

**DO MATERNAL AND CHILD HEALTH  
PROMOTE ECONOMIC DEVELOPMENT?  
A CASE STUDY OF SIX SUB-SAHARAN AFRICAN COUNTRIES**

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## ABSTRACT

Economic development leads to improved health for both women and children through advances in the field of medicine, reduction in mortality rates, and increase in life expectancy. Similarly, optimum maternal and child health are instrumental in human capital formation and productivity, with the potential for economic development. However, the majority of previously published research has focused on the impact of economic development on maternal and child health and rarely examines the reverse relationship (that is, the impact of child and maternal health on economic development), especially in sub-Saharan Africa (SSA). Therefore, the objective of this study was to determine the magnitude of the impact of maternal and child health on economic development (Gross Domestic Product (GDP) per capita), and vice versa, using a 10-year horizon and variance decompositions, for six countries in SSA. These countries, Burkina Faso, Togo, Ghana, Ivory Coast, Botswana and South Africa were grouped according to income brackets. Analyses were all based on Vector Auto Regression models and conducted on annual time-series data from the World Development Indicator data set, 1960-2012. The proxies for child health and maternal health were infant mortality rate and life expectancy at birth for females (in years), respectively. The magnitude of the contribution of child health to GDP per capita was generally higher than vice versa across countries in all income groups: Burkina Faso (41.7% vs 11.6%), Togo (12.2% vs 27.1%), Ghana (17.3% vs 7.8%), Ivory Coast (16.4% vs 9.7%), Botswana (33.4% vs 0.6%) and South Africa (29.3% vs 2.7%). The magnitude of the contribution of maternal health to GDP per capita was higher than the impact of the reverse relationship for the lower middle-income countries of Ghana (10.6% vs 2.4%) and Ivory Coast (82.3% vs 0.1%) and the upper middle-income countries of Botswana (2.3% vs 1.5%) and South Africa (25.6% vs 0.1%). However, the magnitude of the effect of GDP per capita on maternal health was higher than the other way around only for the lower income countries of Burkina Faso (27.9% vs 1.1%) and Togo (30.0% vs 3.8%). This study adds further policy support for improving maternal and child health to achieve substantial benefits on long-term economic growth in SSA.

**Key words:** Maternal health, child health, economic development, sub-Saharan Africa, GDP per capita



## INTRODUCTION

Optimal health among women is essential to child health and survival [1]. In Africa, maternal health has generally improved as evidenced by the reduction (by about half) in the maternal death rate between 1990 and 2015 [1]. In spite of this significant progress, maternal mortality rates in the region remain unacceptably high. Currently, this region has the highest maternal mortality ratio of about 510 deaths per 100,000 births [2]. According to the most recent World Health Organization statistics, about 62% of all maternal deaths globally occurred in sub-Saharan Africa (SSA) alone [2]. Furthermore, properly equipped health facilities, professional health care staff and access to antenatal care are often inadequate or not readily available, impeding the provision of comprehensive healthcare for women and children [3]. There are also challenges with access to pre-natal care that includes nutrition education and food resources in SSA. Additionally, HIV/AIDS and associated nutritional complications during pregnancy and lactation remain critical for women of reproductive age [4].

Similarly, while the global under-five mortality rate since the 1990s has decreased by one third, SSA still has the highest rate with 1 in 11 children dying before their fifth birthday; this is about 15 times the average in developed regions [5]. Undernutrition among children has persistently been a challenge to child health in SSA. Currently, a high proportion of children (between 28.4% and 37.5%) are stunted. Furthermore, about 13.9 million children suffer from wasting. A high percentage of children also suffer from either anemia or caloric deficiency, with over 53.8% of children in Africa classified as anemic, and between 34% and 36% of children being undernourished [6, 7, 8].

While it is plausible for maternal and child health to positively affect economic development, only a handful of studies have focused on this in SSA. Instead, the majority of research has focused on the impact of economic development on maternal and child health. Maternal health is important because healthy women will be more productive in the labor market, with direct consequences on economic output. Additionally, optimal health increases the return on educational investment as both women and children will have fewer missed school days, leading to higher test scores and increased likelihood of graduating [9]. More education allows for increased labor market participation because well-educated workers are more literate and have numeracy skills making them relatively easier to train [9]. Therefore, female health is important for long-term economic development through direct intergenerational transmission of human capital [10]. Although there have been calls for increased investments in maternal and child health, these arguments are often based on moral and public health grounds rather than empirical evidence. [11]. This study, therefore, explores the impact of maternal and child health on economic development in SSA in order to identify potential economic benefits that may accrue from investments in these sectors. Thus, the main objective of this study is to examine the impact of maternal and child health on economic development, and vice versa, at different income levels over an extended period (1960-2012), using a diverse set of six African countries as a case study: Ghana, Ivory Coast, Togo, Burkina Faso, Botswana and South Africa.



The majority of studies that have examined the relationships between income and child mortality conclude that as income rises, child mortality significantly decreases. For example, Amouzou and Hill [12], looked at under-five mortality trends in SSA as well as the relationship between socio-economic status denoted by per capita income, urbanization, illiteracy and under-five mortality rate. Their results showed a consistent negative relationship between child deaths and per capita income. They also observed a significant positive relationship between illiteracy and under-five mortality, as well as a negative association between urbanization and under-five mortality.

Bhalotra [13] explored the extent to which the reduction in child mortality can be attributed to economic growth in 15 major states of India over a period of three decades. She concluded that economic growth does have a significant effect on mortality risk; however, it could not be solely relied on to reach the Millennium Development Goal of reducing the under-five mortality rate by two-thirds. An earlier study by Pritchett and Summers [14], using cross-country panel data for 58 developing countries that were observed from 1960 to 1985, reported that over half a million child deaths in these regions in 1990 alone were linked to the poor economic performance of the 1980s. They explain that poor economic performance may decrease spending on goods that directly or indirectly promote the health of children, such as accessibility to efficient public programs and education of women. Another study focusing on the direct relationship between economic growth and health in Mexico from 1970-1995 provided some evidence that health accounts for about one-third of long-term economic growth [15]. Using a two-stage least squares regression analysis, Malik [16] noted a significant effect of health measured as infant mortality rate, life expectancy rate, and crude health rate on per capita gross national income GNI the proxy for economic growth in this study. For maternal health, Andoh *et al.* [17] found that national net income per capita showed negative relationships with maternal mortality and adult female mortality rate and a positive association with life expectancy at child birth. More recently, Bloom *et al.* [18] noted that improved female health accelerates the demographic transition and, therefore, progress toward sustained economic growth. They suggest that investing in female health may be an essential channel for development policies. They further claim that even slight positive changes in female health could have a major impact on the transition process to a higher income level in the long run.

## METHODS

### Data set

The data used in these analyses were derived from the World Development Indicators (WDI) data set; details of the survey and sampling strategy are provided by the World Bank [19]. Annual time-series data for Ghana, Ivory Coast, Togo, Burkina Faso, Botswana and South Africa from 1960-2012 were selected. For analyses, we classified these countries into income categories based on GNI per capita [20]: Togo and Burkina Faso (low-income economies with GNI per capita \$1,045 or less); Ghana and Ivory Coast (lower-middle-income economies with GNI per capita \$1,046 to \$4,125); and Botswana and South Africa (upper-middle-income economies with GNI per capita \$4,126 to \$12,735). Each pair of countries was selected because of their geographical proximity, comparable challenges in terms of health and nutrition, and similarity in economic



development. Literature was reviewed extensively to identify the predictors of child nutrition or health, maternal health, and economic development, and compared to the variables available in the WDI. Guided by previous empirical growth literature, we accounted for labor force, capital, and labor productivity by employing the following indicators, respectively: population growth (annual %), gross capital formation as a share of GDP, and female secondary/primary school enrollment (% gross) [21, 22]. The health measures were infant mortality rate as a proxy for child health, and life expectancy at child birth for females as a proxy for maternal health [21, 22, 23]. Gaps in the data were filled using linear trends. We had limited data on female secondary school enrollment (% gross) for South Africa (i.e. 23 out of 52 data points); hence, we used primary education, pupils (% female) instead, which had 42 out of the 52 data points available.

### Empirical strategy and data analysis

EViews® Software Package 9.0 for Windows was used for econometric analyses. Tests were conducted to check for collinearity, determine if the residuals followed Vector Auto Regression (VAR) model's assumptions on absence of serial correlation, absence of heteroscedasticity, and if the errors were normally distributed. Relationships were explored using variance decompositions that are all part of the VAR system. Variance decomposition was used to measure the contributions of each source of shock to the (forecast error) variance of each variable at a given forecast time horizon. Specifically, to quantify the impact of GDP per capita and child health on each other or from other variables, and also determine how each variable responds to innovations or shocks from other variables, the generalized forecast error variance decomposition analysis by Pesaran and Shin was applied to aid with the interpretation of a VAR model once it was fitted [24].

## RESULTS AND DISCUSSION

### Descriptive statistics of socio-economic and health variables

Table 1 provides the descriptive statistics on socio-economic and health variables from 1960 to 2012 for the six countries. Socio-economic and health variables among countries of the same income classification showed little variation. The mean GDP per capita (constant 2005 US\$) ranged from a high of \$5042.2 in South Africa to a low of \$291.3 in Burkina Faso. For upper middle-income countries, the study found infant mortality rates of 60.9 per 1,000 live births in Botswana and 54.2 per 1,000 live births in South Africa, which is relatively lower in comparison to the other income groups. In addition, life expectancy among females was observed to be highest among upper middle-income countries, Botswana (55.0 years) and South Africa (55.7 years).

### Variance decomposition quantifying the impact of variables on each other

The results presented in Table 2 shows the generalized forecast variance decomposition for GDP per capita and child health. The magnitude of the contribution of child health to GDP per capita was generally higher than the impact of GDP per capita on child health across countries in all income groups, Burkina Faso (41.7% vs 11.6%), Togo (12.2% vs 27.1%), Ghana (17.3% vs 7.8%), Ivory Coast (16.4% vs 9.7%), Botswana (33.4% vs 0.6%) and South Africa (29.3% vs 2.7%) using a 10-year horizon.



The results of the variance decomposition approach for the output GDP per capita and maternal health are shown in Table 3. The magnitude of the contribution of maternal health to GDP per capita was higher than the impact of GDP per capita on maternal health for lower middle-income countries, Ghana (10.6% vs 2.4%), Ivory Coast (82.3% vs 0.1%) and upper middle-income countries, Botswana (2.3% vs 1.5%), South Africa (25.6% vs 0.1%). However, the magnitude of the effect of GDP per capita on maternal health was higher than the impact of maternal health to GDP per capita only for lower income countries, Burkina Faso (27.9% vs 1.1%) and Togo (30.0% vs 3.8%). In the Ivory Coast, for example, 0.4% of GDP per capita is explained by its own innovative shocks (that is by GDP per capita itself) whereas the contributions of gross fixed capital formation, percentage annual population growth, maternal education, and maternal health are 9.9%, 6.9%, 0.5% and 82.3%, respectively. In South Africa, maternal health contributed to economic growth by 25.6%, and the share of maternal education to economic growth is 4.4%. The contribution of maternal education to maternal health was very important. The contribution of maternal education to maternal health in Botswana was 33.9%. About 18.4% of maternal health was explained by one standard deviation shock in maternal education in Togo.

No previous research appears to have focused on estimating the impact of maternal and child health on economic development in SSA. This study predicted the magnitude of impact of maternal and child health on economic development and vice versa in the six SSA countries of Ghana, Ivory Coast, Togo, Burkina Faso, Botswana, and South Africa at different income levels, using time-series data obtained from the WDI data set from 1960-2012. Infant mortality rate, female life expectancy, GDP per capita, and female secondary/primary school enrollment (% gross) were used as proxies for child health, maternal health, economic growth, and maternal education, respectively.

The highest average GDP per capita was in South Africa an Upper Middle Income Country (UMIC) and lowest in Burkina Faso a Low Income Country (LIC). In UMICs, infant mortality rate was relatively lower and life expectancy for females higher, compared to LICs with relatively higher infant mortality and lower life expectancy for females. These findings are also supported by a study by Jalal *et al.* [25] in UMICs.

### Child health

The magnitude of contribution of child health to GDP per capita, expressed as the forecast variance, was generally higher than the impact of GDP per capita on child health at a 10-year horizon (Table 2). This suggests that improvement in child health through a decrease in the infant morbidity and mortality rate will generally have a larger effect on GDP per capita than the reverse relationship at a 10-year time point. Due to differences in the countries selected and differences in data analyses methods, it is difficult to compare results in this study to others. However, results of most studies are generally consistent with this study's findings. In Chile, Selowsky and Taylor [26] reported the full cost-benefit analysis associated with a nutrition intervention on 33 severely malnourished children's weight, cognitive capacity, and future earnings. This author observed that the rates of return for the protein supplementation program was between 19 and 25%, with the returns on primary education about 17% and physical capital investments around 15%. The paper concluded that funding nutrition programs would be

one of the most productive investments that the government of Chile could undertake. According to Ghana's Cost of Hunger report, an estimated 4.6 billion Ghanaian Cedis (or 2.6 billion US dollars) was lost to child undernutrition in 2012. These losses were equivalent to 6.4 percent of GDP in 2012. The largest share of this cost is attributed to the loss in potential productivity as a result of undernutrition-related deaths [27].

The mechanism supporting the relationship between child mortality and economic growth may be through a reduction in fertility and an increase in schooling of children, ultimately promoting economic growth [28]. Significant improvements in health status are also essential for reducing poverty. Economic growth and health status have a positive association, implying that improved health enhances economic growth by enabling productivity, and higher growth promotes better human capital formation [29].

### Maternal health

This study also found that the magnitude of the contribution of maternal health to GDP per capita was higher than the impact of GDP per capita on maternal health at a 10-year horizon for LMICs and UMICs (Table 3). However, the magnitude of the effect of GDP per capita on maternal health was higher than the impact of maternal health to GDP per capita at 10-year horizon for LICs, Burkina Faso (27.9% vs 1.1%) and Togo (30.0% vs 3.8%). Similar findings of long-term impact of improved health on economic growth have been reported by Jamison *et al.* [30] using Penn World Table data from 53 countries over the period of 1965-1990. It included countries from Africa, Asia, Europe, Oceania, Central America, North America, and South America. They also found that countries with higher initial levels of health (adult survival—as could also be observed in the generally high female life expectancy in LMICs and UMICs) realized more modest contributions to growth from better health than countries with lower initial health. Contrary to our findings, Acemoglu and Johnson [31] noted that the impact of life expectancy on total GDP was rather small both initially and over a 40-year period. This indicates a weak evidence for a large exogenous increase in life expectancy leading to a significant increase in per capita economic growth. Similar to this study, they grouped countries according to income per capita levels. However, they used a larger base sample of 47 countries and excluded Africa because of the absence of reliable data on life expectancy. Similarly, Eastern Europe and Russia were also excluded because of issues with the quality of their GDP data.

Consistent with previous research, the findings of this study noted that in the long term, maternal education has a positive impact on both maternal and child health as well as economic development, although this effect may not be pronounced in all the countries studied [32, 33]. Based on findings of this study, we suggest that formal education could lead to increased ability of women to find, understand, and use health information, and to lower fertility rate. This will consequently lead to important improvements in child health as well. Furthermore, improved health for both mother and child is critical for human capital formation, as there will be a healthy work force with respect to women; and children will grow into healthy and productive adults. Children in good health are able to commute to school, concentrate, and perform well academically, all of which may improve educational outcomes and increased future employment opportunities. On the other hand, Caldwell [34] suggests that educated women can positively influence the



traditional balance of power within the family, leading to changes in decision making and the distribution of resources within the household. For example, women with formal education are more likely than uneducated women to take advantage of advances in medicine and follow recommended treatments [35].

### **Child health and maternal health**

The apparent inconsistency across studies that have attempted to relate child health and maternal health to GDP may be explained by several possible factors. Even though GDP may increase, that increase may not translate to increased expenditures at the family or government level related to health. Families with low incomes in developing regions like SSA may spend the extra income on goods that are not related to health, such as alcohol, tobacco, and entertainment—be it televisions, weddings, or festivals [36]. Thus, as families see improvements in their income, they need nutrition education to learn about wise food choices that will contribute to their health and productivity. It has been shown that an exogenous increase in income can improve child health in developing countries; specifically, the income received by women, compared to men, is more beneficial to the health of children [37]. In addition, improvements in child health and maternal health may not be captured in short term studies of GDP as these may take years to show positive effects [38].

### **Implications for policy**

The results of this study have important policy implications. Countries in SSA could benefit from increased policy efforts related to improving maternal and child health as they may result in long-term economic growth. A recent WHO report has highlighted the importance of investing in the health sector and making services widely accessible especially for women and children in SSA [39]. This includes strengthening technical skills among health workers in order to improve the quality and coverage of nutrition and health services. It also calls for addressing the high prevalence of anemia, especially among adolescent girls in SSA, through the promotion of biofortification, micronutrient fortification of local foods and nutrition education. The formulation of nutrient rich, locally available and inexpensive recipes by individual countries is also critical for complementary feeding of children. The report emphasizes stronger nutrition surveillance within the healthcare system for the identification and management of undernutrition among children, as well as the scaling-up of social and behavior change communication at the community level. Some of the approaches to achieving stronger nutrition surveillance include routine monitoring and surveys to generate rapid response. It is also important for health workers to be trained in anthropometric measurements, child growth monitoring, and health promotion. Community outreach in schools can reinforce the delivery of essential nutrition information to both pupils and their families. The use of multiple media outlets for educating and disseminating information to health workers, childcare givers, and school children, for example, are also vital for nutrition and health improvements for mothers, infants, and young children. New technological advances related to mobile health and nutrition behavior change in international settings are providing relevant information, such as the Global Alliance for Improved Nutrition's "mNutrition: Behavior change in 160 characters or less?" and should be explored [40].



### **Strengths, limitations and future studies**

One important contribution this research adds to the literature is the demonstration of the positive impact of child health and maternal health and maternal education on economic development in the six SSA countries at three different income levels. Additionally, the use of yearly time series data over an extended period —1960 to 2012— strengthens this study. However, it is also important to emphasize that maternal and child health are not the only contributors to economic growth.

Future studies should look at how child health and maternal health relate to different human development and human capital indicators such as family income and expenditure on food and health. It is also important to determine the most efficient and expedient manner in which to invest in health in SSA. Such health economic evaluation studies should take into account income equity challenges across the region's population. More research is needed to understand the underlying causes of maternal and child mortality as well as ill health unique to each country in this region. The combination of both qualitative and quantitative studies would provide insight into the determinants or factors of ill health and mortality. Once these factors have been identified, they can be addressed through community participatory education efforts involving the stakeholders and policy experts.

### **CONCLUSION**

This study has generated evidence that maternal and child health may be beneficial for long-term economic growth in the six SSA countries of Ghana, Ivory Coast, Togo, Burkina Faso, Botswana, and South Africa. Based on this study and the previously existing body of research, efforts by governments and other stakeholders in the region to increase the levels of investment in health and nutrition of women and children is highly recommended. Furthermore, it is important that maternal and child health are prioritized within the overall economic and development plans.



**Table 1: Basic descriptive statistics of socio-economic and health variables from 1960 to 2012 in six sub-Saharan African Countries**

Classification	Country	<i>GDP/c</i>		<i>GCF</i>		<i>POP</i>	
		Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
LICs	Burkina Faso	291.263	82.391	19.621	3.072	2.339	0.555
	Togo	415.357	52.237	2.14E+08	1.64E+08	2.734	0.766
LMICs	Ghana	453.836	81.366	15.522	7.735	2.585	0.413
	Ivory Coast	1216.661	244.46	15.780	5.502	3.352	1.085
UMICs	Botswana	2943.545	2007.888	1.17E+09	1.49E+09	2.573	0.948
	South Africa	5042.197	587.370	21.000	4.093	2.125	0.429

  

Classification	Country	<i>EDU</i>		<i>IMR</i>		<i>LIFE</i>	
		Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
LICs	Burkina Faso	6.125	6.016	115.228	28.124	46.283	6.246
	Togo	15.540	8.460	102.043	30.229	52.604	4.689
LMICs	Ghana	34.588	8.215	90.021	24.956	54.958	4.535
	Ivory Coast	15.095	6.503	122.174	36.990	47.449	4.420
UMICs	Botswana	48.036	28.886	60.904	23.379	55.020	5.828
	South Africa	90.017	9.539	54.149	13.132	55.687	4.017

LIC-Lower Income Country

LMIC-Lower Middle Income Country

UMIC-Upper Middle Income Country

*GDP/c*: GDP per capita (constant 2005 US\$)

*GCF*: gross fixed capital formation (percentage of GDP)

*POP*: population growth (annual %)

*EDU*: female secondary school enrollment (% gross)

*IMR*: infant mortality rate (per 1,000 live births)

*LIFE*: female life expectancy at birth (years)



**Table 2: Generalized forecast variance decomposition results for GDP per capita and child health**

Variance Decomposition of GDP/c:							Variance Decomposition of IMR:					
	Horizon <sup>a</sup>	<i>gdp/c</i>	<i>gcf</i>	<i>pop</i>	<i>edu</i>	<i>imr</i>	Horizon	<i>gdp/c</i>	<i>gcf</i>	<i>pop</i>	<i>edu</i>	<i>imr</i>
Burkina Faso	1	100.000	0.000	0.000	0.000	0.000	1	2.447	34.308	1.071	0.762	61.412
	5	51.233	13.985	4.980	1.780	28.023	5	38.241	6.829	0.291	5.402	49.237
	10	44.200	7.908	0.679	5.556	41.657	10	11.550	9.866	0.416	3.719	74.448
Togo	1	100.000	0.000	0.000	0.000	0.000	1	5.097	25.742	3.627	0.051	65.483
	5	79.483	9.065	5.471	3.998	1.983	5	12.317	47.523	2.190	1.930	36.040
	10	60.015	19.532	4.258	4.045	12.150	10	27.088	39.900	6.422	1.556	25.034
Ghana	1	100.000	0.000	0.000	0.000	0.000	1	0.585	8.317	13.365	6.554	71.179
	5	65.107	7.751	16.158	6.252	4.731	5	5.184	22.979	12.644	1.187	58.006
	10	49.279	7.541	18.783	7.049	17.348	10	7.789	17.012	6.110	4.140	64.950
Ivory Coast	1	100.000	0.000	0.000	0.000	0.000	1	0.731	7.579	5.341	0.000	86.349
	5	69.606	15.922	1.195	2.056	11.221	5	2.339	3.142	2.321	1.015	91.182
	10	40.833	18.679	14.449	9.642	16.397	10	9.657	6.144	18.840	9.703	55.656
Botswana	1	100.000	0.000	0.000	0.000	0.000	1	4.430	26.208	7.213	0.068	62.081
	5	60.139	7.444	4.765	2.728	24.925	5	0.357	37.873	1.198	0.985	59.586
	10	21.048	18.374	24.512	2.659	33.407	10	0.613	33.134	0.968	1.184	64.102
South Africa	1	100.000	0.000	0.000	0.000	0.000	1	1.085	6.124	0.524	6.500	85.768
	5	52.093	13.414	1.806	20.195	12.493	5	1.676	5.348	4.809	11.353	76.815
	10	24.411	19.486	5.689	21.110	29.305	10	2.654	14.962	5.403	20.701	56.280

*gdp/c*: log of GDP per capita (constant 2005 US\$)

*pop*: population growth (annual %)

*imr*: log of infant mortality rate (per 1,000 live births)

*gcf*: log of gross fixed capital formation (percentage of GDP)

*edu*: log of female secondary school enrollment (% gross)

<sup>a</sup> 1, 5, and 10 are years



**Table 3: Generalized forecast variance decomposition results for GDP per capita and maternal health**

Variance Decomposition of GDP/c:							Variance Decomposition of LIFE:					
	Horizon <sup>a</sup>	<i>gdp/c</i>	<i>gcf</i>	<i>pop</i>	<i>edu</i>	<i>life</i>	Horizon	<i>gdp/c</i>	<i>gcf</i>	<i>pop</i>	<i>edu</i>	<i>life</i>
Burkina Faso	1	100.000	0.000	0.000	0.000	0.000	1	38.867	1.272	20.577	0.084	39.201
	5	80.286	2.100	2.386	14.556	0.673	5	15.264	5.716	44.940	7.036	27.044
	10	78.459	1.872	6.617	11.945	1.107	10	27.885	4.196	48.042	7.653	12.224
Togo	1	100.000	0.000	0.000	0.000	0.000	1	31.255	21.788	0.891	21.676	24.389
	5	61.860	20.546	5.727	11.504	0.364	5	29.126	41.774	5.367	18.752	4.982
	10	36.070	38.874	5.608	15.665	3.784	10	29.978	39.964	5.406	18.441	6.212
Ghana	1	100.000	0.000	0.000	0.000	0.000	1	0.498	0.012	42.089	6.152	51.249
	5	65.951	12.638	13.194	7.044	1.172	5	2.157	2.695	65.690	2.267	27.191
	10	46.913	9.253	24.970	8.273	10.591	10	2.412	3.909	73.941	4.729	15.009
Ivory Coast	1	100.000	0.000	0.000	0.000	0.000	1	0.017	2.385	0.121	0.904	96.572
	5	75.551	5.634	14.656	1.305	2.855	5	0.064	13.571	4.520	0.387	81.459
	10	0.419	9.876	6.904	0.519	82.282	10	0.108	7.100	8.186	0.627	83.979
Botswana	1	100.000	0.000	0.000	0.000	0.000	1	11.303	1.576	2.533	14.102	70.487
	5	81.754	10.611	2.707	4.355	0.574	5	4.224	2.699	5.307	30.749	57.020
	10	65.645	6.930	19.737	5.418	2.270	10	1.499	1.269	3.723	33.886	59.623
South Africa	1	100.000	0.000	0.000	0.000	0.000	1	1.331	3.581	5.890	0.107	89.091
	5	83.148	10.978	0.624	4.529	0.721	5	0.825	2.402	2.356	2.178	92.239
	10	40.173	25.750	4.172	4.355	25.550	10	0.117	2.512	0.815	0.822	95.734

*gdp/c*: log of GDP per capita (constant 2005 US\$)

*pop*: population growth (annual %)

*life*: log of life expectancy at birth, female (years)

*gcf*: log of gross fixed capital formation (percentage of GDP)

*edu*: log of female secondary school enrollment (% gross)

<sup>a</sup> 1, 5, and 10 are years



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