturing firms surveyed consider the courts to be unfair, biased, and corrupted. Moreover, managers in some sectors must spend nearly 10 percent of their time dealing with administrative issues.

### **G. Summary and Conclusions**

82. This paper has evaluated Burkina Faso's competitiveness using the REER and survey-based assessment of competitiveness. The paper followed the FEER approach in assessing whether the REER is aligned with economic fundamentals in Burkina Faso. It also assesses external balance by looking at a sustainable current account position. In addition, we used survey-based measures of competitiveness to analyze competitiveness more broadly over the long term.

83. Regression results do not provide any significant evidence of misalignment. Using the ARDL approach to cointegration, we find that hat fundamentals account for most of the fluctuation of the REER. In particular, much of the long-run behavior of the REER can be explained by fluctuations in the terms of trade, government consumption, productivity, and openness. On the basis of these fundamentals, the REER at the end of 2006 was found to be close to its estimated equilibrium level. The results also suggest that in the absence of further shocks about half of the deviations from the equilibrium path are eliminated within

16 months. The recent real appreciation of the CFA exchange rate could be seen as a move toward aligning the exchange rate with its underlying long-run equilibrium value. However, the fact that the equilibrium REER depreciated after 2003, while the actual REER appreciated suggests a loss of competitiveness, which probably continued in 2007.

84. The sustainability of the external current account position provides some evidence of real overvaluation. The present size of the current account deficit appears to large to be sustained over the longer run, and a real depreciation of the exchange rate could contribute to reducing the current account deficit to a more sustainable level. Burkina Faso's membership in WAEMU implies that there is ample access to foreign exchange to finance its balance-of-payment needs.

85. The analysis of the survey-based indicators of competitiveness suggests the need for continued structural reforms to improve competitiveness. The major indexes rank Burkina Faso among the least competitive countries in the world, even though it has improved its ranking. Firm level surveys identified corruption, inadequate access to finance, poor infrastructure, inadequate educated workforce, and weak regulation as the major constraints to private sector development.

86. The government is aware of these challenges and there are a number of efforts underway to address them. Investments in utilities and infrastructure are planned. There are ongoing reforms to improve tax administration and increase revenue performance. The government has created a new institution for oversight and control of corruption. The newly formed *Autorité Supérieure de Contrôle d'État* (ASCE) will investigate government agencies and monitor the work of audit offices. The authorities are also working with the World Bank to improve private sector competitiveness. It is clear from our analysis that it is particularly urgent to improve the government's interface with the business community. Boosting basic and advanced education and training, improving infrastructure, improving regulation, and increasing labor market flexibility should be high on the agenda.

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Table II.1. Burkina Faso: Long Run Estimates from Alternative Specifications of Lags

| ARDL model                    | Selection criteria |       | ARDL specification | Long-run coefficients and t-statistics (computed using delta method): |             |       |             |       |             |       |             |                  |       |             |
|-------------------------------|--------------------|-------|--------------------|---|-------------|-------|-------------|-------|-------------|-------|-------------|------------------|-------|-------------|
|                               | AIC                | SBC   |                    | OPEN  |             | GC    |             | TOT   |             | PROD  |             | Error-Correction |       |             |
|                               |                    |       |                    | Coef.   | t-statistic | Coef. | t-statistic | Coef. | t-statistic | Coef. | t-statistic |                  | Coef. | t-statistic |
| Best model according to AIC   |                    |       |                    |   |             |       |             |       |             |       |             |                  |       |             |
| 1 (best)                      | -1.93              | -1.55 | 0.97               | (1,0,0,1,1)   | 0.26        | 2.25  | -0.45       | -3.26 | 1.02        | 4.45  | 0.56        | 3.02             | -0.52 | -6.17       |
| 2                             | -1.92              | -1.49 | 0.97               | (1,1,0,1,1)   | 0.18        | 1.19  | -0.57       | -2.88 | 1.10        | 4.04  | 0.72        | 2.60             | -0.49 | -6.61       |
| 3                             | -1.89              | -1.46 | 0.97               | (2,0,0,1,1)   | 0.23        | 2.10  | -0.47       | -3.54 | 1.07        | 4.54  | 0.52        | 2.79             | -0.59 | -6.66       |
| 4                             | -1.86              | -1.43 | 0.97               | (1,0,1,1,1)   | 0.26        | 2.14  | -0.45       | -2.87 | 1.01        | 4.04  | 0.56        | 2.76             | -0.49 | -6.13       |
| Best model according to SBC   |                    |       |                    |   |             |       |             |       |             |       |             |                  |       |             |
| 1 (best)                      | -1.93              | -1.55 | 0.97               | (1,0,0,1,1)   | 0.26        | 2.25  | -0.45       | -3.26 | 1.02        | 4.45  | 0.56        | 3.02             | -0.52 | -6.17       |
| 2                             | -1.92              | -1.49 | 0.97               | (1,1,0,1,1)   | 0.18        | 1.19  | -0.57       | -2.88 | 1.10        | 4.04  | 0.72        | 2.60             | -0.49 | -6.61       |
| 3                             | -1.85              | -1.47 | 0.96               | (1,1,0,1,0)   | 0.02        | 0.10  | -0.77       | -3.48 | 1.28        | 3.83  | 0.83        | 2.40             | -0.42 | -5.54       |
| 4                             | -1.80              | -1.46 | 0.96               | (1,0,0,1,0)   | 0.13        | 1.04  | -0.57       | -3.75 | 1.16        | 4.12  | 0.55        | 2.46             | -0.49 | -5.92       |
| Best model according to Rbar2 |                    |       |                    |   |             |       |             |       |             |       |             |                  |       |             |
| 1 (best)                      | -1.89              | -1.46 | 0.97               | (2,0,0,1,1)   | 0.23        | 2.10  | -0.47       | -3.54 | 1.07        | 4.54  | 0.52        | 2.79             | -0.59 | -6.66       |
| 2                             | -1.92              | -1.49 | 0.97               | (1,1,0,1,1)   | 0.18        | 1.19  | -0.57       | -2.88 | 1.10        | 4.04  | 0.72        | 2.60             | -0.49 | -6.61       |
| 3                             | -1.93              | -1.55 | 0.97               | (1,0,0,1,1)   | 0.26        | 2.25  | -0.45       | -3.26 | 1.02        | 4.45  | 0.56        | 3.02             | -0.52 | -6.17       |
| 4                             | -1.84              | -1.36 | 0.97               | (2,1,0,1,1)   | 0.18        | 1.20  | -0.56       | -2.75 | 1.09        | 4.19  | 0.62        | 2.32             | -0.56 | -6.54       |

Source: IMF staff estimates.

### III. VULNERABILITIES RELATED TO RAINFALL AND TERMS OF TRADE VARIATIONS<sup>32</sup>

#### A. Introduction

87. This paper attempts to quantify the impact of rainfall and terms of trade shocks on the Burkinabè economy and draws conclusions about policy measures to lessen the impact of such external shocks. Rainfall is a powerful determinant of economic activity in an agricultural economy like Burkina Faso. The terms of trade, which determine the country's relative purchasing power, in Burkina Faso are driven mostly by cotton and oil prices. The country is vulnerable to drought, rainfall variation, and related natural phenomena such as locust infestation and desertification. The recent crisis in the cotton sector and strains from higher world prices for oil are potent reminders of just how vulnerable the economy is to shocks to the external terms of trade (prices of exportables relative to importables).

88. In a country that depends heavily on agriculture, supply shocks from rainfall variation affect a large proportion of the population. Smoothing such shocks geographically or intertemporally can be difficult, especially for subsistence farmers who depend on surface rainfall, lack adequate storage facilities, have poor communications and transportation links, and lack access to credit. At the macro level adverse rainfall shocks may lead to lower growth, higher prices, less export revenue, increased imports, a drawdown of international reserves, and a redirection of government spending toward emergency relief.

89. Terms of trade shocks also affect the economy in a variety of ways:

- Other things being equal, a terms of trade shock affects the trade balance; at unchanged volumes a favorable shock improves it.
- It also leaves the country with more real income because the same volume of exports allows the country to purchase more goods, which in turn raises demand for both tradables (importables) and nontradables. Consequently, improvement in the trade balance may be tempered and accompanied by an appreciation of the real exchange rate.
- Terms of trade shocks may alter intertemporal consumption choices. The extent of the reallocation will depend on the persistence or permanence of the shock. For example, a temporary increase in oil prices may be more easily absorbed by a widening trade deficit and a loss of reserves than a permanent increase.

90. We report stylized facts about Burkina Faso's vulnerability to rainfall variation and shocks to the terms of trade, and we estimate their impact on key macroeconomic variables. Because the effects of such shocks are complex and data limitations are severe, we chose a parsimonious approach consisting of estimating simple relations between the exogenous

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<sup>32</sup> Prepared by Chris Geiregat.

shocks and such variables as the trade balance, growth, and inflation. This approach is easily interpretable, although it is also likely to pick up indirect effects from omitted macro variables that could bias the analysis.

91. Section B describes stylized facts of rainfall variation and presents the effects on output and prices. Section C discusses variation in the terms of trade, putting Burkina Faso's recent experience in an international perspective. It also gives details on the costs of terms of trade changes and sets out evidence of the impact of terms of trade shocks on the trade balance and prices. Section D draws conclusions and provides some policy recommendations.

## **B. Rainfall Variation**

### **Stylized facts**

92. Like its sahellian neighbors, Burkina Faso's rainfall (Figure III.1) is characterized by low annual amounts, significant variation from year to year, significant regional variation, and strong seasonality. The rainfall data in Figure III.1 are interpolations of satellite grid point data.<sup>33</sup> The top panel of the Figure III.1 depicts the average monthly rainfall for Ouagadougou, Bamako (Mali), and Niamey (Niger) for 1979–2005; the bottom panel shows monthly rainfall for those cities from December 2002 through July 2006.

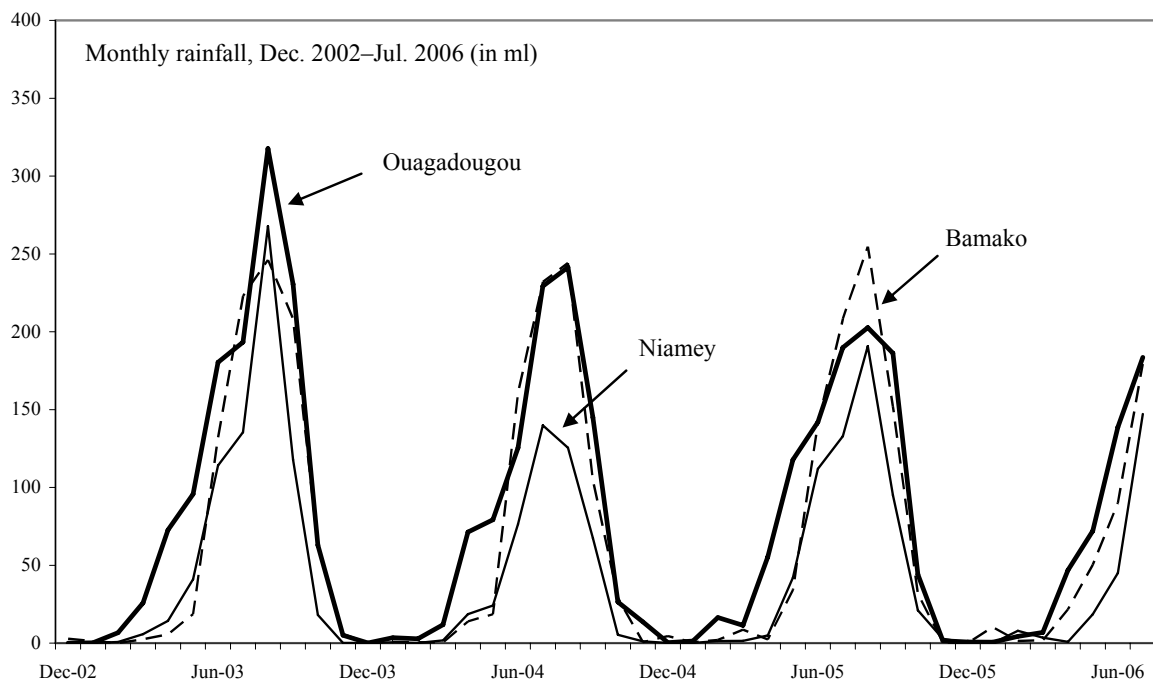
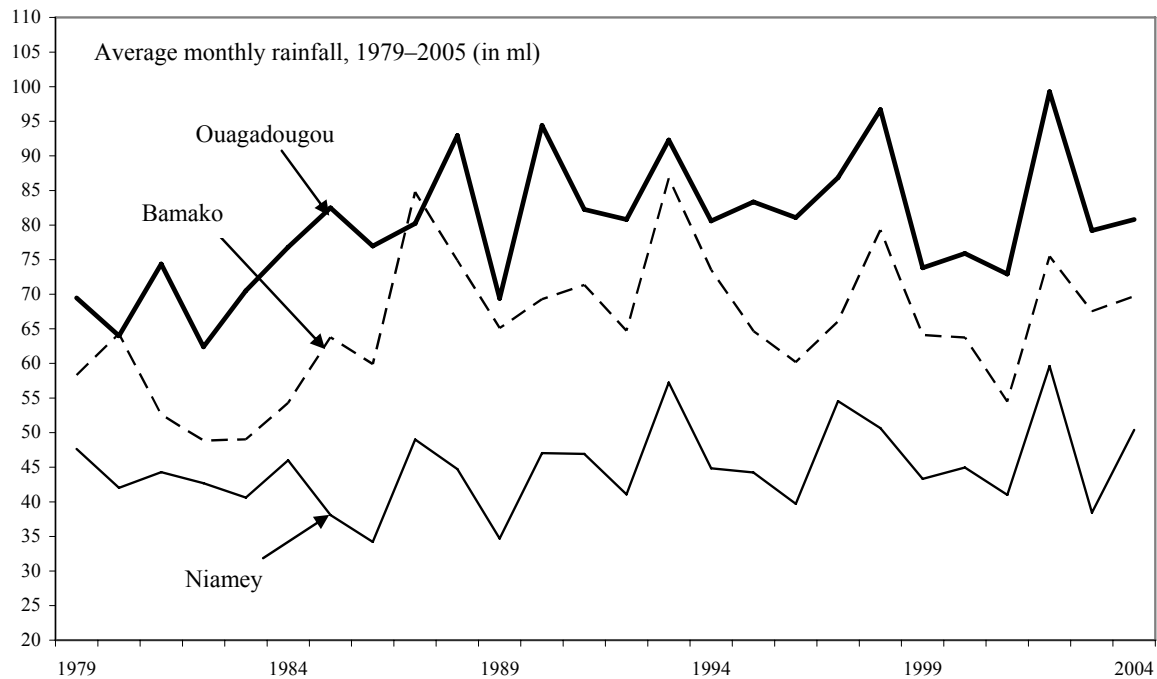
93. Rainfall patterns display significant regional variation; localized pockets of drought may occur even when rainfall for the country as a whole has been good.<sup>34</sup> For Ouagadougou, average monthly rainfall for 1979–2005 was a mere 79.8 ml, but as the top panel of Figure III.1 makes clear, this average number masks substantial year-to-year variation; the standard deviation is 9.4 for the sample period. For example, average monthly rainfall was only 72.9 ml in 2002 but was 99.3 ml in 2003. With a 35 percent increase in rainfall, it is not surprising that harvests in 2003 were much better than in 2002. Typically, rainfall diminishes as one moves further north. For example, average monthly rainfall in Niamey was 45 ml for 1979–2005, about 35 ml less than in Ouagadougou.

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<sup>33</sup> The rainfall data were acquired using the GES-DISC Interactive Online Visualization and Analysis Infrastructure (Giovanni), part of NASA's Goddard Earth Sciences (GES) Data and Information Services Center (DISC).

<sup>34</sup> Unfortunately, we were not able to obtain time series data on rainfall by region in the various regions of Burkina Faso.

Figure III.1. Rainfall in Ouagadougou, Bamako, and Niamey, 1979–2005



Source: <http://disc2.nascom.nasa.gov/Giovanni/tovas/rain.GPCP.2.shtml>.

94. The highly seasonal rainfall pattern determines the rhythm of agriculture, especially for subsistence farming. The seasonality of rainfall is clearly captured in the bottom panel of



Figure III.1: the rains usually in May through September, and November through February are dry months. Deviations from the typical pattern may adversely affect crop yields. For example, the late start of rains in 2007 is estimated to have significantly reduced both the cotton and the maize crops.

### **The impact of rainfall variation on output and prices**

95. To quantify the effect of rainfall shocks on growth and inflation, we estimate a three-variable vector autoregression (VAR) model with one lag, using annual observations for 1980 through 2005. We use the detrended values of the logs of real GDP and CPI; the rainfall data are the log of average monthly rainfall per year.<sup>35</sup> Figure III.2 summarizes results of this VAR estimation by showing impulse responses, cumulative impulse responses, and variance decompositions.<sup>36</sup>

96. The impulse responses trace the intertemporal reaction of a variable (here: output and prices) to an initial shock to rainfall of, with the magnitude of the rainfall shock equal to one standard deviation. The cumulative impulse responses measure the cumulative effect of the intertemporal reaction of the variables of interest to the initial rainfall shock. Finally, the variance decompositions calculate the fraction of the overall variation in a variable that is due to movements of the other variables.

97. The main results confirm several intuitive points:

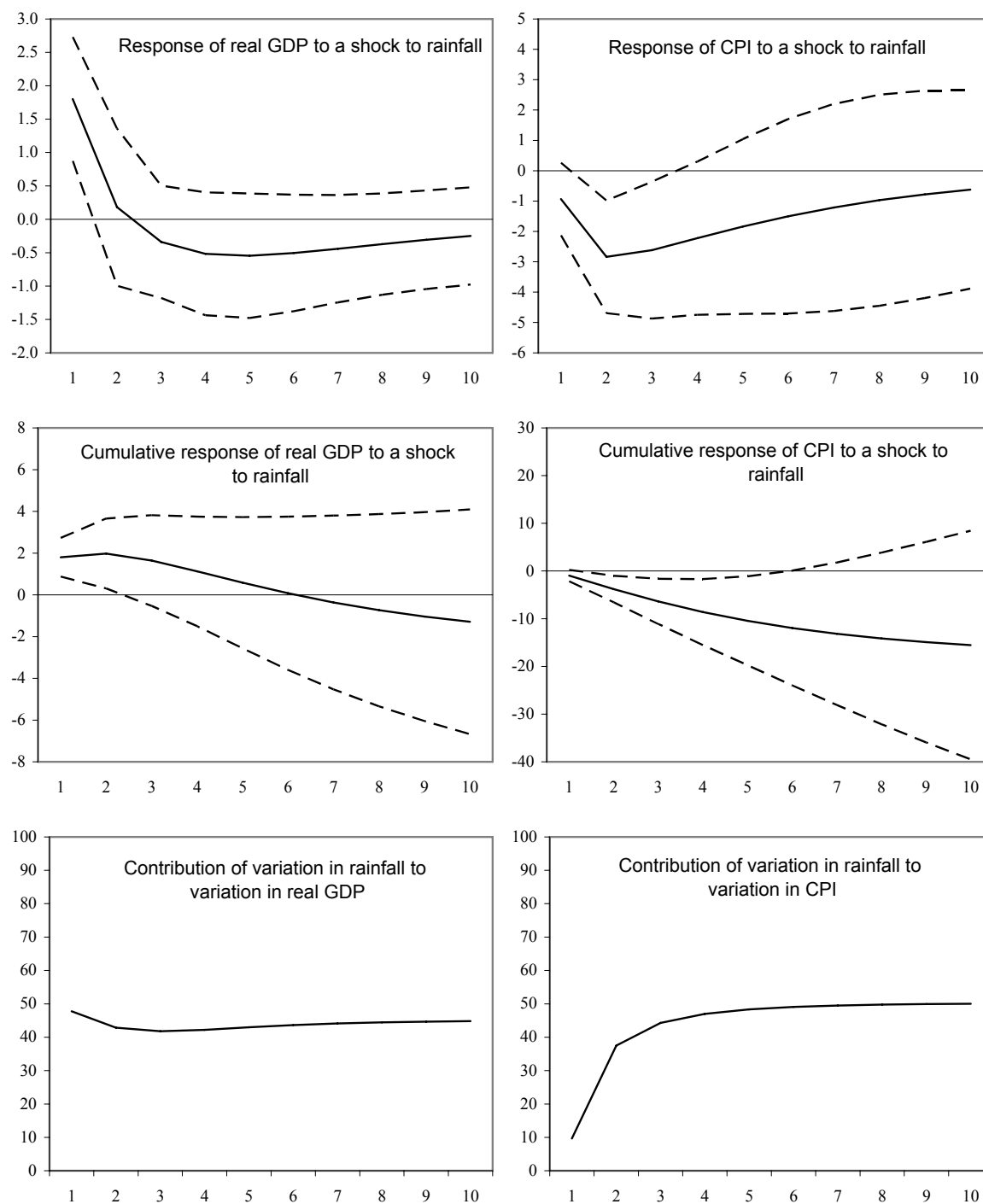
- A positive rainfall shock (equal to one standard deviation; about 10 ml) initially pushes output above trend by almost 2 percent and prices below trend by about 1 percent.
- The effect of the positive impulse on output is persistent, though eventually it dies out and output returns to trend.
- The change in prices is also drawn out, but the cumulative response function suggests a permanently lower price level effect;
- Finally, variance decomposition suggests that rainfall variation explains almost half of the output and CPI variation in output.

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<sup>35</sup> We also included a dummy for 1994, to absorb the outlier of the 1994 devaluation on inflation. Throughout the study, variables were detrended using the Hodrick-Prescott filter.

<sup>36</sup> The impulse responses and variance decompositions were obtained via a Cholesky decomposition, with rainfall ordered first. The confidence bands are drawn based on plus and minus two standard deviations, thus encompassing 95 percent of possible outcomes.

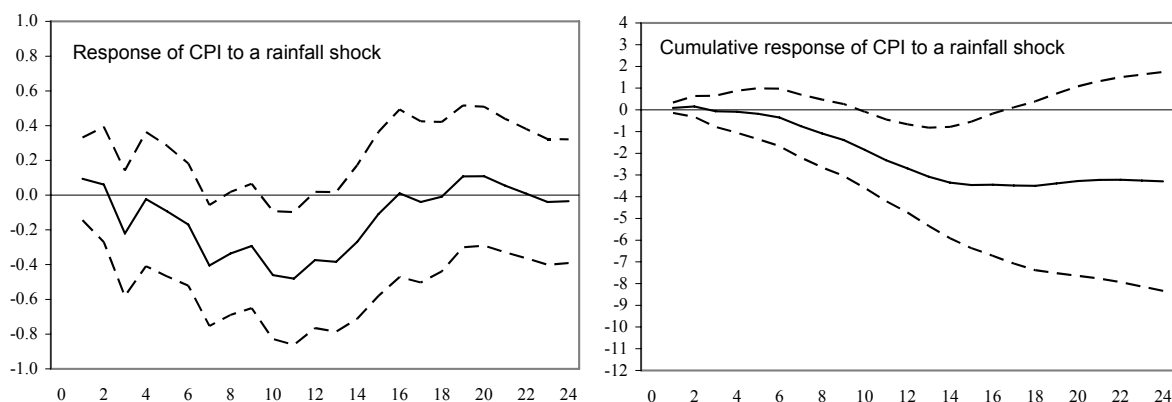
Figure III.2. Burkina Faso: Response of Real GDP and Prices (CPI) to Rainfall Shocks, 1980–2005 (Percent, VAR specification, annual data)



Source: IMF staff estimates.

98. To check the robustness of the results of rainfall on prices, we also ran a monthly regression model with data on rainfall, gasoline prices, and CPI prices. The regression model uses a VAR setup with detrended data, and the sample period runs from February 1998 through April 2007. Twelve lags account for seasonality. The estimated impact of rainfall on prices is shown in Figure III.3. The findings confirm that prices fall in response to a positive rainfall shock. The monthly results also show that the response of prices appears to kick in after 6–12 months and that the effect seems to be permanent (seen most clearly in the cumulative responses). The delayed response of prices is confirmed by the variance decompositions: the effect of rainfall shocks on prices starts to build up about six months after the shock. The variance decompositions also confirm the important contribution of rainfall to price variation (almost 20 percent).

Figure III.3. Burkina Faso: Response of Prices to Rainfall Shocks, 1998–2007 (April)  
(Percent, VAR specification, monthly data)



Source: IMF staff estimates.

### C. Shocks to the Terms of Trade

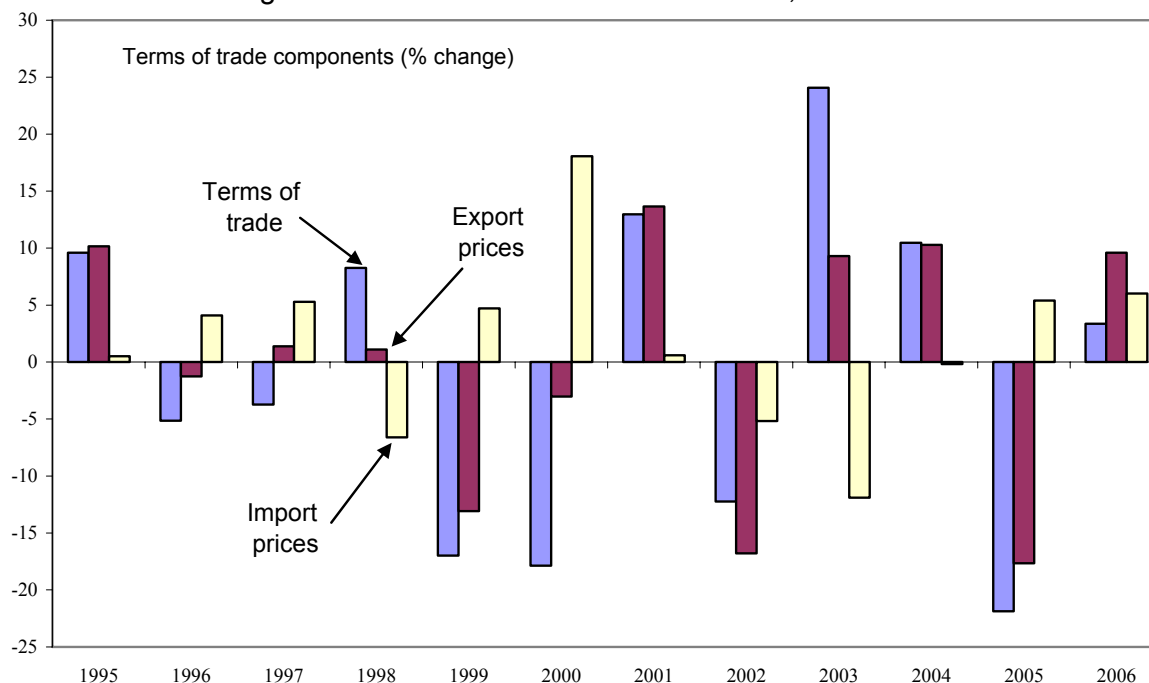
99. A positive terms of trade shocks provides a country with more real income since the same volume of exports allows the country to purchase more goods. The reaction to the shock depends on whether the change is thought to be permanent or temporary. For example, a temporary increase in cotton prices would narrow the trade deficit and tend to increase reserves without fundamentally changing economic behavior. A permanent increase in cotton prices, however, raises permanent income and consumption, thus offsetting a part of the improvement in the trade balance. Also, a permanent shock may increase demand and thus production of nontradables, which could lead to an appreciation of the real exchange rate.

#### Stylized facts

100. Variation in cotton prices has been the most important explanatory factor for the observed large swings in the terms of trade:

- The terms of trade have been declining since after the devaluation of 1994, and large year-to-year swings have been quite common (see Figure III.4). In 7 out of 12 years, there were swings of more than 10 percent in seven out of twelve years, even exceeding 20 percent in 2003 and 2005 swings of more than 20 percent.

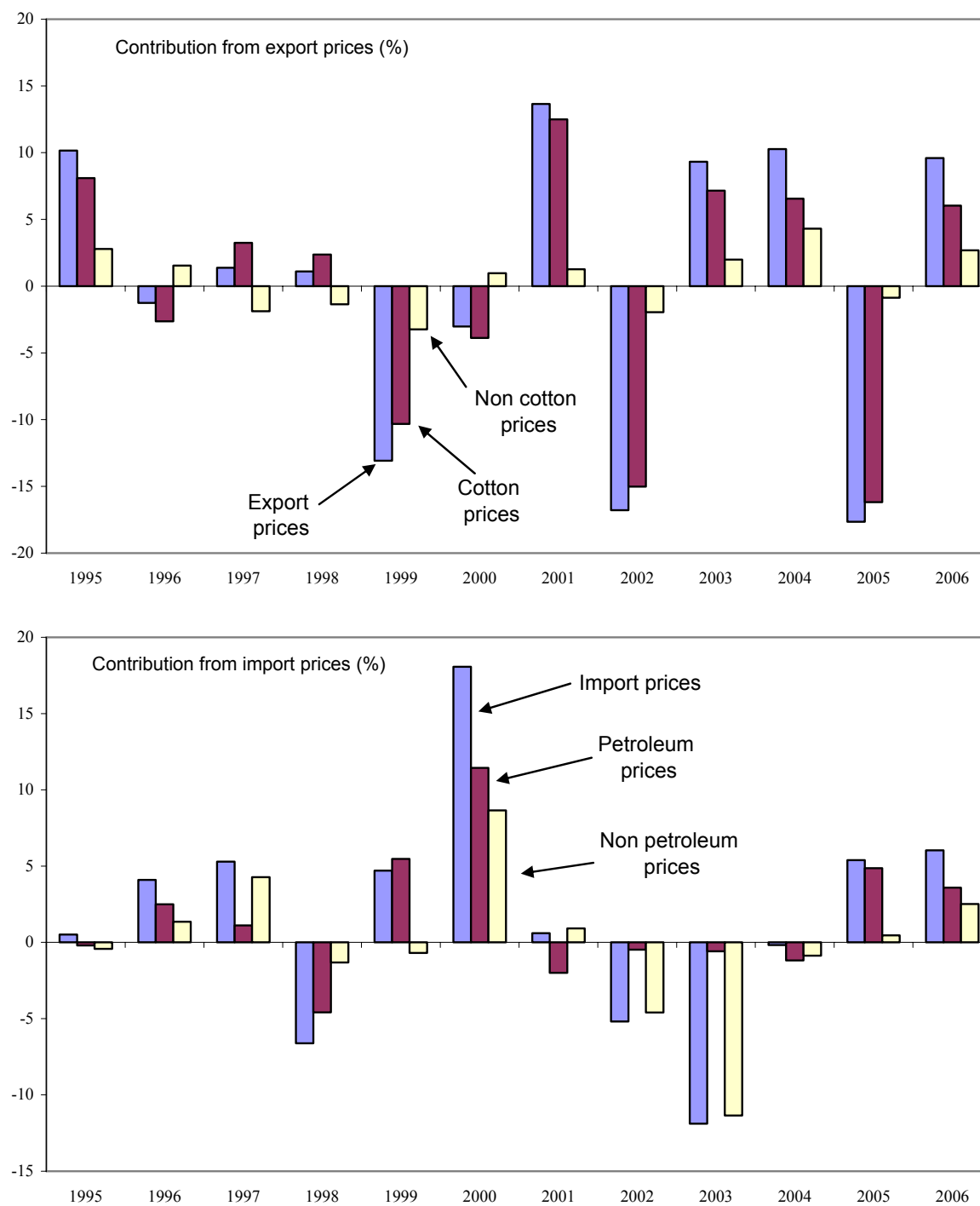
Figure III.4. Burkina Faso: Terms of Trade, 1995–2006



Sources: Burkinabè authorities; and IMF staff estimates.

- Both export and import price changes contribute to changes in the terms of trade. Often, these factors reinforce each other, as they did in 2003 and in 2005. However, with few exceptions large swings in the terms of trade are due to changes in export prices.
- Cotton prices are largely responsible for changes in export prices (Figure III.5). This is not entirely surprising given the dominant role of cotton in Burkina Faso's overall exports—about 60 percent in recent years.
- Changes in petroleum prices contributed substantially contributed to changes in import prices (2002 and 2003 are exceptions), but had a limited impact on the terms of trade.

Figure III.5. Burkina Faso: Contribution to Changes in the Terms of Trade, 1995–2006



Source: Burkinabè authorities; and IMF staff estimates.

101. The terms of trade are relatively more volatile in Burkina Faso than in its neighbors (Table III.1). In 2005, for example, only in Benin was the deterioration nearly as dramatic as in Burkina Faso. Burkina Faso, Benin, and Mali are the only countries in the comparison that depend on a single product for more than 50 percent of export revenues, and Burkina Faso seems to be unique in that its main crop explains nearly all the movements in export prices (Table III.2). Senegal is at the other end of the spectrum, presumably because its export base is more diversified. On the other hand, regarding import prices, the contribution from petroleum prices to Burkina Faso's experience is fairly similar to that of neighboring countries (Table III.3).

### **The cost of terms of trade changes on the economy**

102. We introduce three concepts to measure the economic impact of changes in the terms of trade. The annual impact can be quite large; up to 5 percent of GDP in gains or losses for the economy in terms of consumption possibilities gained or lost. The first measure of the impact is the *import cost* of changes to the terms of trade, which is calculated as the product of the percentage change in the terms of trade and last period's import-to-GDP ratio:

$$\begin{aligned}\text{Import cost in \% of GDP} &\equiv -\% \Delta(\text{terms of trade}) * (\text{imports/GDP}) \\ &\approx - [ \% \Delta(\text{export prices}) * (\text{imports/GDP}) - \% \Delta(\text{import prices}) * (\text{imports/GDP}) ]\end{aligned}$$

103. Import cost captures the extent to which a country is poorer when the terms of trade deteriorate by showing how much more net income it needs to purchase the same quantity of imports, and the extent to which it is richer when the terms of trade improve because the same purchases take less net income. Import cost increases in import prices and in imports-to-GDP (the same increase in import prices is more costly when the country had higher imports to begin with). It decreases in export prices, since exports generate additional income.

104. Although the import cost measure is intuitively appealing, it does not take into account the effect of terms of trade changes on net exports.<sup>37</sup> To account for this effect, we introduce the *income cost measure*:

$$\begin{aligned}\text{Income cost in \% of GDP} &\equiv - [ \% \Delta(\text{export prices}) * (\text{exports/GDP}) \\ &\quad - \% \Delta(\text{import prices}) * (\text{imports/GDP}) ]\end{aligned}$$

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<sup>37</sup> Imagine a country with a trade deficit and both import and export prices increase by the same percentage. Since the terms of trade are not affected, the import cost measure would be zero. However, the additional income generated from exports would not be enough to compensate for the additional cost of imports.

105. Income cost is also expressed as a percentage of GDP, and the export-to-GDP and import-to-GDP ratios are those of the previous period. It essentially measures the impact on the trade balance of a change in the terms of trade, holding constant any volume effects (with the sign inversed). Note that the income cost measure is identical to the import cost measure if the import-to-GDP and export-to-GDP ratios are the same—that is, if the trade balance is zero. Also, if most variation in the terms of trade comes from export prices and the country runs a trade deficit, income cost will typically be smaller in absolute value than import cost.

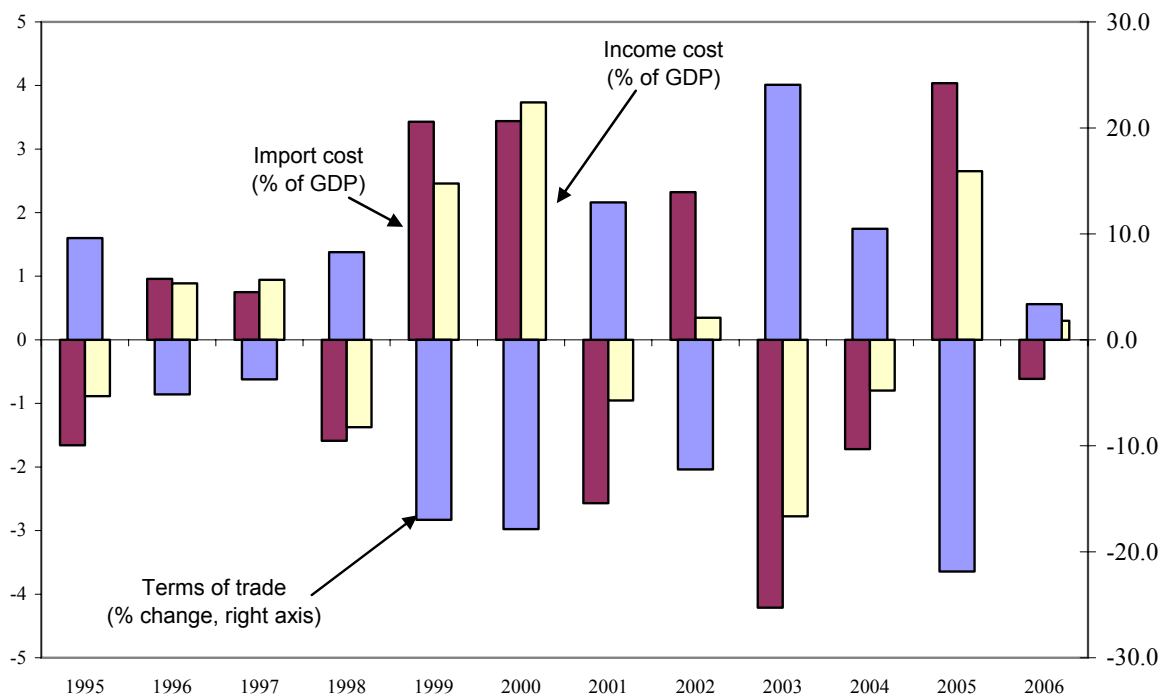
106. A third measure captures the notion that the purchasing power of exports falls when the terms of trade deteriorate and an economy can compensate for the loss by increasing the volume of exports (see Dornbusch and Helmers 1988). This measure, which applies to the *purchasing power of exports*, is calculated as the product of the terms of trade and the export volume:

$$\text{Purchasing power of exports} \equiv \text{Terms of trade} * \text{Export volume}$$

107. The import cost and the income cost have been considerable in Burkina Faso since the devaluation of 1994 (Figures III.6). Our calculations indicate that the import cost of terms of trade changes has generally fluctuated between about –4 and +4 percent of GDP (recall that positive values are costs and negative ones are gains). The severity of the terms of trade deterioration in 2005 is confirmed by an import cost of 4.4 percent of GDP. We also note that there are several years of impressive gains; 2003 had a record gain of 4.2 percent of GDP. The calculated income cost measure is qualitatively similar to the import cost measure but is typically smaller (except in 2000, when the large deterioration in the terms of trade came mostly from import prices). Since devaluation the income cost has varied between –2.7 percent and +4.6 percent of GDP. The 2005 terms of trade deterioration translated into an income cost of about 3 percent of GDP. This, however, is still smaller in absolute value than the cumulative income gains enjoyed in 2003–04 and the 4 percent of GDP income loss of 2000.

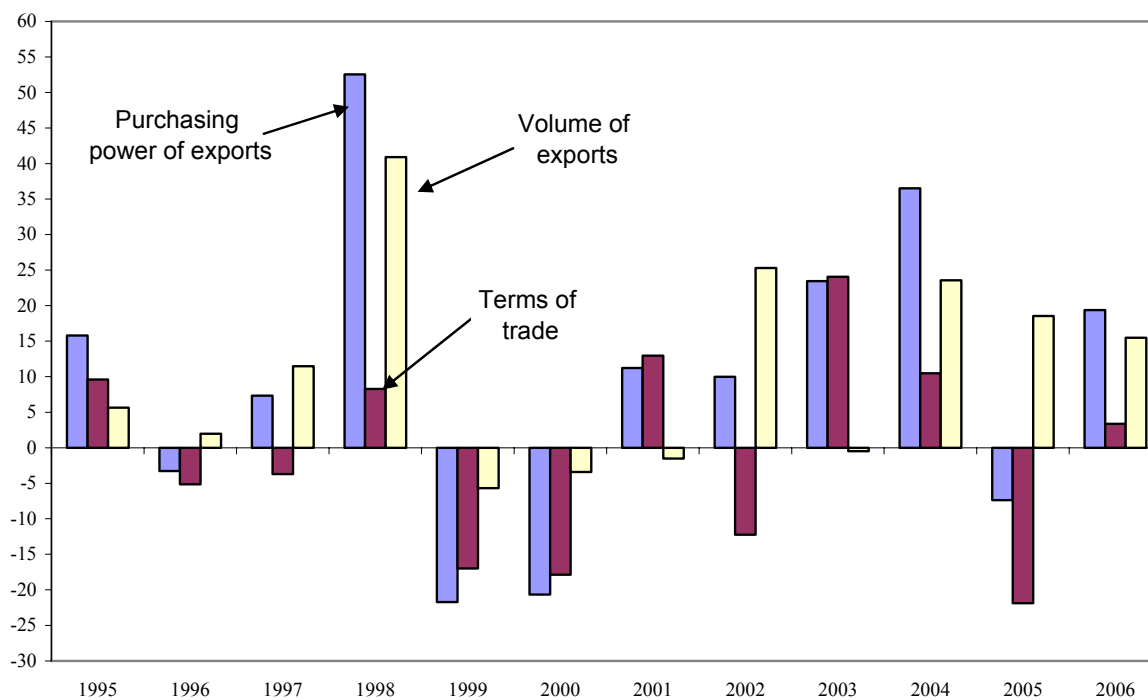
108. There were also large movements in the purchasing power of exports since devaluation period (Figure III.7). The purchasing power of exports declined by 8.6 percent in 2005; the increased volume of exports was able to mitigate but not fully compensate for the adverse impact from the terms of trade deterioration. This contrasts with 2002, where deterioration in the terms of trade was more offset by the volume increase of exports.

Figure III.6. Burkina Faso: Import Cost and Income Cost of Changes in the Terms of Trade, 1995–2006



Source: IMF staff estimates.

Figure III.7. Burkina Faso: Terms of Trade Shocks and Purchasing Power of Exports, 1995–2006 (Percentage change)



Source: IMF staff estimates.



109. Although Burkina Faso has generally experienced larger terms of trade swings since 2000, some of its neighbors (particularly Côte d'Ivoire, Ghana, and Togo) have had to cope with larger import and income costs (Text Table III.1 and Table III.4). Cumulatively Burkina Faso's terms of trade improved about 10 percent over 2000–06, with a corresponding cumulative income gain of about 1.4 percent (in spite of the large deterioration in 2005). Among neighboring countries Niger had the largest improvement (about 23 percent) in its terms of trade for the period, with a cumulative income gain of 2.1 percent. In contrast, Benin, Côte d'Ivoire, Mali, and Togo saw a terms of trade deterioration; Togo suffered the highest income cost (5.4 percent cumulatively). Finally, Burkina Faso recorded the largest cumulative gain—130 percent—in the purchasing power of exports for 2000–06, followed at a distance by Mali with about 50 percent and Ghana with about 30 percent.

Text Table III.1. Cumulative Cost of Terms of Trade Changes of Selected African Countries, 2000–06<sup>1</sup>

|   | Benin | Burkina Faso | Côte d'Ivoire | Ghana | Mali | Niger | Senegal | Togo |
|---|-------|--------------|---------------|-------|------|-------|---------|------|
| (Percentage change, unless otherwise indicated) |       |              |               |       |      |       |         |      |
| Terms of trade                                  | -12.1 | 9.7          | -10.6         | 10.2  | -4.0 | 23.1  | 0.2     | -8.3 |
| Import cost (% of GDP)                          | 2.2   | -1.8         | 2.6           | -5.0  | 0.9  | -5.4  | -0.1    | 3.5  |
| Income cost (% of GDP)                          | 0.6   | -1.4         | -1.8          | 3.4   | 1.2  | -2.1  | 2.6     | 5.4  |
| Purchasing power of exports                     | 3.4   | 127.9        | -3.2          | 29.6  | 51.7 | 14.3  | 1.6     | 2.3  |

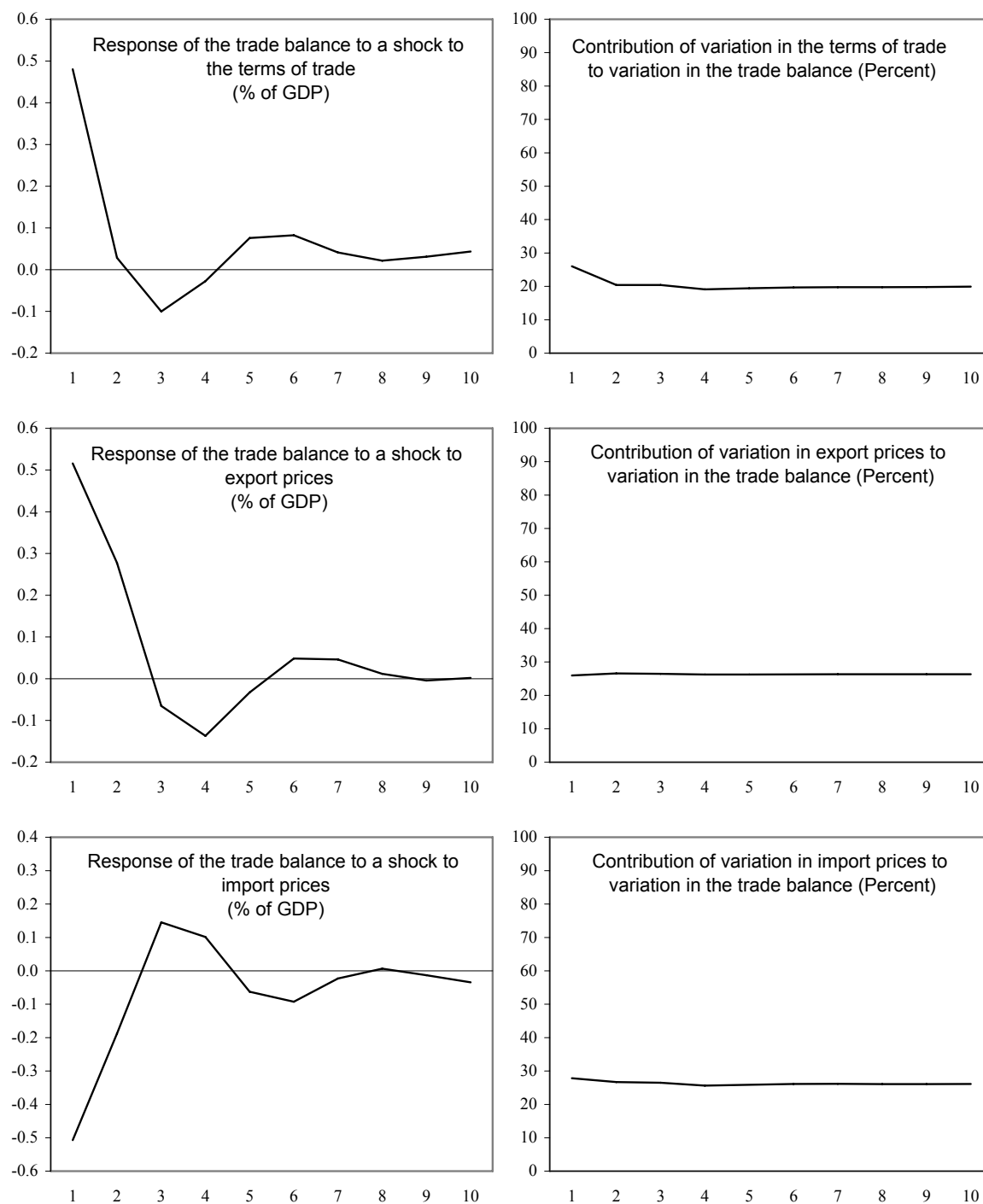
Source: IMF staff calculations.

<sup>1</sup> Cumulative values calculated using the percentage change in the terms of trade, import prices, and export prices (between 2000–06), and the average imports-to-GDP and exports-to-GDP ratio over 2000–06.

### The impact of terms of trade changes

110. Because the intuitive measures just discussed do not capture intertemporal effects, they cannot substitute for intertemporal econometric estimations. Unfortunately, for Burkina Faso it is hard to estimate the reaction of the trade balance to shocks in the terms of trade because the sample size of the post-devaluation period is short. We therefore proceed cautiously by estimating three simple bivariate vector error correction models (VECM), each with one lag. The two variables are the trade balance as a percent of GDP and the terms of trade, export prices, and import prices. The impulse responses and the variance decompositions of each of the three specifications are shown in Figure III.8.

Figure III.8. Burkina Faso: Response of the Trade Balance to Shocks to the Terms of Trade, 1995–2007 (Three VECM specifications, annual data)

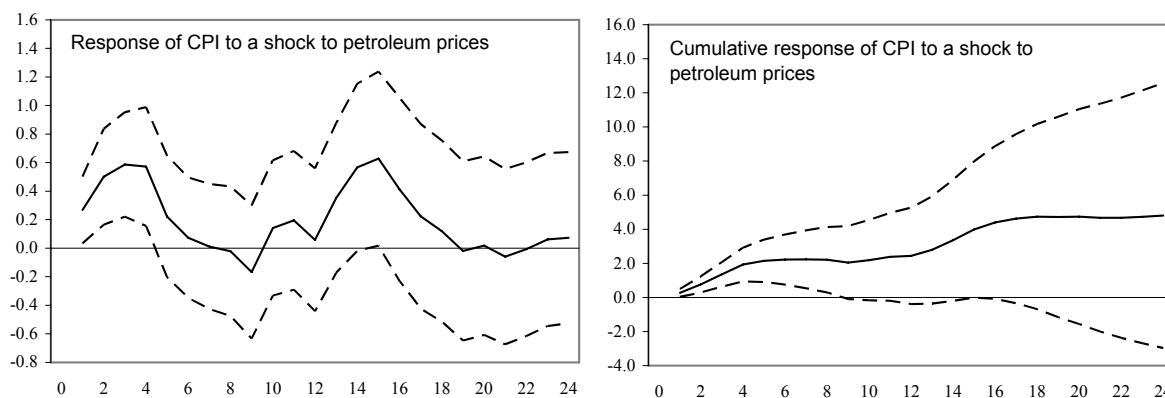


Source: IMF staff estimates.

111. Despite the short sample period, the results confirm the basic conjecture about term of trade shocks: a positive shock to export prices improves the trade balance, and a positive shock to import prices causes it to deteriorate. Specifically, a typical one-standard-deviation shock to the terms of trade affects the trade balance by about  $\frac{1}{2}$  percent of GDP. Though the reaction of the trade balance persists into the second year, the effect soon dies out. The variance decompositions suggest that terms of trade shocks explain about 20 percent of the variation in the trade balance; this goes up to about 26 percent for a separate decomposition of export and import price shocks.

112. Finally, we report the effects of petroleum price shocks on CPI prices (Figure III.9) using the three-variable VAR with monthly data on rainfall, petroleum prices, and CPI prices, with twelve lags to capture seasonal effects. The effect of world petroleum prices on CPI prices is significant. In fact, the impulse responses in Figure III.9 show that CPI prices appear to react in two waves, with the first-wave response capturing the direct effect of price changes at the pump (left panel of Figure III.9). Indeed, the government has in place a system of automatic price adjustment that allows for the direct pass-through of world petroleum prices to domestic prices. After about one year, a second-wave response to prices begins. It may be that the cost structure of some goods and services is affected by petroleum prices, but that the prices of those products change infrequently.

Figure III.9. Burkina Faso: Response of CPI to Petroleum Shocks, 1998–2007 (April)  
(Percent, VAR specification, monthly data)



Source: IMF staff estimates.

## D. Conclusion

113. Burkina Faso is vulnerable to external shocks. Rainfall variation may explain as much as half of the observed cyclical variation of output and prices. The country is also subject to large swings in its external terms of trade that affect the trade balance, prices, and incomes. Although petroleum prices contribute, these swings are largely due to variation in world cotton prices. Unsurprisingly, the big drop in world cotton prices in 2005 had a large cost for

Burkina Faso in terms of lost income, for which increased volumes could not fully compensate. Though neighboring countries also experienced significant changes in their terms of trade, Burkina Faso is especially vulnerable because it is so dependent on a single commodity for export revenue. Indeed, by the end of 2006 the share of cotton in overall exports had increased to more than 60 percent, and the purchasing power of exports had increased by 130 percent.

114. There are some possible policy options for responding to rainfall variations, though less so for terms of trade shocks. The important rainfall variations present in Burkina Faso imply high risk premiums that may make investments in agriculture less attractive and permanently restraining the movement of the sector beyond subsistence. Moreover, subsistence farmers have few instruments at their disposal to lessen the impact of these shocks. However, possible medium-term policy responses would be to increase food storage facilities to be able to supply deficit regions with additional food. It would also be important to improve water storage, irrigation, and roads, install early warning methods, and broaden access to credit. These measures would allow farmers to better adjust to the variations in rainfall and would thus lessen the impact of rainfall variations on agricultural output. Regarding terms of trade shocks the main policy response would be to facilitate adjustment to permanent changes, and to smooth temporary changes including through improved access to credit.

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Table III.1. Terms of Trade of Selected African Countries, 2000–06

|  | 2000                 | 2001 | 2002  | 2003  | 2004  | 2005  | 2006 | Cumul. |
|--|----------------------|------|-------|-------|-------|-------|------|--------|
|  | (Percentage changes) |      |       |       |       |       |      |        |
| Benin: terms of trade, <i>of which</i> :         | 2.1                  | 16.7 | -23.4 | 5.8   | 5.6   | -16.8 | 5.8  | -12.09 |
| Export prices                                    | 9.0                  | 18.7 | -17.4 | 4.6   | 6.5   | -23.9 | 3.0  | -14.29 |
| Import prices                                    | 6.8                  | 1.7  | 7.9   | -1.1  | 0.9   | -8.6  | -2.6 | -2.499 |
| Burkina Faso: terms of trade, <i>of which</i> :  | -17.9                | 13.0 | -12.2 | 24.1  | 10.5  | -21.9 | 3.4  | 9.7    |
| Export prices                                    | -3.0                 | 13.6 | -16.8 | 9.3   | 10.3  | -17.7 | 9.6  | 2.9    |
| Import prices                                    | 18.1                 | 0.6  | -5.2  | -11.9 | -0.2  | 5.4   | 6.0  | -6.2   |
| Côte d'Ivoire: terms of trade, <i>of which</i> : | -17.0                | 6.4  | 30.4  | -23.5 | -11.1 | -10.5 | 5.7  | -10.58 |
| Export prices                                    | -1.0                 | 9.0  | 28.4  | -3.1  | -10.9 | 6.8   | 3.2  | 33.3   |
| Import prices                                    | 19.3                 | 2.4  | -1.6  | 26.6  | 0.2   | 19.3  | -2.4 | 49.0   |
| Ghana: terms of trade, <i>of which</i> :         | -16.6                | 4.8  | 9.4   | 14.8  | -15.1 | -6.9  | 5.9  | 10.2   |
| Export prices                                    | -4.4                 | -2.3 | 12.6  | 28.9  | -1.6  | 1.5   | 15.5 | 63.6   |
| Import prices                                    | 14.6                 | -6.7 | 2.9   | 12.3  | 15.9  | 9.0   | 9.1  | 48.5   |
| Mali: terms of trade, <i>of which</i> :          | 1.4                  | 2.2  | -9.5  | -1.1  | 1.5   | -10.7 | 15.7 | -4.0   |
| Export prices                                    | 12.1                 | 9.6  | -10.7 | 1.6   | 2.0   | -5.6  | 33.3 | 27.7   |
| Import prices                                    | 10.5                 | 7.2  | -1.3  | 2.8   | 0.5   | 5.7   | 15.2 | 33.1   |
| Niger: terms of trade, <i>of which</i> :         | -12.8                | 6.3  | 1.1   | 4.3   | -1.6  | 5.0   | 6.2  | 23.1   |
| Export prices                                    | -6.1                 | 6.1  | 2.6   | 3.7   | 4.6   | 13.4  | 9.0  | 45.7   |
| Import prices                                    | 7.7                  | -0.2 | 1.4   | -0.6  | 6.2   | 8.0   | 2.6  | 18.4   |
| Senegal: terms of trade, <i>of which</i> :       | 0.4                  | 7.1  | -2.6  | -1.8  | -4.2  | -3.5  | 5.7  | 0.2    |
| Export prices                                    | 14.7                 | 3.1  | -3.8  | -0.1  | 3.8   | 7.6   | 10.8 | 22.6   |
| Import prices                                    | 14.3                 | -3.8 | -1.2  | 1.7   | 8.3   | 11.5  | 4.8  | 22.3   |
| Togo: terms of trade, <i>of which</i> :          | -14.1                | 3.3  | 4.2   | 3.7   | -12.2 | -3.6  | -2.9 | -8.293 |
| Export prices                                    | 3.7                  | -2.4 | -2.4  | 1.0   | 2.5   | 10.2  | -1.4 | 7.1694 |
| Import prices                                    | 20.7                 | -5.5 | -6.4  | -2.7  | 16.8  | 14.3  | 1.6  | 16.861 |

Source: IMF African Department country desks.

Table III.2. Decomposition of Export Prices of Selected African Countries, 2000–06

|   | 2000                                  | 2001 | 2002  | 2003 | 2004  | 2005  | 2006  | Cumul. |
|---|---------------------------------------|------|-------|------|-------|-------|-------|--------|
|   | (Percent, unless otherwise indicated) |      |       |      |       |       |       |        |
| Benin: export prices (percent change)         | 9.0                                   | 18.7 | -17.4 | 4.6  | 6.5   | -23.9 | 3.0   | -6.5   |
| Contribution from cotton                      | 4.3                                   | 8.7  | -12.5 | 3.6  | 18.2  | -27.6 | 18.8  | 4.4    |
| Contribution from non cotton                  | 5.5                                   | 8.2  | -6.4  | -3.5 | -7.6  | 10.7  | -16.5 | -12.0  |
| Burkina Faso: export prices (percent change)  | -3.0                                  | 13.6 | -16.8 | 9.3  | 10.3  | -17.7 | 9.6   | -0.2   |
| Contribution from cotton                      | -3.9                                  | 12.5 | -15.0 | 7.2  | 6.6   | -16.2 | 6.0   | -6.8   |
| Contribution from non cotton                  | 1.0                                   | 1.3  | -2.0  | 2.0  | 4.3   | -0.9  | 2.7   | 8.6    |
| Côte d'Ivoire: export prices (percent change) | -1.0                                  | 9.0  | 28.4  | -3.1 | -10.9 | 6.8   | 3.2   | 31.9   |
| Contribution from cocoa                       | -8.8                                  | 12.3 | 17.1  | -3.0 | -12.4 | -1.5  | 1.0   | 1.4    |
| Contribution from non cocoa                   | 9.9                                   | -1.2 | 10.8  | 0.0  | 1.3   | 5.8   | -1.5  | 26.9   |
| Ghana: export prices (percent change)         | -4.4                                  | -2.3 | 12.6  | 28.9 | -1.6  | 1.5   | 15.5  | 56.4   |
| Contribution from cocoa                       | -5.9                                  | -2.3 | 4.5   | 14.2 | -6.3  | -1.2  | 0.6   | 2.3    |
| Contribution from gold                        | 0.2                                   | -1.1 | 4.6   | 6.0  | 4.2   | 2.6   | 11.9  | 31.4   |
| Contribution from other                       | 3.2                                   | -1.4 | -0.9  | 11.6 | 4.7   | 1.1   | 1.9   | 21.5   |
| Mali: export prices (percent change)          | 12.1                                  | 9.6  | -10.7 | 1.6  | 2.0   | -5.6  | 33.3  | 43.1   |
| Contribution from cotton fiber                | -4.1                                  | 4.6  | -1.3  | 2.3  | 2.5   | -10.7 | 3.9   | -3.7   |
| Contribution from gold                        | 9.7                                   | -0.8 | -5.4  | -0.7 | 0.9   | 6.6   | 23.6  | 35.9   |
| Contribution from other                       | 10.2                                  | 6.5  | -0.8  | 0.7  | -2.2  | -2.0  | 4.2   | 17.0   |
| Niger: export prices (percent change)         | -6.1                                  | 6.1  | 2.6   | 3.7  | 4.6   | 13.4  | 9.0   | 36.8   |
| Contribution from uranium                     | -0.5                                  | -0.6 | -0.3  | -0.2 | 0.0   | 3.0   | 2.8   | 4.3    |
| Contribution from non uranium                 | -5.7                                  | 6.8  | 2.8   | 3.9  | 4.6   | 9.8   | 6.4   | 31.6   |
| Senegal: export prices (percent change)       | 14.7                                  | 3.1  | -3.8  | -0.1 | 3.8   | 7.6   | 10.8  | 40.6   |
| Contribution from fish                        | 7.7                                   | 2.5  | -1.6  | -2.4 | 0.8   | 0.0   | 1.6   | 8.6    |
| Contribution from phosphoric acid             | 0.1                                   | -0.2 | -0.6  | -1.6 | 0.5   | 1.4   | 0.5   | -0.1   |
| Contribution from other                       | 7.2                                   | 1.1  | -1.3  | 5.4  | 1.0   | 6.4   | 8.3   | 31.1   |
| Togo: export prices (percent change)          | 3.7                                   | -2.4 | -2.4  | 1.0  | 2.5   | 10.2  | -1.4  | 11.1   |
| Contribution from cotton fiber                | 6.1                                   | -2.2 | -5.0  | 0.1  | 3.5   | 9.9   | -6.2  | 5.4    |
| Contribution from phosphate                   | 1.9                                   | -1.5 | -2.0  | -2.0 | 0.5   | -1.3  | 0.9   | -3.5   |
| Contribution from other                       | -1.9                                  | 3.4  | 6.1   | 0.7  | 0.7   | 3.1   | 6.9   | 20.2   |

Source: IMF staff calculations.

Table III.3. Decomposition of Import Prices of Selected African Countries, 2000–06

|   | 2000                                  | 2001  | 2002 | 2003  | 2004 | 2005  | 2006  | Cumul. |
|---|---------------------------------------|-------|------|-------|------|-------|-------|--------|
|   | (Percent, unless otherwise indicated) |       |      |       |      |       |       |        |
| Benin: import prices (percent change)         | 6.8                                   | 1.7   | 7.9  | -1.1  | 0.9  | -8.6  | -2.6  | 4.2    |
| Contribution from petroleum                   | 9.5                                   | -1.6  | -0.3 | -0.4  | 2.9  | 7.9   | 3.4   | 22.8   |
| Contribution from non petroleum               | 2.1                                   | -1.6  | 13.5 | -3.2  | -4.1 | -19.1 | -1.8  | -15.7  |
| Burkina Faso: import prices (percent change)  | 18.1                                  | 0.6   | -5.2 | -11.9 | -0.2 | 5.4   | 6.0   | 10.7   |
| Contribution from petroleum                   | 11.4                                  | -2.0  | -0.5 | -0.6  | -1.2 | 4.9   | 3.6   | 16.0   |
| Contribution from non petroleum               | 8.7                                   | 0.9   | -0.5 | -11.4 | -0.9 | 0.5   | 2.5   | -1.2   |
| Côte d'Ivoire: import prices (percent change) | 19.3                                  | 2.4   | -1.6 | 26.6  | 0.2  | 19.3  | -2.4  | 77.8   |
| Contribution from petroleum                   | 24.2                                  | -3.1  | -3.1 | -0.2  | 3.9  | 11.0  | 6.6   | 43.0   |
| Contribution from non petroleum               | 2.3                                   | -4.5  | 6.7  | 31.5  | -3.1 | 6.9   | -10.7 | 26.7   |
| Ghana: import prices (percent change)         | 14.6                                  | -6.7  | 2.9  | 12.3  | 15.9 | 9.0   | 9.1   | 70.2   |
| Contribution from petroleum                   | 3.9                                   | 12.4  | -2.9 | -0.2  | 2.6  | 5.7   | 9.4   | 34.2   |
| Contribution from non petroleum               | 11.5                                  | -15.0 | 6.7  | 12.5  | 13.9 | 3.5   | -0.7  | 33.1   |
| Mali: import prices (percent change)          | 10.5                                  | 7.2   | -1.3 | 2.8   | 0.5  | 5.7   | 15.2  | 47.0   |
| Contribution from petroleum                   | 8.9                                   | 1.3   | -3.6 | -1.3  | 9.8  | 2.6   | 4.0   | 22.9   |
| Contribution from non petroleum               | 4.1                                   | 5.9   | 2.6  | 3.7   | -6.9 | 2.6   | 10.5  | 24.0   |
| Niger: import prices (percent change)         | 7.7                                   | -0.2  | 1.4  | -0.6  | 6.2  | 8.0   | 2.6   | 27.5   |
| Contribution from petroleum                   | 6.4                                   | -2.3  | -0.3 | -2.8  | 4.1  | 6.5   | 1.8   | 13.7   |
| Contribution from non petroleum               | 2.8                                   | 2.2   | 0.3  | 2.7   | 0.7  | 2.8   | -0.2  | 11.8   |
| Senegal: import prices (percent change)       | 14.3                                  | -3.8  | -1.2 | 1.7   | 8.3  | 11.5  | 4.8   | 39.8   |
| Contribution from petroleum                   | 12.9                                  | -1.9  | -2.1 | 0.3   | 3.4  | 8.7   | 2.5   | 25.4   |
| Contribution from non petroleum               | 3.4                                   | -9.5  | 3.8  | 4.8   | 3.8  | 2.1   | -5.5  | 2.0    |
| Togo: import prices (percent change)          | 20.7                                  | -5.5  | -6.4 | -2.7  | 16.8 | 14.3  | 1.6   | 41.1   |
| Contribution from petroleum                   | 6.9                                   | -0.8  | -2.8 | 0.5   | 4.7  | 12.1  | 4.4   | 26.9   |
| Contribution from non petroleum               | 14.6                                  | -15.9 | -0.5 | -5.3  | 13.2 | -0.9  | -10.9 | -9.1   |

Source: IMF staff calculations.



Table III.4. Cost of Terms of Trade Changes of Selected African Countries, 2000–06

|   | 2000  | 2001 | 2002  | 2003  | 2004  | 2005  | 2006 | Cumul. <sup>1</sup> |
|---|-------|------|-------|-------|-------|-------|------|---------------------|
| (Percentage change, unless otherwise indicated) |       |      |       |       |       |       |      |                     |
| <b>Benin</b>                                    |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | 2.1   | 16.7 | -23.4 | 5.8   | 5.6   | -16.8 | 5.8  | -12.1               |
| Import cost (% of GDP)                          | -0.4  | -3.1 | 4.3   | -1.1  | -1.1  | 3.3   | -1.0 | 2.2                 |
| Income cost (% of GDP)                          | 0.5   | -1.2 | 2.9   | -0.6  | -0.4  | 0.4   | -0.7 | 0.6                 |
| Purchasing power of exports                     | 49.0  | 13.4 | -15.4 | 18.0  | -7.0  | 2.1   | -3.9 | 3.4                 |
| <b>Burkina Faso</b>                             |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | -17.9 | 13.0 | -12.2 | 24.1  | 10.5  | -21.9 | 3.4  | 9.7                 |
| Import cost (% of GDP)                          | 3.4   | -2.6 | 2.3   | -4.2  | -1.7  | 4.0   | -0.6 | -1.8                |
| Income cost (% of GDP)                          | 3.7   | -1.0 | 0.3   | -2.8  | -0.8  | 2.7   | 0.3  | -1.4                |
| Purchasing power of exports                     | -20.7 | 11.2 | 10.0  | 23.5  | 36.5  | -7.4  | 19.4 | 127.9               |
| <b>Côte d'Ivoire</b>                            |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | -17.0 | 6.4  | 30.4  | -23.5 | -11.1 | -10.5 | 5.7  | -10.6               |
| Import cost (% of GDP)                          | 3.6   | -1.4 | -6.6  | 4.8   | 2.5   | 2.8   | -1.8 | 2.6                 |
| Income cost (% of GDP)                          | 4.4   | -2.7 | -10.5 | 6.8   | 4.5   | 2.2   | -2.2 | -1.8                |
| Purchasing power of exports                     | -30.1 | 7.6  | 27.9  | -33.8 | 8.2   | -7.8  | 6.5  | -3.2                |
| <b>Ghana</b>                                    |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | -16.6 | 4.8  | 9.4   | 14.8  | -15.1 | -6.9  | 5.9  | 10.2                |
| Import cost (% of GDP)                          | 7.0   | -2.6 | -5.0  | -6.5  | 6.5   | 3.3   | -2.9 | -5.0                |
| Income cost (% of GDP)                          | 7.3   | -2.8 | -2.9  | -4.2  | 7.3   | 3.9   | 0.5  | 3.4                 |
| Purchasing power of exports                     | -15.7 | 3.4  | 7.1   | 7.0   | -2.8  | -7.7  | 21.9 | 29.6                |
| <b>Mali</b>                                     |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | 1.4   | 2.2  | -9.5  | -1.1  | 1.5   | -10.7 | 15.7 | -4.0                |
| Import cost (% of GDP)                          | -0.3  | -0.5 | 2.3   | 0.2   | -0.3  | 2.4   | -3.7 | 0.9                 |
| Income cost (% of GDP)                          | -0.2  | -0.4 | 2.3   | 0.2   | -0.3  | 2.4   | -3.3 | 1.2                 |
| Purchasing power of exports                     | -6.1  | 32.7 | -18.9 | 12.2  | 0.3   | 26.5  | -0.9 | 51.7                |
| <b>Niger</b>                                    |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | -12.8 | 6.3  | 1.1   | 4.3   | -1.6  | 5.0   | 6.2  | 23.1                |
| Import cost (% of GDP)                          | 2.6   | -1.4 | -0.2  | -0.9  | 0.3   | -1.2  | -1.7 | -5.4                |
| Income cost (% of GDP)                          | 2.4   | -1.0 | -0.1  | -0.6  | 0.8   | -0.1  | -0.5 | -2.1                |
| Purchasing power of exports                     | 5.8   | -0.5 | -3.8  | 5.6   | 6.2   | 1.1   | 5.3  | 14.3                |
| <b>Senegal</b>                                  |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | 0.4   | 7.1  | -2.6  | -1.8  | -4.2  | -3.5  | 5.7  | 0.2                 |
| Import cost (% of GDP)                          | -0.1  | -2.0 | 0.8   | 0.5   | 1.3   | 1.1   | -1.9 | -0.1                |
| Income cost (% of GDP)                          | 0.8   | -1.7 | 0.4   | 0.5   | 1.8   | 2.1   | -0.3 | 2.6                 |
| Purchasing power of exports                     | -11.1 | 16.7 | 2.4   | -3.4  | 0.8   | -6.4  | -6.8 | 1.6                 |
| <b>Togo</b>                                     |       |      |       |       |       |       |      |                     |
| Terms of trade                                  | -14.1 | 3.3  | 4.2   | 3.7   | -12.2 | -3.6  | -2.9 | -8.3                |
| Import cost (% of GDP)                          | 4.5   | -1.3 | -1.6  | -1.5  | 5.5   | 1.6   | 1.3  | 3.5                 |
| Income cost (% of GDP)                          | 5.8   | -1.5 | -1.9  | -1.3  | 6.9   | 3.8   | 1.0  | 5.4                 |
| Purchasing power of exports                     | -15.5 | 4.2  | 19.0  | 16.0  | -20.5 | -10.6 | 0.1  | 2.3                 |

Source: IMF staff calculations.

<sup>1</sup> Cumulative values calculated using the percentage change in the terms of trade, import prices, and export prices (between 2000–06) and the average imports-to-GDP and exports-to-GDP ratio for the period.

## **IV. MINING BURKINA FASO: AN OVERVIEW<sup>38</sup>**

### **A. Introduction**

115. Although Burkina Faso has significant potential for mining manganese, bauxite, copper, nickel, zinc, limestone, and gold, mining accounts for only a small amount of Burkina Faso's GDP. However, the mining industry is expected to become increasingly important to the economy; several gold mines are being developed and mineral exploration is intensifying. Since the mining code was revised in 2003, the number of exploration permits has increased to 443, against 353 between 1990 and 2002.

116. Gold mining could have a positive impact on public finances through higher revenue in the form of taxes on industrial and commercial profits; taxes levied on behalf of employees; priority royalties paid to the state; and dividends paid to shareholders, including the state. However, this source of income is unstable because it depends on trends in gold production and international prices.

### **B. Artisan Gold Mining**

117. The authorities have been promoting artisan mining as an activity that helps increase the incomes of poor people, especially in the dry season. Artisan mining essentially applies to gold. It mobilizes some 200,000 people who work in more than 200 sites throughout the country, with some sites accommodating up to 20,000 people at a time. Artisan mining makes little or no use of power equipment. Miners extract gold-bearing ores using simple hand tools, pulverize them using mortar and pestle, and wash the powder to pick out flakes of gold. Women are often active in the mining camps both workers and suppliers of food and other services. Between 1986 and 2005, according to official data, this activity yielded 15,576 kg of gold exports, slightly higher than industrial production. Official data show annual production of 190 kg of artisan gold in 2005, but the World Bank estimates that this may represent only 10–15 percent of actual production and exports. Measures to promote artisan mining include production and use of affordable equipment, improving land tenure systems, training miners on the technical characteristics of sites and mining methods, and improving social conditions at the sites.

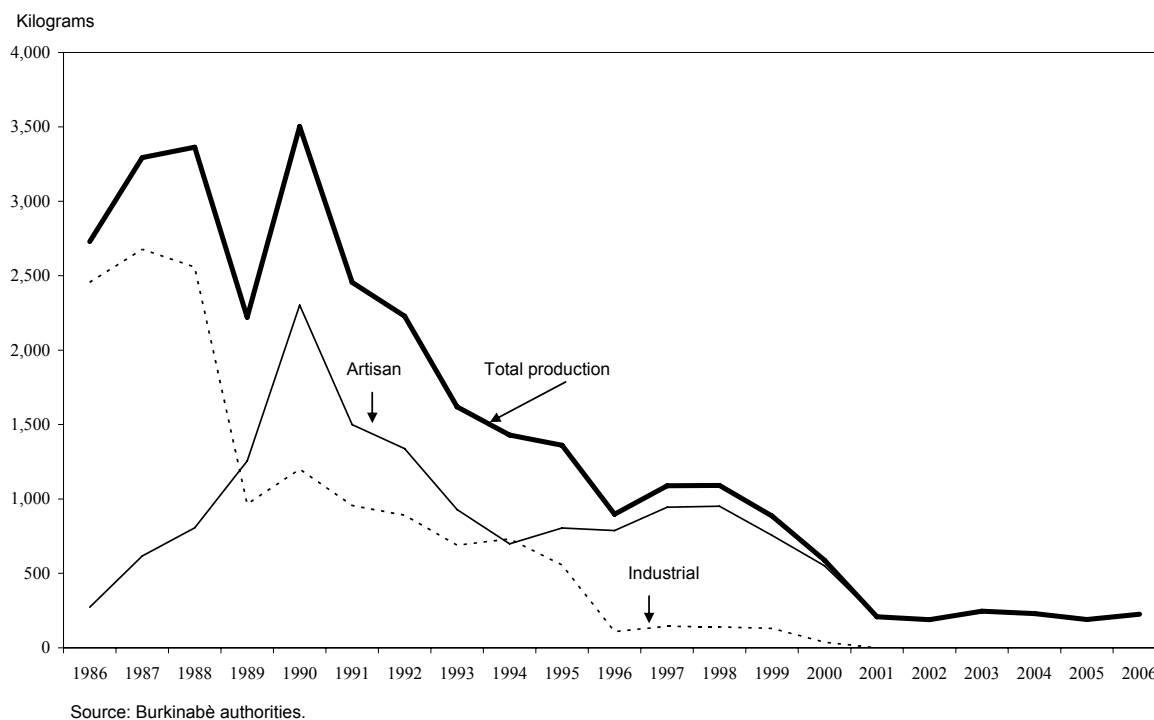
118. Health and safety conditions in artisan sites are dismal. The state tried to organize and supervise the sector through a capacity-building project, PRE-CAGEME (National Mining Sector and Environmental Management Capacity Building Project). PRE-CAGEME, which ran from 1998 to 2004, promoted the development of small-scale mines and supported local companies designing and manufacturing user-friendly processing equipment for use without applying chemical products like mercury. Small-scale mines, mainly locally owned, use motorized equipment and other small power tools to extract and process mineral ores, which

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<sup>38</sup> Prepared by Mario Zejan.

increases production and lowers costs compared to manual production. Mechanization allows the miner to go deeper, beyond alluvial deposits. Operation of the equipment requires technical and mechanical skills that are locally available, although in short supply. It is easier for the government to monitor operations and provide technical extension services to small-scale than to artisan mines.

Figure IV.1 Burkina Faso: Gold Production, 1986–2006



### C. Industrial Gold Mines

119. The only industrial gold mine in the 1980s and 1990s was Poura, operated by the parastatal *Société de recherches et d'Exploitations Minières du Burkina*. Its output fell dramatically in the 1990s, and Poura suspended operations in 1998 due to low gold prices and managerial problems. Since then artisan production has become the only source of gold.

120. Burkina Faso's gold reserves are estimated at more than 6 million ounces and industrial production was expected to begin in 2007. Six companies have obtained exploitation permits and two of them are starting production: Taparko, developed by Canada's High River Gold Mines, and Youga, developed by the Burkina Mining Company with the Canadian company Etruscan as a majority owner. The mines are expected to produce between 20 and 35 tons a year over a seven- to eight-year lifespan.

121. Another four gold mines are expected to start production in 2008 or later: Kalsaka, developed by Kalsaka Mining, a joint venture between British and Burkinabè companies;

Mana, developed by the Canadian company Semafo); Inata Belahourou, licensed by Canadian Goldbelt Resources; and Guiro-Diouga, owned by STRESCO with British interests. Together they could produce some 65–70 tons/year for seven to eight years.

122. Though the Essakan mine developed by Canadian Orezone Resources Inc. and South African Gold Fields Ltd., which hosts the largest known gold resource in the country, has not yet requested an exploitation permit, production there could begin in 2009 and exports in 2010. Technical studies on other deposits could further boost gold exports after 2010. Forecasts of gold and mineral export earnings of Burkina Faso are shown in Table IV.1.

Table IV.1. Burkina Faso: Industrial Mining Production Forecasts, 2007–10

|  | 2007   | 2008    | 2009    | 2010    |
|--|--------|---------|---------|---------|
| Gold   |        |         |         |         |
| Turnover in US\$ millions (at US\$ 425/ounce)  | 20.5   | 88.8    | 116.1   | 136.6   |
| Exports (ounces of gold).                      | 48,226 | 208,979 | 273,281 | 321,507 |
| Zinc   |        |         |         |         |
| Turnover in US\$ millions (at US\$ 1,500/ton). | 0      | 0       | 93.6    | 93.6    |
| Exports (tons).                                | 0      | 0       | 62,400  | 62,400  |

Source: World Bank.

#### D. Other Minerals

123. Low manganese prices and the lack of railway transport resulted in suspension of operations at the Tambao mine in 1998. A manganese mine in Kiéré is expected to start construction in 2008. An Australian company has been developing the Perkoa zinc deposit in the western part of the country and plans to start production in early 2008. The project is expected to add some US\$90 million to Burkina Faso's export earnings. A Canadian enterprise has been evaluating copper deposits in the south. The deposit at Kodjari produces 3,000 tons of phosphate annually, which are ground and used as fertilizer in Burkina Faso. Recent work by the BUMIGEB (Bureau of Mines and Geology of Burkina Faso) has identified several areas for uranium mineralization.

#### E. Sector Institutions and Legal Framework

124. Since the mid-1990s the authorities have instituted a number of reforms to modernize the environment for mining investment. A new Ministry of Mines, Quarries and Energy was created in 1995. The regulatory mandates of the BUMIGEB and the state-owned buying office, the CBMP (*Comptoir Burkinabè des Metaux Precieux*), were revised to make them more supportive of private sector activities. In 1996 the government abolished the CBMP's monopoly and issued regulations for the operations of private gold buying agencies. The CBMP was liquidated in 2006.

125. A mining code was adopted in 1997 to make exploration and exploitation of mineral resources more attractive. In 2003 the National Assembly revised it significantly and a new law was adopted to encourage mining prospecting and formalize semi mechanized small-scale operations to enhance the mining sector's contribution to Burkina Faso's Poverty Reduction Strategy.

126. The mining code establishes that mineral resources are the property of the state, with mineral rights to be granted by the Ministry of Mines, Quarries, and Energy. It gives domestic and foreign firms the same rights and obligations. The state guarantees the right of ownership, freedom of management, free transfer of capital and returns, and stability of agreements made according to the law.

127. The mining code provides for three types of permits: exploration (three years, renewable twice); industrial operation of mines; and semi mechanized small-scale operations. For industrial operations, after the initial permit (20 years for large mines, 10 years for small), permits are renewable for consecutive periods of five years until the deposit is depleted. Small-scale operations are granted a five-year permit, renewable for periods of three years.

128. The code distinguishes between exploration and exploitation, with the latter stage including a construction and an operation period. At the exploitation stage, the applicant for a permit must grant the state a 10 percent free ownership share in the mining company.

129. In the exploration stage holders of a permit or authorization are given customs and tax concessions. The custom concessions give the right to a duty of just 5 percent on equipment, spare parts, raw materials, consumables, fuel, and lubricants and also allow for temporary admission. Tax concessions consist of full exemption from VAT on goods and services, the industrial and commercial tax (BIC), the professional minimum flat rate tax (IMFPIC), and the employers' and apprenticeship tax (TPA).

130. During the operations phase permit holders are exempted from the professional minimum flat-rate tax (IMFPIC), the employers' and apprenticeship tax (TPA), and property in mortmain tax. These exemptions are valid for the lesser of seven years or one half the mine's life. Permit holders also benefit from the right to a reduced customs duty of 7.5 percent on equipment, spare parts, raw materials, consumables, fuel, and lubricants. The VAT is subject to a refund system. A withholding tax of 7.5 percent and a company tax of 25 percent apply. The company tax takes into account exploration expenditure, a loss carry-forward for five years, provisions for site rehabilitation and deposit reconstitution, and accelerated depreciation for new equipment. Holders are also exempt from registration fees when increasing capital.

## **F. Conclusion**

131. Industrial mining represents a major new source of foreign exchange and government revenue that requires transparent management and accountability to ensure that the revenues contribute to sustainable development and poverty reduction. If good governance is

encouraged in the sector, revenues can be an important engine for long-term economic and social development. For these reasons, the authorities are considering the participation of Burkina Faso in the Extractive Industries Transparency Initiative.

132. The Burkinabè authorities still need to tackle obstacles that make for an unfavorable environment for attracting foreign investment in mining. Among them are inconsistent and arbitrary interpretation of the mining code by tax and custom officials, red tape in processing applications for permits, and delays in reimbursing VAT rebates. Rigidities in the Labor Code negatively affect mining companies, which need access to temporary employment in the exploration phase. Burkina Faso has considerable gold reserves to increase its exports and revenues; it would do well to ensure that its mining policies are sound and stable in their application.

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