Working Paper

INTERNATIONAL MONETARY FUND

IMF Working Paper

WP/99/117

INTERNATIONAL MONETARY FUND

African Department

Investment, Capital Accumulation, and Growth: Some Evidence from The Gambia 1964–98

Prepared by Christian H. Beddies[1]

Authorized for distribution by Sérgio Pereira Leite

August 1999

Abstract

This paper considers the potential variables that have determined economic growth in The Gambia during 1964–98. The results indicate that The Gambia's aggregate production function exhibits increasing returns to scale, thus supporting the endogenous growth–type model. The impact of private investment—and thus private capital accumulation—on output is large and significant. Furthermore, increases in public investment boost output substantially. Finally, the effects associated with human capital accumulation are positive and statistically significant. The paper also estimates a series on total factor productivity growth that indicates that The Gambia was able to use its resources more efficiently.

JEL Classification Numbers: O11, O40, O55, C22

Keywords: endogenous growth, human capital, investment, capital stock, total factor productivity

Author's E-Mail Address: cbeddies@imf.org

---

[1] I wish to thank David Coe, Dhaneshwar Ghura, Sérgio Pereira Leite, Erik de Vrijer, and Luisa Zanforlin for useful comments and helpful suggestions on an earlier draft of this paper. Of course all errors and omissions remain my own.

Contents

Page

I. INTRODUCTION

The Gambia is a small open economy located on the west cost of Africa and surrounded on three sides by Senegal. The Gambia extends inland for 320 kilometers along the banks of the River Gambia, at widths varying from 24 to 48 kilometers. Its resources are very limited, and the population density in rural areas is high, at 460 inhabitants per square kilometer (as of 1996). The overall population density is estimated at about 115 inhabitants per square kilometer. In 1997, the level of human capital in The Gambia was relatively low, as reflected by the high illiteracy rate of 67 percent; however, this has improved significantly from the rates of 94 percent in 1962 and 79¾ percent in 1985 (percent of people with more than 15 years of age). Primary school enrollment is also quite low. In 1995, 77 percent were enrolled in primary schools, 25 percent in secondary schools and only 1¾ percent in colleges.[2] After almost three decades of multiparty democracy a military coup took place in July 1994, bringing Colonel Yahyah Jammeh to power. He became president in the 1996 elections.

A variety of studies have addressed the issue of economic growth, mostly using either cross-country or panel data.[3] While most of these studies utilize the standard neoclassical growth model or its extended version that includes human capital, more recent studies focus on endogenous growth models, using them to address problems arising in the context of neoclassical growth models. For example, Romer (1994) points out "that economic growth is an endogenous outcome of an economic system, not the result of forces that impinge from outside."[4] Two key elements of the neoclassical growth model are that technological progress is exogenously given and that it has "public goods" character. However, technological progress can hardly be an exogenous process, completely unrelated to the economic agents' activities. Furthermore, in reality, inventions are not usually public goods. New technologies or products—if important enough—are usually excluded from other people's usage through patent laws, at least for a certain period of time. The endogeneity of technological progress is captured in both the Romer (1986) and the Lucas (1988) models; the importance of monopoly rents or the patenting of inventions is still open for debate. The mechanism through which steady state growth can be achieved assumes that the production process exhibits increasing returns to scale in reproducible factors. For example by assuming that technological progress is endogenously achieved through private investment (Romer, 1986), this spillover effect results in a production function exhibiting increasing returns to scale. In this vein Ghura (1997) provides an analysis of economic growth in an individual developing country, namely Cameroon.

---

[2] These numbers are percentages of the relevant age group. Data drawn from the World Development Indicators database (WDI), The World Bank.

[3] See, for example, Barro (1997), Hadjimichael (1995) and others and the papers cited therein.

[4] Romer (1994, p. 3).

This paper investigates the determinants of economic growth in The Gambia during 1964-98. The advantages of analyzing the growth behavior of an individual country are that one can study the contribution of country-specific historical and institutional aspects.[5] The paper also analyzes the separate impacts of private and public investment on growth and points to the importance of positive externalities that stem from human capital accumulation. Second, it constructs a time series on public as well as private capital stocks. Human capital data—as, for example, published by Nehru, Swanson, and Dubey (1995)—are not available for The Gambia. The Barro-Lee (1996) data set on mean school years of education is also incomplete in the case of The Gambia. The paper suggests a possible proxy for this variable by updating the Barro-Lee data set for the years before 1975, by using enrollment data. The main results can be summarized as follows: both private and public investment and, thus, total capital accumulation are important determinants of economic growth. The human capital proxy turns out to be a significant explanatory variable in the estimated growth equations. Since private investment and the accumulation of private capital are shown to be such important determinants of growth in The Gambia, the authorities might consider the implementation of policies that enhance this type of investment. The overall results support the endogenous growth–type model.

The remainder of the paper is organized as follows. Section II gives some background and outlines recent economic and social developments in The Gambia. Section III presents the theoretical underpinnings of this paper. Section IV portrays the empirical methodology and the estimation results for investment, following the Ghura (1997) framework. Section V develops the estimation of the capital stock in The Gambia and compares the results obtained from estimating economic growth directly via capital accumulation with the indirect method using investment data. The final section concludes the paper and discusses some policy implications of the main findings.

II. Background

The Gambia is one of the few countries in West Africa that is not a member of the West African Monetary Union (WAMU), also called the CFA franc zone. Its currency, the dalasi, is issued by the Central Bank of The Gambia (CBG) and floats against foreign currencies. Toward the end of the nineteenth century the British extended their rule up the Gambia river from the small former slaving port of Bathurst—which is now the capital Banjul—making the country an enclave within Senegal.

The Gambia has very limited natural resources, with a per capita real income of about D 2,491 (US $234) as of 1998. Agricultural output is an important source of income, although its share in total real GDP declined by about 3 ½ percentage points (from about 22 percent to 19 percent) over the past eight years. The major component of the Gambia's GDP is the services sector, which increased from 53 percent of total GDP in 1990-91 to almost 58

[5] Ghura (1997).

percent of total GDP in 1998. While the first ten years of independence were characterized by broadly stable conditions, a series of adverse external shocks and inappropriate domestic policies caused a substantial deterioration of overall economic performance. At the same time, the size of the public sector increased markedly, resulting in ever-widening fiscal imbalances.[6]

Under IMF- and World Bank-supported structural and stabilization programs, The Gambia undertook major economic reforms, beginning in the mid-1980s under the auspices of the Economic Recovery Program (ERP) and the Program for Sustained Development (PSD). The intention behind the former program was to end economic deterioration and to lay the foundation for sustained economic growth. Key elements of the new policies were an exchange rate policy reform comprising a devaluation of the dalasi and the liberalization of foreign exchange markets. The PSD aimed at supporting growth and deregulation by improving the links between the financial and the real sectors of the economy.[7]

The Gambia's recent history of economic and social development may be subdivided into four major subperiods: the 1964-78 period, before economic deterioration became widespread in sub-Saharan Africa; the period 1979-86, which spanned both the decline in economic activity and the beginning of adjustment; the period 1987-94, which witnessed both the military coup and the CFA franc devaluation; and the period 1995-98, which followed the removal of the CFA franc overvaluation in neighboring countries.

A. 1964-78: The First 13 Years After Independence

Until 1978, the Gambian economy experienced relatively high real growth rates, averaging 7 percent during 1964-78. Also per capita real growth was at its highest level during this period (Table 1 and Figure 1). The primary sector—that is, agriculture, forestry and fishing—accounted for about 35 percent of nominal output during 1964-78. Total investment as a share of GDP averaged 32 percent, with private investment accounting, on average, for 19 percent and government investment for 13 percent of GDP during that period (Table 1 and Figure 2). Government revenue was about 21 percent of GDP during 1964-78, and total government expenditure about 25 percent. The overall budget deficit during 1964-78 averaged about 4½ percent of GDP (Table 1 and Figure 3).

B. 1979-86: Recession and Structural Adjustment

The second period under consideration saw a sharp decline in real economic activity. Both, the internal and external imbalances resulted mainly from substantial increases in import prices—notably petroleum products during the 1970s. A long drought in the Sahel

---

[6] See Hadjimichael and others (1992).
[7] See McPherson and Radelet (1995).

zone, low world market prices for groundnuts, declining donor aid, and inappropriate fiscal and monetary policies contributed to this development. The exchange rate, which at that time was pegged to the pound sterling, was thought to be overvalued, thus worsening economic conditions.[8] Finally, the attempted military coup in 1981, aimed at overthrowing the government of president Jawara—aborted only by the intervention of Senegalese troops—resulted in a drop of tourist arrivals by about 20 percent.[9] All these factors led to a decline in real growth and declining investment ratios, which recently show signs of slow recovery.

During 1979-86, average real GDP growth dropped to about 5¼ percent, and growth of per capita real income fell to about 1½ percent. The drop in per capita real income over that period was about 8 percent. Average inflation almost tripled in these eight years to 17 percent, with inflation reaching 56½ percent in 1986. The increase in the size of the public sector resulted in an expansion of average total spending during 1979-86 to 32½ percent of GDP, compared with the 25½ percent recorded during 1964-78. At the same time, total revenue and grants averaged 24 percent of GDP only, leading to an average overall budget deficit of about 8½ percent of GDP (Table 1 and Figure 3). It is not surprising, therefore, that the major aim of the adjustment efforts since 1985-86 has been a substantial reduction in public sector involvement in the economy and the development of a functioning private sector.[10]

Gross domestic investment as a percentage of GDP fell to 24 percent on average during 1979-86, reflecting the overall decline in economic activity. Most of the fall, however, occurred in the private sector. Private investment dropped from 15½ percent of GDP in 1979 to about 8 percent of GDP in 1986, while public sector capital expenditure declined by about 3¼ percentage points—from 10½ percent in 1979 to 7 percent in 1986.

The exchange rate reform, which was an essential part of the ERP, resulted in a nominal depreciation of the exchange rate by about 78 percent in 1986. As a result of this depreciation, real producer prices for groundnuts and other crops could be increased without negatively affecting cross-border trade. Despite the high inflation rate in 1986, the depreciation ensured that the relative price of nontraded goods did not rise. In fact, the relative price of nontraded goods declined by about 9½ percent in 1986.[11]

As mentioned earlier, the fiscal position worsened substantially during the late 1970s and mid-1980s. Revenue measures of the ERP included the introduction of a sales tax, the broadening of the tax base and the strengthening of the tax administration. To foster efficiency and improve the incentive structure within the economy, external trade taxes were reformed by eliminating all quantitative restrictions, rationalizing import duties, abolishing the import and the export taxes, introducing a sales tax, and replacing all but three specific duties with ad valorem duties. Measures on the spending side included increasing the

---

[8] See also McPherson and Radelet (1995).
[9] See McPherson and Radelet (1995), Chapter III, for a more detailed exposition of the events.
[10] See for example Hadjimichael and others (1992).
[11] The calculation of the underlying index is described in footnote 3 of Table 1.

efficiency of public services, improving the human capital base, and moderately increasing wages for civil servants.

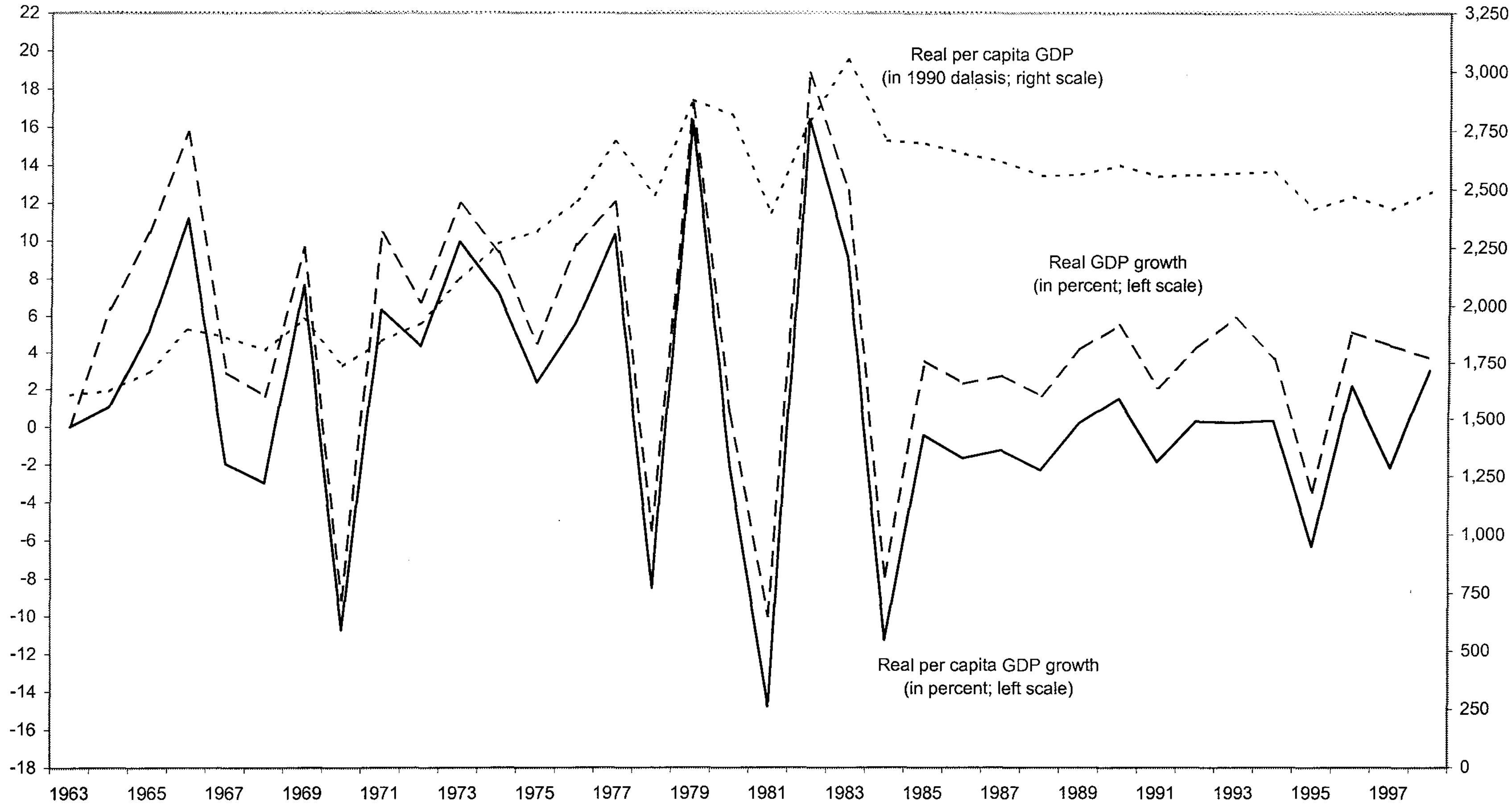
Table 1. Selected Economic Indicators, 1964-98
(Period averages; in units indicated)

	1964-78	1979-86	1987-94	1995-98
National income and prices				
Real GDP growth rate	6.90	5.33	3.88	2.62
Per capita real GDP				
Level	2,039.61	2,747.69	2,575.26	2,448.00
Growth 1/	3.15	1.46	-0.33	-0.78
GDP deflator (index, 1990=100)	13.35	32.39	100.46	137.09
Gross domestic investment/GDP (percentage)	32.35	23.93	19.00	19.15
Private investment/GDP (percentage)	19.31	13.30	13.09	9.62
Government investment/GDP (percentage)	13.04	10.63	5.92	9.53
Consumer price				
Level (index, 1990=100)	9.83	30.13	103.53	143.73
Inflation 1/	6.51	17.17	10.25	2.99
Government budget				
Total revenue and grants/GDP (percentage)	20.83	24.18	28.34	20.99
Total expenditure and net lending/GDP (percentage)	25.42	32.61	28.94	27.35
Capital expenditure/GDP (percentage)	13.04	10.63	5.92	9.65
Overall budget balance (percentage)	-4.59	-8.43	-0.60	-6.36
Monetary developments				
Broad money				
Level (in millions of 1990 dalasis)	33.44	159.11	593.83	1,096.09
Growth 1/	16.92	16.19	14.63	13.29
Velocity	4.44	4.01	4.17	3.65
Discount Rate 2/	6.00	10.88	16.44	13.63
U.K. bank rate (in percent end of period)	8.90	...	...	...
U.K. money market rate (in percent overnight) 3/	3.91	11.85	9.85	6.38
External sector (index, 1990=100, unless otherwise indicated)				
Real effective exchange rate	...	123.96	101.18	95.83
Nominal effective exchange rate	...	186.90	100.30	115.71
Relative price of nontraded goods /4	102.38	96.22	100.62	104.01
Consumer price (United Kingdom)				
Level	19.88	64.03	99.79	123.31
Inflation 1/	9.16	8.87	4.99	3.09
Terms of trade	91.98	148.53	107.37	122.25
U.K. exchange rate (pound sterling per U.S. dollar)	0.43	0.61	0.60	0.62

Sources: IMF, *International Financial Statistics*, and World Economic Outlook database; and staff calculations.

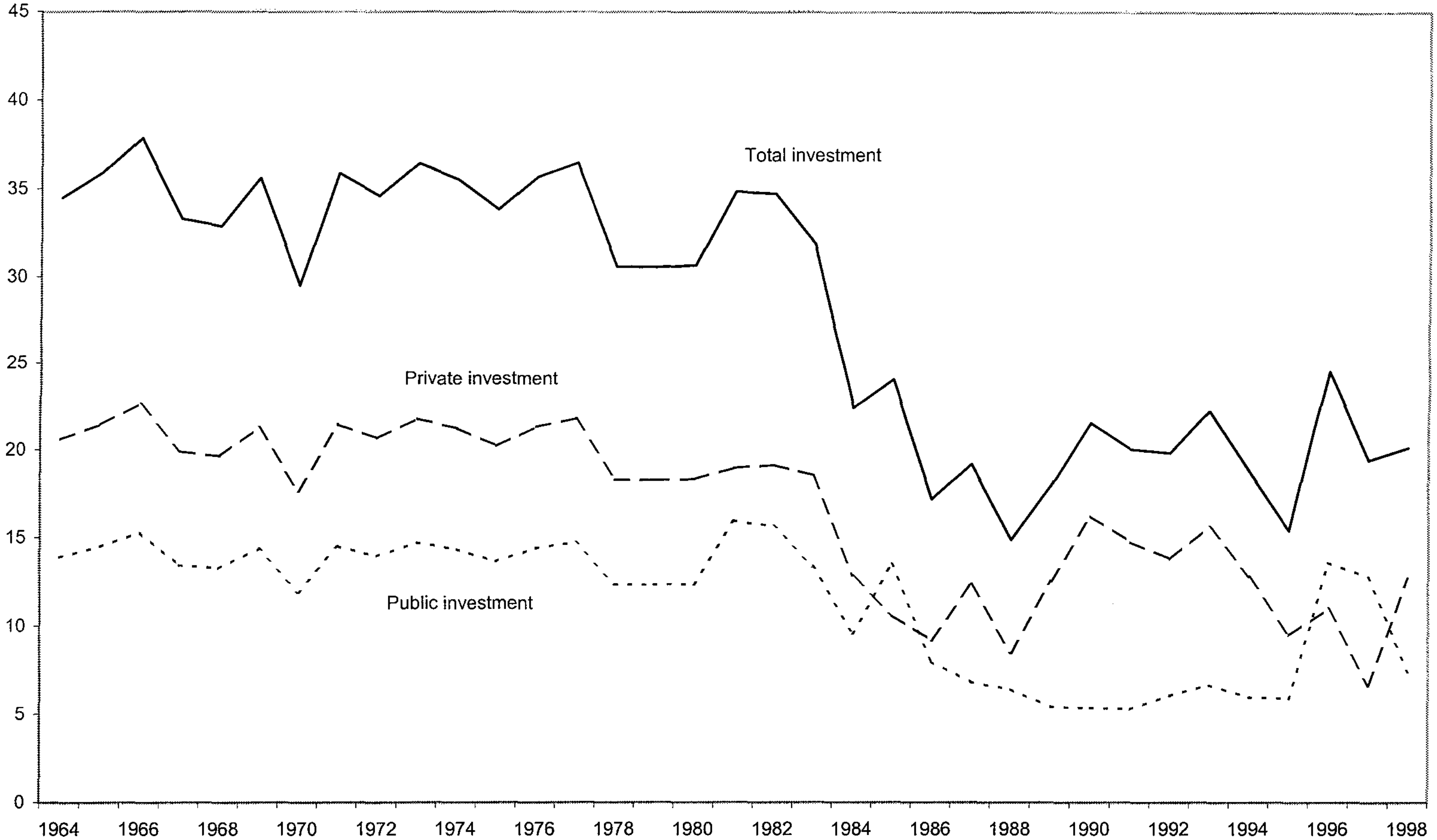
1/ Annual percentage change.
2/ The series begins in 1978.
3/ The first time interval begins in 1969.
4/ Following Edwards (1988), this index is constructed as $CPI/(EI*WPI^{US})$, where *CPI* is the domestic consumer price index, *EI* is an index of the nominal exchange rate (dalasis per U.S. dollar), and WPI^{US} is the U.S. wholesale price index.

Figure 1. The Gambia: Real GDP: Growth and Level, 1963-98



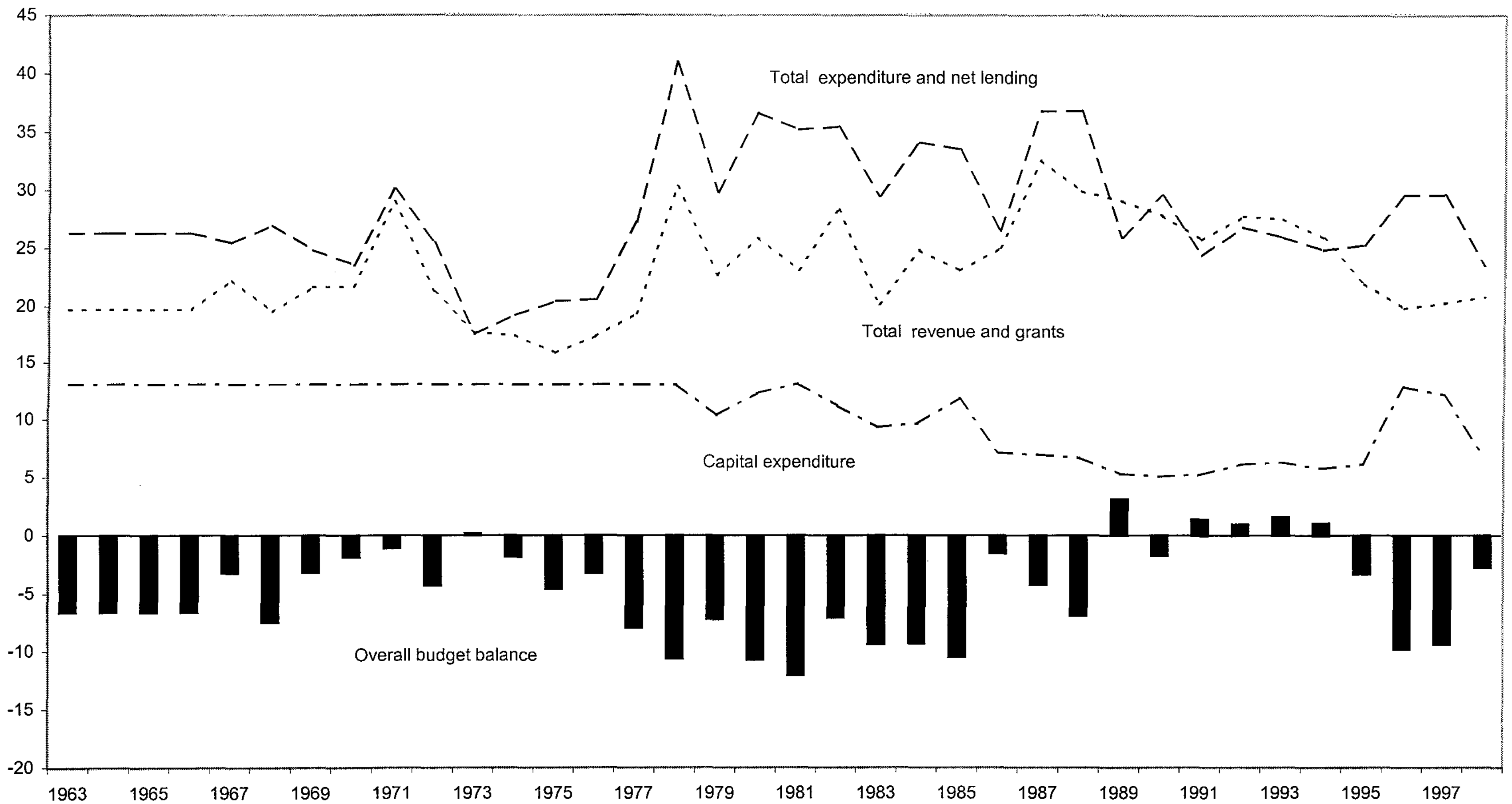
Source: IMF, World Economic Outlook database.

Figure 2. The Gambia: Real Investment, 1964-98
(In percent of real lagged GDP)



Sources: IMF, World Economic Outlook database; and staff estimates.

Figure 3. The Gambia: Fiscal Developments, 1963-98
(In percent of GDP)



Source: IMF, World Economic Outlook database.

On the social side, things improved substantially. While total primary school enrollment averaged 30 percent during 1964-78, it increased markedly in 1979-86 to 54¼ percent (Table 2).

Table 2. Selected Social Indicators, 1964-98
(Period averages; in units indicated)

	1964-78	1979-86	1987-94	1995-98
Education				
Primary school enrollment ratio (in percent)				
Total	29.83	54.33	67.25	...
Female	18.83	38.67	56.50	...
Male	40.67	69.67	77.50	...
Secondary school enrollment ratio (in percent)				
Total	9.33	13.00	18.50	...
Female	5.50	8.00	12.50	...
Male	13.67	18.67	24.25	...
Illiteracy rate				
Total 1/	94.0	79.80	72.80	68.0
Female 2/	...	89.50	84.00	74.7
Male 3/	...	69.60	61.00	61.1
Total stock of education 4/	0.51	1.08	1.75	2.41
Health				
Life expectancy at birth (in years)	38.37	43.61	51.13	...
Infant mortality rate (per thousand)	180.90	150.13	110.53	...
Mortality rate, female (per 1,000 female adults)	519.00	466.00	432.00	...
Mortality rate, male (per 1,000 male adults)	655.00	584.00	530.00	...
Physicians per thousand people	0.04	0.08	...	...

Sources: World Bank: *World Development Indicators (WDI)*; and Barro and Lee (1996).

1/ Percentage of total population of age 15+; the 1964-78 figure is actually the one reported for 1962.
2/ Percentage of female population of age 15+.
3/ Percentage of male population of age 15+.
4/ Data on total mean school years of education per working person, as published in Nehru, Swanson, and Dubey (1995) are not available for The Gambia. Thus, a crude measure of the total stock of education has been estimated using the Barro and Lee (1996) quinquennial data from 1975 to 1990 and WDI enrollment data for primary and secondary education.

The total stock of education, as measured by mean school years of total education, increased from an average 0.51 years in 1964-78 to an average 2.41 years in 1995-98. Although the primary school enrollment ratio increased for female students, the gap relative to their male counterparts widened from about 22 percentage points to about 31 percentage points.

The economic downturn of the late 1970s and early 1980s did not negatively affect health indicators. Relative to the period 1964-78, the 1979-86 period experienced an increase in life expectancy of about 5 years on average. The infant mortality rate dropped from an

average of 181 per thousand to 150 per thousand, an improvement that can be partly attributed to the doubling in physicians per thousand people (Table 2).

C. 1987-94: From Adjustment to the Military Coup

After the devaluation of the dalasi in 1986 and the strong efforts to consolidate the government budget, The Gambia experienced in 1987-94 positive real growth, declining inflation, and an improvement in the competitive position of the economy. The latter outcome can be primarily credited to the depreciation of the real effective exchange rate of about 18 percent on average over the period (Figure 4). The government reduced the overall budget deficit to an average of 0.6 percent of GDP during 1987-94, compared with the 8½ percent deficit recorded during 1979-86 (Figure 3). This positive fiscal development, however, was not accompanied by an increase in the government's capital expenditure, whose ratio to GDP declined to an average of 6 percent during 1987-94 from an average of 11 percent during 1979-86. As private investment remained more or less constant during that time, the total investment ratio declined by about 5 percentage points (Table 1).

D. 1995-98: After the Military Coup

A major consequence of the 1994 military coup was that The Gambia was in a difficult position to obtain aid from its donors. Average real growth during 1995-98 was about 2½ percent, and real per capita income actually declined on average by 0.8 percent during that time. However, this decline is not surprising given that the Gambian population increased by an average of 3½ percent during 1995-98. The average decline in real per capita GDP was primarily due to the sharp drop of 6¼ percent recorded in 1996. Similarly, the low overall real average growth rate of 2½ percent over the period also resulted from the large decline in growth of 3½ percent in 1996. As the Gambian economy moved more and more from an agricultural-oriented economy to a services-oriented economy—with tourism and trade as the major contributors—the military coup had particularly severe effects. Travel advisories issued by the U.K. and Scandinavian governments led to a drop in tourist arrivals of about two-thirds during the 1994-95 season.

On the investment side, no major improvement could be achieved during 1995-96. Although during that period public sector capital expenditure increased to 9½ percent of GDP, private investment declined to about 9½ percent—owing to loss of investors' confidence in the aftermath of the military coup. The military rulers significantly loosened fiscal policy during 1994-95 and inflation remained high, at about 7 percent, in those two years. The central bank's tight policy stance was basically responsible for reducing average inflation during 1995-98 to a low 3 percent (Table 1). Fiscal performance, however, was less successful. Despite reform efforts started by the government in early 1997 after the parliamentary elections, the average fiscal deficit was 6½ percent of GDP. In both 1996 and 1997, for example, the overall fiscal deficit reached to about 10 percent of GDP. A close look

at Table 1 and Figure 3 discloses that, while during 1987-94—the period of the ERP and PSD programs—revenues and expenditures as a share of GDP were broadly in line with each other, almost leading to a balanced budget, the 1995-98 period was characterized by major overspending, putting upward pressure on interest rates and crowding out investment.

III. Theoretical Background

As in Ghura (1997), this paper utilizes a Solow-Swan–type aggregate production function that is modified in the following way: the total capital stock is subdivided into three different types of capital—private and government physical capital, and human capital. Given this assumption, the aggregate production function can be written as

$$Y_t = A_t (K_t^p)^\alpha (K_t^g)^\beta (Z_t)^\gamma, \qquad Z_t = H_t L_t, \tag{1}$$

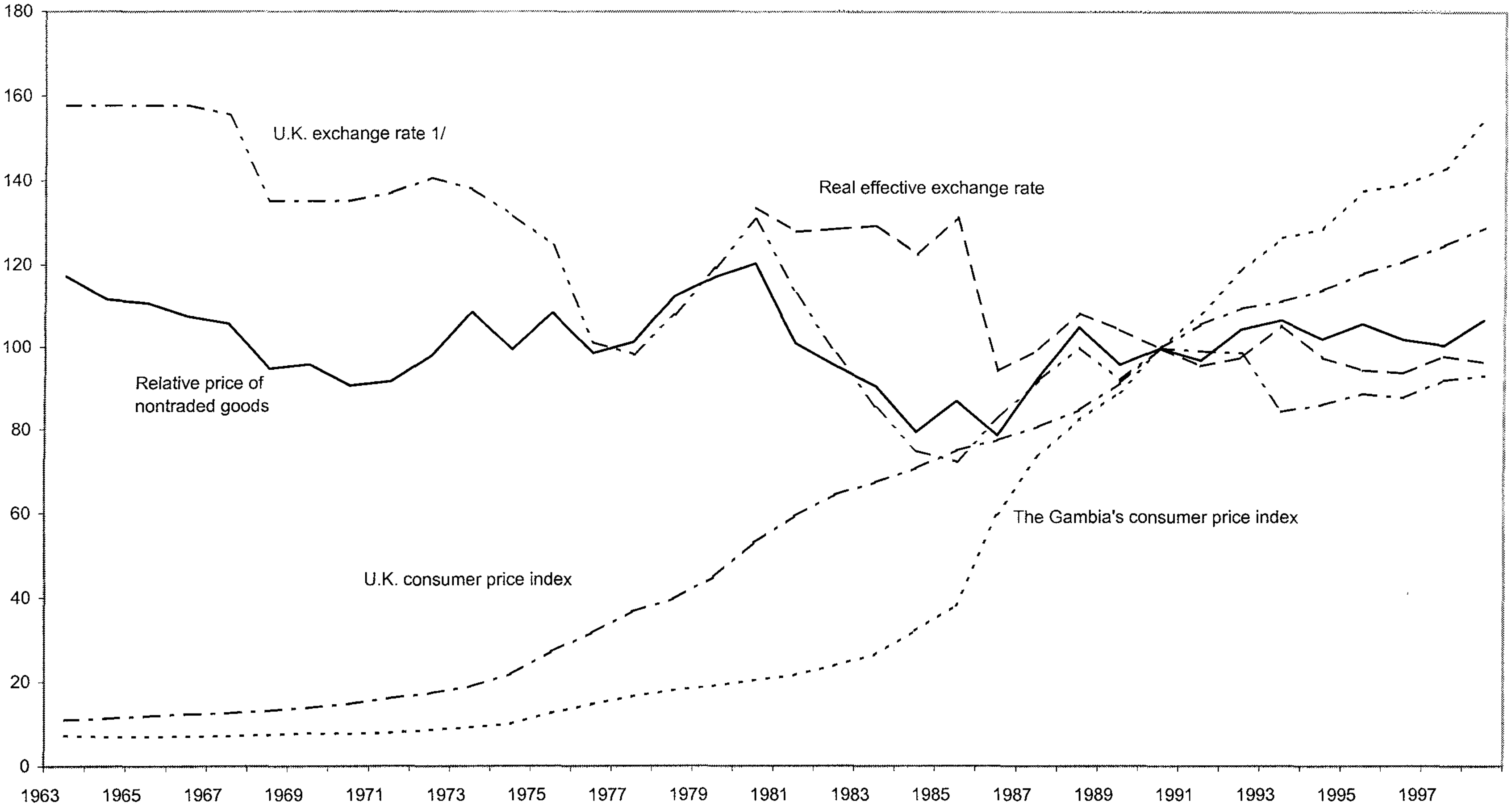
where Y_t denotes output in period t; A_t is a measure of technology in period t; K_t^p and K_t^g denote the private and the government physical capital stocks in period t, respectively; Z_t is labor L_t in period t, augmented by human capital developments H_t. The parameters α, β, and γ denote the elasticities of output with respect to the three types of capital stocks—private and government physical capital, and human capital. There are a couple of issues worth noting at this point. As mentioned earlier, a key element of the neoclassical growth theory is that technical change is exogenous and that the same technical opportunities are available across countries. This assumption implies that steady state growth solely depends on exogenous population growth and exogenous technical progress. Given the properties of capital, that is, that its marginal product decreases as a country accumulates it, the neoclassical model predicts that poor countries should gradually converge toward richer countries. The rejection of this hypothesis led to the so-called convergence controversy and prompted authors such as Romer (1986) and Lucas (1988) to drop the central assumptions of the neoclassical growth model, namely, that technical progress is exogenous and available in the same way to all countries.[12]

Rewriting equation (1) in terms of growth rates gives (with lower-case letters denoting growth rates) gives

$$y = a + \alpha k^p + \beta k^g + \gamma z \tag{2}$$

[12] See Romer (1994) and Hadjimichael and others (1995) and the literature cited therein for a discussion.

Figure 4. The Gambia: Indicators of External Competitiveness, 1963-98
(Indices, 1990=100)



Sources: IMF, *International Financial Statistics* , and World Economic Outlook database; and staff calculations.

1/ Index of U.S. dollars per pound sterling.

Data on the capital stock for The Gambia are not available as such, thus making it difficult to estimate a long-run growth equation, such as (2). Without data on the capital stock, one has to make simplifying assumptions to transform equation (2) into a form that can be estimated. The next section attempts to construct data on both the private and public capital stocks and compares the results to the ones obtained in this section, where investment data are used. Following Ghura (1997), consider the following equations representing the growth of both private and government capital stocks:

$$\frac{\Delta K_t^p}{K_{t-1}^p} = \frac{I_t^p}{K_{t-1}^p} - \delta^p, \tag{3}$$

$$\frac{\Delta K_t^g}{K_{t-1}^g} = \frac{I_t^g}{K_{t-1}^g} - \delta^g, \tag{4}$$

where I_t^p denotes real private investment, I_t^g represents real government investment, and δ^p and δ^g are the rates of depreciation for the private and government capital stocks, respectively. Assuming that both private and government capital stocks are a constant share of real GDP, that is,[13]

$$K^p = \mu^p Y, \tag{5}$$

$$K^g = \mu^g Y, \tag{6}$$

where μ^p and μ^g are the respective fixed coefficients on private and government capital, one can rewrite equation (2) to obtain:

$$y = a' + \alpha'\left[\frac{I_t^p}{Y_{t-1}}\right] + \beta'\left[\frac{I_t^g}{Y_{t-1}}\right] + \gamma z, \tag{7}$$

where $a' = (a - \alpha\delta^p - \beta\delta^g),\ \ \alpha' = \frac{\alpha}{\mu^p},\ \ \beta' = \frac{\beta}{\mu^g}.$

Since data on investment are available for The Gambia, equation (7) can be estimated. Output growth y is measured as real GDP; from 1981 onward, data on private and

---

[13] While this is not factually correct (see next section), it is used here as a simplifying approximation.

government investment are taken from the World Economic Outlook (WEO) database. From 1964 until 1980, only total investment is available on the WEO database. Thus, data on private and government investment are obtained by using the average share of these investments of the total during 1981-98 and applying these shares to the series on total investment during 1963-80. In order to obtain series on real government and private investment, the total investment deflator was used during 1981-98, since data on separate investment deflators for private and government investment, respectively, were not available. For the period covering 1964-80, no investment deflator was available at all. Thus, the GDP deflator was used as a proxy. The measurement of the human capital stock turned out to be the least straightforward task. The time series on human capital in Nehru, Swanson, and Dubey (1995) unfortunately do not contain any data on The Gambia. This paper thus approximates the total stock of education, as measured by mean school years of education per working person, by making use of the Barro and Lee (1996) data on average years of schooling in the working population aged 15 and above, and the enrollment data from the WDI database. Since the latest available figures on school enrolment end in 1994, the remaining years have been estimated by assuming a constant growth rate of 5 percent.[14]

IV. Estimation Method and Results: Investment

The equivalent of equation (7) above—which will be used for estimation purposes—can be written as

$$y = a' + \alpha' PIY_t + \beta' GIY_t + \gamma ALG_t + \varepsilon_t, \tag{8}$$

where y represents output growth, as defined above; the variable PIY_t denotes real private investment as a share of lagged real GDP; GIY_t is the ratio of real government investment to lagged real GDP; ALG_t denotes labor growth LG_t, augmented by the human capital stock proxy; and, finally, ε_t is an independently and identically distributed (i.i.d.) stochastic shock (in period t respectively). The paper proceeds by testing the data for the order of integration and by analyzing the effects of the two kinds of investment—private and government—and of human capital on real growth.

A. The Data

Before turning to the actual estimation of equation (8), some issues relating to the properties of the underlying data have to be clarified. Testing for stationarity of our time

[14] The 5 percent increase was chosen because it is the average increase in school enrollment during 1981-94.

series ensures that the variables used in the regressions are not subject to spurious correlation. The problem of spurious correlations can also emerge when variables are deflated by a stochastic series such as GDP.[15] Figure 1 indicates that output growth looks stationary with, however, a nonconstant variance. The tests will reveal whether heteroscedasticity is indeed a problem in the estimated equation. Regarding real investment, as defined above, Figure 2 shows a slightly different picture. All three investment series—private investment, public investment, and total investment—look non stationary but could be trend stationary. While labor growth appears to be increasing over time—that is, a non-I(0) series—the growth of human capital—augmented labor will be shown to be stationary. As is standard in the literature, the augmented Dickey-Fuller test (ADF) is used to test for unit roots in the data. The null hypothesis of this test is that there is a unit root, necessarily the alternative hypothesis rejects the existence of a unit root. Table 3 summarizes the results of the stationarity tests for all five variables—*y*, *GIY*, *PIY*, *LG*, and *ALG*. Note that the equation used to perform the ADF test contains a constant as well as a time trend.

Table 3. Investment: Testing for Unit Roots

Alternative: No Unit Root

ADF test: $\Delta y_t = \omega + \omega_1 t + \omega_2 y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + e_t$.

Variable	Lag Length	ADF Test Statistic (t-statistic on ω_2)
y	0	-7.4822**
PIY	0	-3.2436
GIY	0	-2.8525
LG	0	-0.9223
ALG	0	-5.8651**

Notes: The sample period is 1966-98. The critical value at the 5 percent significance level is –3.551; at the 1 percent significance level, the critical value is –4.26. Two stars denote significance at the 1 percent level, one star at the 5 percent level.

As the graphical analysis already suggested, output growth and labor growth—adjusted for human capital—are stationary while the other variables appear to be nonstationary. One way out of this dilemma would be to look for structural breaks and test for unit roots once the structural break—if just one—is accounted for. This is the route followed by Ghura (1997) for the case of Cameroon, using the Perron (1989) methodology. However, the data for The Gambia do not suggest a clear-cut structural break in any of the series but rather a simple trend. For that reason, private investment, public investment, and the labor growth variable have been detrended in the following way.[16] The relevant variable was regressed on a constant, a time trend, and its own (significant) lags. The residuals from these regressions were then used as the detrended series in the subsequent analysis.

[15] Also, see Madansky (1964).

[16] This coincides with the Perron (1989) methodology when there are no structural breaks.

Repeating the above exercise and testing for stationarity of the new series gives the results shown in (Table 4).

Table 4. Investment: Testing for Unit Roots for the Detrended Series

Alternative: No Unit Root

ADF Test: $\Delta y_t = \omega + \omega_2 y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + e_t$.

Variable	Lag Length	ADF Test Statistic (t-statistic on ω_2)
PIY	0	-5.5320**
GIY	0	-5.3082**
LG	0	-5.6805**

Notes: The sample period is 1966-98. The critical value at the 5 percent significance level is –2.953; at the 1 percent significance level, it is –3.642. Two stars denote significance at the 1 percent level, one star at the 5 percent level.

B. Estimation Results

Having established the order of integration of the data, we estimated equation (8) by using ordinary least squares (OLS). Table 5 summarizes the results for both cases—model 1, which uses raw labor growth (*LG*) as an explanatory variable and model 2, which uses labor growth augmented by human capital (*ALG*). To avoid misspecification of the estimated equation, two dummy variables have been included to account for large outliers in output growth in 1979 and 1981 (Figure 1). In 1979 real output increased substantially, largely on account of an increase in tourist arrivals (over 60 percent) and groundnut production (about 63 percent). In 1981 on the other hand the contribution of groundnut production to total value added was less than half of the 1979 level.[17] At the same time, tourist arrivals dropped by about 20 percent because of problems with water and electricity supply. The attempted military coup was also a major factor in the reduction of tourist arrivals (also see section II B).

As in Ghura (1997), the coefficient on the growth rate of the labor force is far too high. However, in contrast to his findings for Cameroon, raw labor growth is significant only at the 10 percent level in the case of The Gambia. Not surprisingly, when adjusting raw labor growth for human capital developments, the estimated coefficient becomes much lower and—in contrast to the Cameroon case—almost significant at the 5 percent level (the exact probability is 6.4 percent). The coefficient on private investment does not decrease substantially in model 2 and the estimate on government investment increases only marginally. Both R^2 and the adjusted R^2 increase slightly when moving to model 2.

[17] Senegal experienced the same movements in output, although to a lesser extent, which seems to indicate that weather patterns contributed to this outcome.

Table 5. Estimating Equation (8)

Variable	Model 1: Raw Labor Growth	Model 2: Augmented Labor Growth
Constant	0.054	0.018
	(6.519)	(0.945)
PIY	1.533	1.358
	(4.157)	(3.801)
GIY	0.908	0.997
	(2.224)	(2.506)
LG	9.056	...
	(1.725)	
ALG	...	0.333
		(1.925)
R^2 and Adjusted R^2	0.62 and 0.55	0.63 and 0.57
DW	1.56	2.00
Regression standard error	0.0463	0.0457
F-statistic	$F(5, 28)$=9.25	$F(5, 28)$=9.60
Wald	$F(2, 28)$=14.11	$F(2, 28)$=13.34
AR 1-4	$F(4, 24)$=0.95	$F(4, 24)$=0.59
ARCH 4	$F(4, 20)$=2.30	$F(4, 20)$=0.84
Normality	$\chi^2(2)$=0.74	$\chi^2(2)$=1.28
X_i^2	$F(8, 19)$=0.27	$F(8, 19)$=0.53
X_i*X_j	$F(11, 16)$=0.27	$F(11, 16)$=0.64
Reset	$F(1, 27)$=0.42	$F(1, 27)$=0.62

Notes: The sample period is 1965-98. R^2 adjusted is the usual R^2, adjusted for the degrees of freedom; DW is the Durbin-Watson test for residual serial correlation. The F-test tests the null hypothesis that all coefficients except for the intercept are zero. "Wald" is the Wald test for a subset of linear restrictions testing that both dummy variables are jointly zero. The numbers in parentheses below the parameter estimates are the corresponding t-values. The reported misspecification tests are conducted to test a number of null hypotheses on the residuals of the regression, including autocorrelation, autoregressive conditional heteroscedasticity (ARCH), residual distribution normality, heteroscedasticity, and, finally, functional form misspecification. Most diagnostic tests are performed through an auxiliary regression. The regressions here are single-equation models and thus the tests are single-equation tests; the test statistic takes the form TR^2 for the auxiliary regression. These are asymptotically distributed as $\chi^2(s)$ under their null hypotheses and can be approximated with an F-test with the appropriate degrees of freedom (see Doornik and Hendry, 1995). The residual autoregression test (AR) is an LM test that is transformed into a simpler F-test. The idea is to regress the residuals on all the regressors of the original model and the lagged residuals. The ARCH test works the same way, i.e., through an auxiliary regression. The normality test is a $\chi^2(s)$ test and checks whether residual skewness and kurtosis correspond to the skewness and kurtosis of a normal distribution. The heteroscedasticity test (X_i^2) is in principle a White test and again involves the use of an auxiliary regression. As before, only the F approximation is reported here. The (Ramsey) "Reset" test (Regression specification test) tests the specification of the model against the alternative of higher powers of the fitted values of the model.

The results presented here are fully comparable to those obtained by Ghura (1997) for the case of Cameroon. While the results here suggest that a 1 percentage point increase in private investment raises output growth by about 1.36 percentage points—compared with the 1.4 percentage points found for Cameroon—an increase in public investment by 1 percentage point results in a 1 percentage point increase in output growth; the relevant coefficient found for Cameroon is slightly lower, 0.75 percentage point.

To complete the analysis within this section, one has to look at ways to track down the original coefficients α and β from equation (2). Recall that these parameters could not be estimated directly, given that investment data were used to estimate the growth equation. This exercise is particularly interesting as one can make inferences about the likely pattern of the production function, that is, whether it exhibits increasing returns to scale—supporting the endogenous growth model—or constant returns to scale. It will also be interesting to compare the results of this exercise with the results obtained when constructing the capital stock in the following section. From equations (5), (6), and (7), it is immediately established that $\alpha=\alpha'\mu^p$ and $\beta=\beta'\mu^g$.

The problem, however, is that we do not know the correct capital-output ratios. Before this argument is taken further, it is worth noting that in order to have a production function that exhibits constant returns to scale, that is $\alpha+\beta+\gamma=1$, $\alpha+\beta$ has to be smaller than unity in this example (as the coefficient of *ALG* is estimated at 0.33). While Nehru and Dhareshwar (1993) provide some estimates of the total capital-output ratios for various African countries, including Cameroon, such an estimate is not available for The Gambia.

Following Mankiw, Romer, and Weil (1992), who point out that the total capital output ratio in low-saving countries is close to 1, and assuming as Ghura (1997) that this capital output ratio is equally split between the private and the government capital stocks, the contribution of private and government capital would be about 0.68 and 0.50 respectively. The resulting contribution of the total capital stock would thus be about 1.18. As a result, $\alpha+\beta+\gamma=1.51$. The corresponding value for Cameroon was shown to be 1.47.[18]

The results presented in this section of the paper clearly suggest that The Gambia's aggregate production function exhibits increasing returns to scale, thus supporting the assumptions of endogenous growth models.[19] As mentioned earlier, there seem to be positive externalities associated with both human and physical capital accumulation.[20]

---

[18] See Ghura (1997, p. 22).

[19] See, for example Romer (1986), and Lucas (1988).

[20] The inclusion of other potentially relevant variables (one at a time) such as the deficit ratio as an indicator of fiscal policy, the real exchange rate as a measure of competitiveness and the terms of trade or export volume, did not prove to be fruitful. The coefficients on these variables were not statistically significant at commonly used significance levels. They did, however, have the expected sign; i.e. losses in competitiveness appear to have a negative impact on growth. The same is true for the deficit ratio, which has a negative impact on growth performance.

V. The Capital Stock: Estimation Method and Results

In order to estimate equation (2) directly, one has to construct a series for the capital stock.[21] In this paper, the capital stock series is constructed using the perpetual inventory method by assuming an initial capital-output ratio of unity, a depreciation rate of 15 percent,[22] and using the time series on total investment.[23]

$$K_t = K_{t-1}(1-\delta) + I_t, \tag{9}$$

where K_t is the total capital stock in period t, δ is the rate of depreciation, and I_t is total investment in period t.

To construct a series on the public capital stock, it was assumed that the share of government capital in the total capital stock was equal to the average government investment ratio over the sample. From there on, the series is obtained the same way as the total capital stock. Finally, the private capital stock is obtained residually. Thus

$$\begin{aligned} K_t^g &= K_{t-1}^g(1-\delta^g) + I_t^g \\ K_t^p &= K_t - K_t^g \end{aligned}, \tag{10}$$

A. The Data

As before, we need to establish the properties of the data first. Table 6 summarizes the results of the stationarity tests for both private capital accumulation and government capital accumulation—*KP* and *KG*. Note that the equation used to perform the ADF test contains a constant as well as a time trend.

The ADF test indicates that both the growth rate of the private capital stock and the growth rate of the public capital stock are nonstationary. Since our data on the respective

---

[21] See for example Sacerdoti, Brunschwieg, and Tang (1998).
[22] We chose a 15 percent depreciation rate because lower rates of depreciation would apply only to long-term capital goods, such as factory buildings. Furthermore, this rate gave the most plausible capital-output ratios—about 1—which matches the ratios observed in other developing countries.
[23] The real capital stock was constructed by using data on real investment (see previous section) and data on real GDP.

capital stocks follows a similar pattern as the underlying investment data, the series were detrended. The resulting series were then tested for stationarity by using the ADF test as before. The results are summarized in Table 7; both detrended series on private and public capital accumulation appear to be stationary.

Table 6. The Capital Stock: Testing for Unit Roots

Alternative: No Unit Root ADF Test: $\Delta y_t = \omega + \omega_1 t + \omega_2 y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + e_t$.		
Variable	Lag Length	ADF Test Statistic (t-statistic on ω_2)
KP	0	-3.2017
KG	0	-2.8299

Notes: The sample period is 1966-98. The critical value at the 5 percent significance level is –3.551; at the 1 percent significance level, it is –4.26; two stars denote significance at the 1 percent level, one star at the 5 percent level.

Table 7. The Capital Stock: Testing for Unit Roots for the Detrended Series

Alternative: No Unit Root ADF Test: $\Delta y_t = \omega + \omega_2 y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + e_t$.		
Variable	Lag Length	ADF Test Statistic (t-statistic on ω_2)
KP	0	-5.6872**
KG	0	-5.9657**

Notes: The sample period is 1966-98. The critical value at the 5 percent significance level is –3.573; at the 1 percent significance level, it is –4.308; two stars denote significance at the 1 percent level, one star at the 5 percent level.

B. Estimation Results

Recall equation (2) from section III. The evolution of the growth rate of output was shown to be:

$$y = a + \alpha k^p + \beta k^g + \gamma z \tag{11}$$

The equivalent of equation (11) above—which will be used for estimation purposes—can be written as

$$y = a + \alpha KP_t + \beta KG_t + \gamma ALG_t + \varepsilon_t, \qquad (12)$$

where y represents output growth as defined above; the variable KP_t denotes real private capital growth KG_t is real public capital growth; ALG_t denotes labor growth LG_t, augmented by the human capital stock; and, finally, ε_t is the i.i.d. stochastic shock (all in period t).

The results of estimating equation (12) are summarized in Table 8 below. As before, model 3 uses raw labor growth, while model 4 captures the impact of human capital accumulation by augmenting the raw growth rate of the labor force with a measure of human capital. In order to avoid misspecification of the estimated equation, the two dummy variables for 1979 and 1981—as in models 1 and 2—have been included. This was necessary in order to capture large outliers in output growth. The results of estimating model 3 indicate that the contribution of raw labor growth to total output growth is far too large and not significant at commonly used significance levels.

As a result, the distribution of the contribution of private capital accumulation relative to public capital accumulation seems to be disturbed. While the coefficient of 1.1 on private capital accumulation is certainly on the high side, the coefficient of 0.52 on public capital accumulation seems to be fairly low. Note that this coefficient is not significant either. When moving to model 4, that is substituting the variable on human capital—augmented labor growth for the variable on raw labor growth, the coefficient on private capital accumulation decreases while the coefficient on public capital accumulation increases. The results show that an increase in private capital accumulation of 1 percent raises growth by 0.85 percent. The contribution of public capital accumulation to economic growth is about 0.64 percentage point. What is more important is the coefficient on augmented labor growth. It almost matches the coefficient found by Ghura (1997) in his investment specification in the case of Cameroon—0.386, compared with the 0.374 found here. However, our coefficient, when either using investment data or the constructed capital stocks, is significant at least at the 10 percent level.

The final step within this section will be to compare our investment model and the capital model provided here. Recall from the above discussion that we were assuming a constant capital-output ratio of unity—equally distributed between private capital and public capital. The resulting value for the contribution of the total capital stock was shown to be about 1.18. As a result, we found $\alpha+\beta+\gamma=1.51$. Since we now have estimates on both types of capital stocks, we can calculate the average capital-output ratios for private capital and public capital respectively. Using our series on the respective real capital stocks and real output, the average private capital—output ratio, μ^p, is 0.65, while the average public capital—output ratio, μ^g, is 0.43. Combining these ratios with our estimates in model 2 results in $\alpha+\beta=1.31$ and, hence, $\alpha+\beta+\gamma=1.64$. However, when using the direct estimates of model 4, the contribution of the total capital stock is $\alpha+\beta=1.48$ and, thus,

Table 8. Estimating Equation (12)

Variable	Model 3: Raw Labor Growth	Model 4: Augmented Labor Growth
Constant	0.052	0.013
	(5.345)	(0.544)
KP	1.097	0.847
	(2.881)	(2.309)
KG	0.519	0.636
	(1.286)	(1.611)
LG	11.152	...
	(1.735)	
ALG	...	0.374
		(1.819)
R^2 and Adjusted R^2	0.47 and 0.38	0.48 and 0.39
DW	1.99	2.06
Regression Standard Error	0.0546	0.0544
F-Statistic	$F(5, 28)$=5.04	$F(5, 28)$=5.14
Wald	$F(2, 28)$=9.95	$F(2, 28)$=9.08
AR 1-4	$F(4, 24)$=0.59	$F(4, 24)$=0.70
ARCH 4	$F(4, 20)$=0.68	$F(4, 20)$=0.38
Normality	$\chi^2(2)$=6.68	$\chi^2(2)$=5.99
X_i^2	$F(8, 19)$=0.21	$F(8, 19)$=0.25
X_i*X_j	$F(11, 16)$=0.21	$F(11, 16)$=0.25
Reset	$F(1, 27)$=3.31	$F(1, 27)$=1.55

Notes: As before, the sample period is 1965-98. R^2 adjusted is the usual R^2, adjusted for the degrees of freedom; DW is the Durbin-Watson test for residual serial correlation. The F-test tests the null hypothesis that all coefficients except for the intercept are zero. "Wald" is the Wald test for a subset of linear restrictions testing that both dummy variables are jointly zero. The numbers in parentheses below the parameter estimates are the corresponding t-values. The reported misspecification tests are conducted to test a number of null hypotheses on the residuals of the regression, including autocorrelation, autoregressive conditional heteroscedasticity (ARCH), residual distribution normality, heteroscedasticity, and, finally, functional form misspecification. Most diagnostic tests are performed through an auxiliary regression. The regressions here are single-equation models and thus the tests are single-equation tests; the test statistic takes the form TR^2 for the auxiliary regression. These are asymptotically distributed as $\chi^2(s)$ under their null hypotheses and can be approximated with an F-test with the appropriate degrees of freedom (see Doornik and Hendry, 1995). The residual autoregression test (AR) is an LM test that is transformed into a simpler F-test. The idea is to regress the residuals on all the regressors of the original model and the lagged residuals. The ARCH test works the same way, i.e., through an auxiliary regression. The normality test is a $\chi^2(s)$ test and checks whether residual skewness and kurtosis correspond to the skewness and kurtosis of a normal distribution. The heteroscedasticity test (X_i^2) is in principle a White test and again involves the use of an auxiliary regression. As before, only the F approximation is reported here. The (Ramsey) "Reset" test (Regression specification test) tests the specification of the model against the alternative of higher powers of the fitted values of the model.

$\alpha+\beta+\gamma=1.85$. However, the appropriate F tests in the respective regressions indicate that the coefficients are not significantly different from each other.[24]

C. The Growth of Total Factor Productivity

The capital stock estimates allow us to calculate total factor productivity (TFP). From an empirical viewpoint, the growth rate of TFP is given by the estimated constant—the deterministic component of TFP—plus the error term—the stochastic component of TFP that result from estimating the growth equation (12) above. Thus, TFP growth is given by the following equation.

$$TFPGR_t = y - \alpha KP_t - \beta KG_t - \gamma ALG_t = a + \varepsilon_t, \qquad (13)$$

where $TFPGR_t$ is total factor productivity growth in period t, consisting of the deterministic component a—the constant—and the stochastic component ε_t—the residual in period t.

Figure 5 plots the result from this exercise. It appears that *TFPGR* is a stationary series. In fact, the Augmented Dickey-Fuller test, including one lag, returns a value of –5.182 for total factor productivity growth. The critical value at the 1 percent level is –4.271. Thus, the series constructed for total factor productivity is I(0) with a mean of about 1.3 percent. This result implies that total factor productivity is an I(1) series, increasing over time. The economic implication of this result is that The Gambia could improve its use of resources, as it became more productive and efficient over time. The mean of the growth rate of total factor productivity of 1.3 percent implies that about one fourth of total growth during the past 35 years (the mean is about 5 percent) is accounted for by an improvement in The Gambia's resource management.[25]

VI. Conclusion and Policy Implications

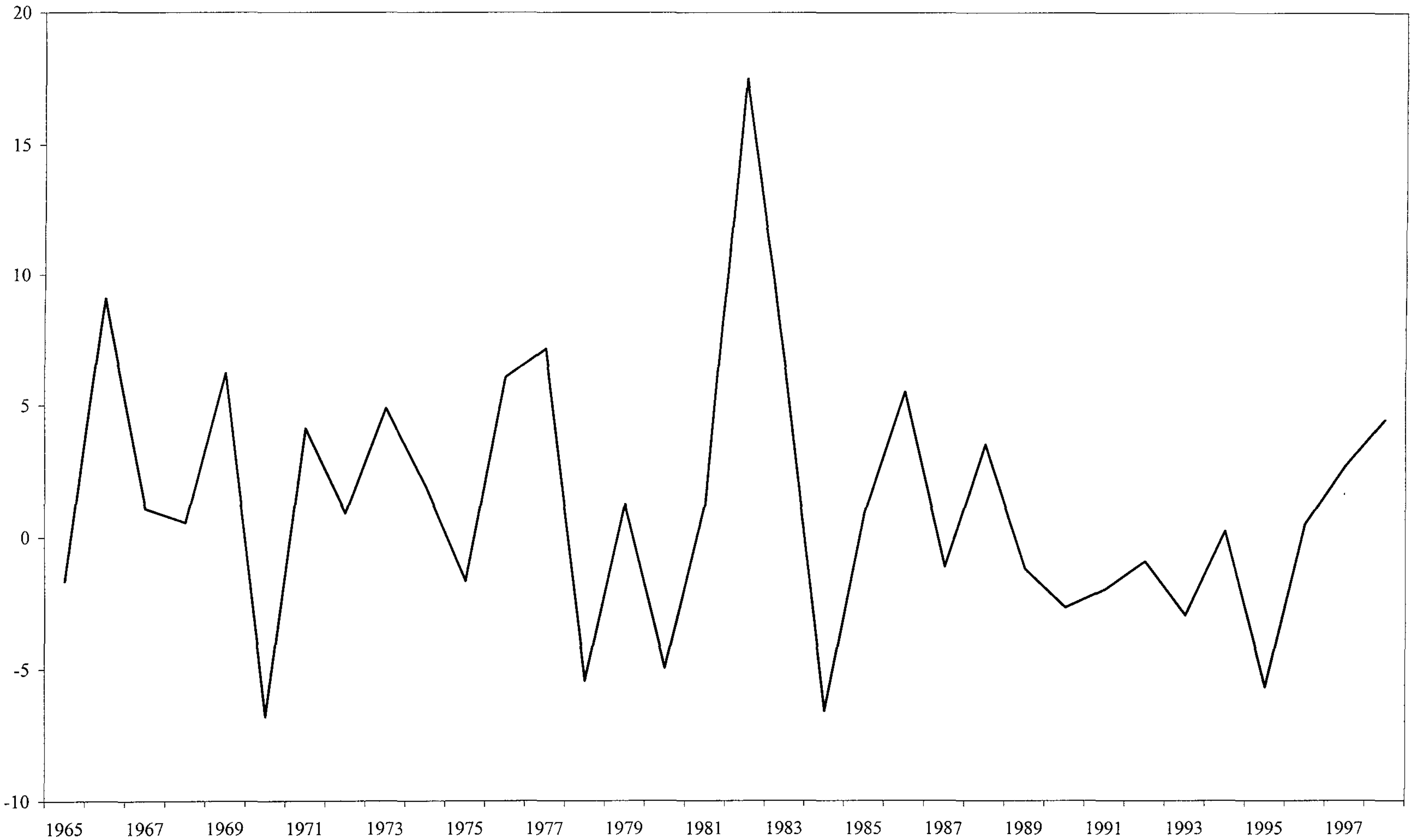
The regressions performed in this paper suggest that the aggregate production function in The Gambia exhibits increasing returns to scale, thus supporting the endogenous growth–type model. Both private and public investment are important determinants of

---

[24] The inclusion of other potentially relevant variables did not lead to a significant result (see footnote 20 on page 20).

[25] One might argue that this is on the high side, because of measurement problems with the capital stock. It is also worth noting that the constant term in model 4 is not significant at commonly used significance levels.

Figure 5. The Gambia: Total Factor Productivity Growth, 1965-98
(In percent)



Source: Staff estimates.

economic growth. Labor growth, augmented by the human capital proxy, turns out to be a significant explanatory variable in the estimated growth equations.

The paper also constructed time series on both the private and the public capital stock. The estimates from these regressions provided even more support for the endogenous growth–type model. Private capital accumulation and human capital accumulation turned out to be key determinants of economic growth in The Gambia. As a result, the authorities might consider the implementation of policies that particularly enhance these types of capital accumulation. Finally, the paper constructed a time series on total factor productivity growth. The results indicated that The Gambia experienced an increase in total factor productivity over the past 35 years, i.e. an improvement in the efficiency. Over that time period, total factor productivity growth accounted for about one fourth of total growth.

Given these results, the key to increasing the low growth rates of the past years (see Table 1) appears to be the enhancement of private investment and thus private capital accumulation. While the groundnut production and agricultural production in general are still important contributors to the Gambian economy—they are in particular important to the poorer rural population—the movement toward higher diversification both within the agricultural sector and within the economy as a whole would help the Gambian economy to grow faster and open up oportunities for new investments. The fact that the authorities are about to implement a new investment incentive system is certainly a move in the right direction. Plans to divest the publicly owned companies, in particular the utilities companies, are also very useful because doing so will result in a more cost efficient production of energy. This would allow for energy prices coming down and thus boost the tourism sector, since hotels are heavy energy consumers.

The human capital component was shown to be an important determinant of The Gambia's growth performance as well, thus, a focus on policies that aim at increasing the level and the quality of education for the Gambian population seems to be highly desirable.

Appendix

Source and Definition of Data

Variable	Definition	Source[26]	Data Range
ALG	Growth of the labor force, augmented with the total human capital stock, *HCS*.	Growth rate of *HCS*	1961-98
GCF	Gross capital formation.	WEO	1963-98
GCFR	Real gross capital formation in constant 1990 prices.	Derived from *GCF*, *INVDEF* and *GDPDEF*	1963-98
GDP	Nominal Gross Domestic Product.	WEO, AFR	1963-98
GDPDEF	GDP deflator.	WEO	1963-98
GDPR	GDP in constant 1990 prices.	WEO	1963-98
GIS	Government investment share.	WEO, AFR, the earlier years (1963-1979) have been estimated by using the average share of government investment during 1981 and 1998	1981-98
GIY	Real government investment as a share of real GDP.	Derived from *GPCFR* and *GDPR*	1964-98
GPCF	Gross public capital formation.	WEO	1963-98
GPCFR	Real gross public capital formation in constant 1990 prices.	Derived from *GPCF*, *INVDEF* and *GDPDEF*	1963-98
GPRCF	Gross private capital formation.	WEO	1963-98

[26] AFR = African Department database, International Monetary Fund; BL = Barro and Lee (1996) data set on years of education; IFS = International Financial Statistics database, International Monetary Fund; WEO = World Economic Outlook database, International Monetary Fund; WDI = World Development Indicators database, World Bank.

Variable	Definition	Source[26]	Data Range
GPRCFR	Real gross private capital formation in constant 1990 prices.	Derived from *GPRCF*, *INVDEF* and *GDPDEF*	1963-98
HCS	Total human capital stock. Product of the total labor force and MSY.	Derived from *MSY* and *L*	1960-98
INVDEF	Investment deflator.	WEO, the earlier years (1963-1979) have been derived from *GDPDEF*	1981-98
K	Total real capital stock in 1990 prices. The stock is calculated by assuming an initial capital output ratio of 1, a depreciation rate of 15 percent and using the perpetual inventory method to build the stock.	Derived from *GDPR* and *GCF*	1963-98
KG	Government real capital accumulation.	Growth rate of K^g	1964-98
K^g	Government real capital stock. The average investment share was used to find the initial value. The stock was then built the same way as K.	Derived from *GPCFR* and *GIS*	1963-98
KP	Private real capital accumulation.	Growth rate of K^p	1964-98
K^p	Private real capital stock.	Difference between *K* and K^g	1963-98
L	Labor force.	WDI	1960-98
LG	Growth of the labor force.	Derived from *L*	1961-98
MSY	Mean school years of education. The missing values have been estimated by using the change in enrolment data.	BL and derived from *PSER* and *SSER*	1975-90 for BL, 1963-98 after extrapolation
PIY	Real private investment as a share of lagged real GDP.	Derived from *GPRCFR* and *GDPR*	1964-98

Variable	Definition	Source[26]	Data Range
PSER	Primary school enrolment.	WDI	Irregularly between 1960 and 1995
SSER	Secondary school enrolment.	WDI	Irregularly between 1960 and 1995
TIY	Total real investment as a share of lagged real GDP.	Derived from *GCFR* and *GDPR*	1964-98
y	Growth rate of real GDP.	Derived from *GDPR*	1964-98

Bibliography

Barro, Robert J., 1997, *Determinants of Economic Growth: A Cross-Country Empirical Study* (Cambridge Massachusetts: MIT Press)

_____, and Jong W. Lee, 1996, "International Measures of Schooling Years and Schooling Quality," *American Economic Review (Papers and Proceedings)*, Vol. 86 (May), pp. 218-24.

Calamitsis, Evangelos A., Anupam Basu, and Dhaneshwar Ghura, 1999, "Adjustment and Growth in Sub-Saharan Africa," IMF Working Paper 99/51 (Washington: International Monetary Fund).

Doornik, J. A., and D. F Hendry, 1995, *PcGive 8.0: An Interactive Econometric Modelling System* (London and New York: Chapman and Hall).

Edwards, Sebastian, 1988, "Real and Monetary Determinants of Real Exchange Rate Behavior: Theory and Evidence from Developing Countries" *Journal of Development Economics*, Vol. 29 (November), pp. 311-41.

Granger, C.W.J., 1969, Investigating Causal Relations by Econometric Models and Cross-Spectral Methods," *Econometrica*, Vol. 37 (July), pp. 424-38.

Ghura, Dhaneshwar, 1997, "Private Investment and Endogenous Growth: Evidence from Cameroon," IMF Working Paper 97/165 (Washington: International Monetary Fund).

Hadjimichael, Michael T., and others, 1992, *The Gambia: Economic Adjustment in a Small Open Economy*, IMF Occasional Paper No. 100, (Washington International Monetary Fund).

Hadjimichael, Michael T., and others, 1995, *Sub-Saharan Africa: Growth, Savings, and Investment, 1986-93*, IMF Occasional Paper No. 118 (Washington International Monetary Fund).

Hernández-Catá, Ernesto, and others, 1998, *The West African Economic and Monetary Union: Recent Developments and Policy Issues*, IMF Occasional Paper No. 170 (Washington International Monetary Fund).

Lucas, Robert E., Jr., 1988, "On the Mechanics of Economic Development," *Journal of Monetary Economics*, Vol. 22 (July), pp. 3-42.

Mankiw, N. Gregory, David Romer, and David N. Weil, 1992, "A Contribution to the Empirics of Economic Growth," *Quarterly Journal of Economics*, Vol. 107 (May), pp. 407-37.

Madansky, Albert, 1964, "Spurious Correlation Due to Deflating Variables". *Econometrica*, Vol. 32 (October), pp. 652-55.

McPherson, Malcolm and Steven C. Radelet, eds., 1995, *Economic Recovery in The Gambia: Insights for Adjustment in Sub-Saharan Africa*, Harvard Studies in International Development (Cambridge Massachusetts: Harvard University Press).

Nehru, Vikram and Ashok Dhareshwar, 1993, "A New Database on Physical Capital Stock: Sources, Methodology, and Results," *Revista de Analisis Economico*, Vol. 8 (June), pp. 37-59.

_____, Eric Swanson, and Ashutosh Dubey, 1995, "A New Database on Human Capital Stock in Developing and Industrial Countries: Sources, Methodology, and Results," *Journal of Development Economics*, Vol. 46 (April), pp. 379-401.

Perron, Pierre, 1989, "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis," *Econometrica*, Vol. 57 (November), pp. 1361-401.

Rebelo, Sergio, 1991, "Long-Run Policy Analysis and Long-Run Growth," *Journal of Political Economy*, Vol. 99 (June), pp. 500-21.

Romer, Paul M. 1986, "Increasing Returns and Long-Run Growth," *Journal of Political Economy*, Vol. 94 (October), pp. 1002-37

_____, 1987, "Growth Based on Increasing Returns Due to Specialization," *American Economic Review (Papers and Proceedings)*, Vol. 77 (May), pp. 56-62.

_____, 1990, "Human Capital and Growth: Theory and Evidence," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 32 (Spring), pp. 251-86.

_____, 1994, "The Origins of Endogenous Growth," *Journal of Economic Perspectives*, Vol. 8, (Winter), pp. 3-22.

Sacerdoti, Emilio, Sonia Brunschwig, and Jon Tang, 1998, "The Impact of Human Capital on Growth: Evidence from West Africa," IMF Working Paper 98/162 (Washington: International Monetary Fund).

Tallman, Ellis W., and Ping Wang, 1994, "Human Capital and Endogenous Growth: Evidence from Taiwan," *Journal of Monetary Economics*, Vol. 34 (August), pp. 101-24.