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Full Length Research Paper

Does dependency rate really impede savings? Some Sub-Saharan African evidence

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This study examines whether the age dependency ratio exerts a negative effect on the domestic savings rates. We test this issue for 16 African countries using annual data. The empirical analysis was conducted using the bounds test of cointegration of Pesaran et al. (2001) and the modified Granger causality test due to Toda and Yamamoto (1995). The advantage of using these two approaches is that they both avoid the pre-testing bias associated with standard unit root and cointegration tests. The bounds test indicates evidence of cointegration for 11 countries. Further, results from causality analysis reveal that dependency ratio causes savings rate negatively in nine countries, and positively in two countries. Overall, our findings support the view that changes in non-working population size are important in explaining the future path of the domestic savings rate in Africa.

Key words: Savings, dependency rates, bounds testing, cointegration, granger causality.

INTRODUCTION

International comparative analysis of the savings behaviour over the last three decades have shown that the world has witnessed a marked divergence in saving rates, particularly dramatic within developing countries. While saving rates have risen steadily in East Asia and stagnated in Latin America, they have fallen in Sub-Saharan Africa (Loayza et al., 2000). These regional disparities have raised academic interest in the following question: why do saving rates differ so much across countries and time periods? This question has stimulated a large body of empirical works across the world. Among the various factors that are likely to play an important role in explaining savings the demographic structure of the population has viewed as crucial. The "East Asian Miracle" is often attributed to the rapid demographic transition which has contributed to increase the rates of national savings and economic growth by lowering fertility rates and changing the age composition of the population (Higgins and Williamson, 1997; Bloom and Williamson, 1998; Mason, 2001). A striking feature of most African countries is the age structure of their population. Although fertility has started to decline (Cohen, 1998; Kirk and Pillet, 1998; Tabutin and Schoumaker, 2004), Sub-Saharan Africa is the region of the world with the highest fertility level[1]. As noted by Bongaarts (1998) and Bloom et al. (2008), changes in fertility affect the age structure of the population. High fertility rate leads to a young structure of the population and therefore to high youth-dependency ratio[2]. This has serious implications for the domestic savings.

There are many reasons to believe that the dependency ratio is central for explaining differences in savings behaviour and economic growth across countries. The theoretical underpinnings of this belief are based on the life cycle hypothesis. The argument goes as follows. Economic agents has negative savings when young with little or no income, positive savings during their productive years and again negative savings when they are old and retired (Modigliani, 1970). As children constitute a burden for parents and do not contribute to production, an increase in their proportion in the population is expected to reduce the private savings rate

[1] The United Nations estimated in the 2006 revision of World Population Prospects, an average total fertility of 5.48 for the region in 2000-2005 (United Nations, 2007). This is an extremely high level of fertility compared with that of Asia (2.47).
[2] They also documented that the decline in dependency in developing countries is very closely tied to the decline in fertility. See also Ashford Lori (2007).

(Leff, 1969). Similarly, an increase in the proportion of elderly in the population is also expected to hamper the aggregate savings rate since the retired depend on the working population, thus they are assumed to dissave. On the other hand, increase in the dependency ratio may put significant upward pressure on government spending on health and education needed to improve the quality of life. This could involve a reduction in public savings if fiscal policies remained unchanged. Hence the age structure of the population has a special role in explaining the overall national savings rates.

On empirical grounds, an extensive literature has been performed to investigate the effect of dependency ratio on savings. Evidence is mixed across countries and methodologies. Studies using cross-country data have been more successful than time-series studies for individual countries in finding significant demographic effects. In particular, Leff (1969), Modigliani (1970), Graham (1987), Edwards (1996), Muradoglu and Taskin (1996), Kelley and Schimdt (1996), Masson et al., (1998), and Loayza et al. (2000) have found some evidence in line with the life-cycle model. However, cross-country regression analysis may be criticised since they assume that saving behaviour is the same across countries, an assumption that can hardly be defended because of differences in institutional, social, economic and demographic structures. Therefore, the overall result obtained from these regressions represents only an average relationship, which may or may not apply to individual countries in the sample. There is a need to use individual country time-series data for undertaking a more in-depth econometric analysis in order to derive more useful policy implications. Some attempts have been undertaken at individual country level. Horioka (1997), Escobar and Cardenas (1998), Elbadawi and Mwega (2000), Thornton (2001), Prema-Chandra and Pnag-Long (2003), Serres and Pelgrin (2003), and Modigliani and Cao (2004) show that higher age dependency ratios are associated with lower saving rates. However, other studies including Goldberger (1973), Ram (1982), Husain (1995), Faruquee and Husain (1998), and Baharumshah et al. (2003) present cases in which the dependency ratio effect on savings may be insignificant or even positive.

The purpose of this study is to test whether dependency rate has a positive or negative long-run effect on domestic savings rate for African countries, in which the life-cycle model may be less applicable, because of cultural peculiarities such as the uncertainty of income and the greater prevalence of intergenerational transfers within families[3]. Our study has two other reasons. First, it is now widely recognized that saving play a crucial role in explaining much of the difference in economic performance between Africa and Southeast Asian countries. While its availability is not by itself a panacea for economic and social problems facing Africa, domestic saving is nevertheless believed to be a necessary requirement for financing Africa’s domestic investment and economic and social development. Second, it has been reported by some economists that the rationale of Africans is altered by social constraints which impede saving and investment behaviours (Mahieu, 1990; Hugon, 1993). The support to dependents is organised within families and implies great amounts of financial private transfers.

Our empirical analysis makes use of the bounds testing approach to cointegration suggested by Pesaran et al. (2001) and the Granger Causality test due to Toda and Yamamoto (1995) that overcomes some of the deficiencies of standard approaches. Our study is an advance over most existing works using the bounds tests because we compute exact critical values specific to our sample size using Monte Carlo simulations. By calculating finite critical values, we ensure that our inference is correct. The remainder of this paper is organized as follows: 1) highlights the econometric methodology 2) presents the data and empirical results and 4) offers a brief summary and gives some concluding remarks.

THE ECONOMETRIC METHODOLOGY

The Bounds test approach to cointegration

Econometric literature offers several methods to test for the existence of a long-run relationship among a set of time-series variables. The most widely used methods include the two-step residual-based test of Engle and Granger (1987) and the full information maximum likelihood-based approach due to Johansen and Juselius (1990). These standard tests require that all the system’s variables are integrated of the same order (I(1)). This inevitably involves a step of stationarity pre-testing, thus introducing a certain degree of uncertainty into the analysis. As long as there exist both I (1) and I (0) variables, these cointegration tests will produce biased results in the long-run interaction between the variables. Gonzalo and Lee’s (1998) Monte Carlo evidence shows that Johansen and Juselius multivariate cointegration test tend to find spurious cointegration with probability approaching to one when the series are not purely I(1) processes. In addition, these tests suffer from low power and do not have good small sample properties (Cheung and Lai, 1993).

In view of these shortcomings, we employ the bounds testing approach of cointegration proposed by Pesaran et al. (2001) within the autoregressive distributed lag (ARDL) framework. Our choice of this methodology is based on several considerations. Firstly, the ARDL approach yields consistent estimates of the long-run

[3] In most African countries, private transfers from children to aged parents are more common than in Europe and United-States (Nugent, 1985; Attias-Donfut, 1995, and Altonji et al., 1997), and such intergenerational transfers could mitigate the need for life-cycle saving, since child becomes an effective substitute for life-cycle savings.

coefficients that are asymptotically normal irrespective of whether the variables have an order of integration less than or equal to one. This approach, hence, rules out the uncertainties present when pre-testing the order of integration of the series. It is particularly appropriate for small samples in which the order of integration is not known or may not be necessarily the same for all variables of interest. Secondly, the bounds test generally provides unbiased estimates of the long-run coefficients and valid *t*-statistics even when some of the regressors are endogenous (Inder, 1993). The bounds test is based on the estimation of the following unrestricted error correction model:

$$\Delta S_t = \phi_0 + \phi_1 S_{t-1} + \phi_2 D_{t-1} + \phi_3 y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta S_{t-i} + \sum_{i=0}^{m} \gamma_i \Delta y_{t-i} + \theta t + \mu Dum_t + e_t \quad (1)$$

where S_t is the domestic savings rate, D_t is the age-dependency ratio, y_t is the real GDP per capital, and Dum_t denotes dummy variable capturing changes, defined as $Dum_t = 0$ for $t < \tau$ and $Dum_t = 1$ for $t \geq \tau$, where τ is the date of change. The bounds test for cointegration is conducted by restricting the lagged levels variables in the Equation (1). Equal to zero. Therefore, the null hypothesis of no cointegrating relation is:

$$H_0 : \phi_1 = \phi_2 = \phi_3 = 0 \quad (2)$$

The null hypothesis is tested by the mean of an F-test. However, this test statistic has an asymptotic non-standard distribution. Its distribution under the null depends on the order of integration of the variables. Thus, the calculated F-statistic is compared with two critical values tabulated by Pesaran et al. (2001). The lower critical value assumes that all the regressors are I(0), while the upper critical value assumes that they are I(1). Therefore, if the computed F-statistic is greater than the upper critical value, the null of no cointegration is rejected and we conclude those saving and age-dependency rates are linked in the long-run. Conversely, if the calculated F-statistic is below the lower critical value, then the null hypothesis of no cointegration cannot be rejected regardless of the orders of integration of the variables. Lastly, if the F-statistic is between the lower and upper critical values, the test is inconclusive unless we know the order of integration of the underlying variables.

We are aware of the fact that the critical values provided by Pesaran et al. (2001) are not suitable for our small sample size and hence we compute the appropriate critical values from the stochastic simulations procedure suggested by the authors. Once the bounds tests confirm the existence of cointegration, Bardsen's (1989) method will be used to compute the long run coefficients. From the estimation of (1), the long-run effect θ_1 of dependency ratio on savings rate is computed as the coefficient on D_{t-1} divided by the coefficient on S_{t-1} and then multiplied by a negative sign (that is $\theta_1 = -\phi_2 / \phi_1$).

The Toda-Yamamoto approach to Granger causality test

To complement the cointegration analysis, we implement the Granger-causality test proposed by Toda and Yamamoto (1995) as an alternative approach to test for long-run causality. This approach has the advantage of not requiring pre-testing for cointegration properties of the system and can be implemented irrespective of whether the underlying variables are stationary, or integrated of different orders, cointegrated or non-cointegrated. The Toda and Yamamoto procedure essentially involves the determination of the maximum likely order of integration (d_{max}) of the series in the model and the estimation of the following augmented level VAR:

$$Z_t = \Phi_0 + \Pi t + \sum_{i=1}^{p^*} \Phi_i Z_{t-i} + u_t \quad (3)$$

where $Z_t = (S_t, D_t, y_t)'$, $p^* = k + d_{max}$ and Φ_i are (3×3) coefficient matrices. Once this augmented level VAR is estimated, a standard Wald test is applied to the first lagged *k* explanatory variables to make causal inference. The last lagged d_{max} coefficients are ignored because the inclusion of extra lags is to ensure that the computed Wald-statistic for Granger causality test has the standard asymptotic distribution where valid inference can be made.

DATA DESCRIPTION

The study uses time series annual data on gross domestic savings rates as share of GDP (S_t), age dependency ratio (D_t) and real per capita GDP (y_t). The age dependency is defined here as the ratio of the population younger than 15 years and older than 64 years to the population between 15 and 64 years old. It is a rough index of the dependency burden imposed by dependents (children and elderly). The sample includes 16 African countries, namely: Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, South Africa, Togo, Zambia and Zimbabwe. The sample size varies from country to country and covers the period 1965 to 2005 for Zimbabwe and Cameroon, 1964 to 2005 for Sierra Leone, 1967 to 2005 for Mali and 1960 to 2005 for the remaining countries. All the data are extracted from the 2008 World Development Indicators tapes of the World Bank (2008).

Table 1 reports some descriptive statistics of the two variables of interest. The most striking features to emerge are the low levels of savings rates in our sample. As indicated by the minimum, a number of countries had negative rates of saving for a number of years. Cote d'Ivoire, Nigeria, South Africa and Zambia have the highest average savings rates of 22.93, 20.09, 24.84, and 22.18%, respectively. The rates of domestic savings in the remaining countries have averaged less than 20% of GDP over the past four decades. Overall, the average savings rates are lower than those of the fast growing Asian countries (Husain, 1995; Baharumshah et al., 2003). Low levels of domestic savings in most African countries condemn them to an excessive reliance upon foreign savings which makes them vulnerable to financial crises. Except for South Africa, the age dependency rate is over 80% in each of the countries under study. With such high dependency ratios how can African countries achieve high level of savings rates? As a first step in exploring the bivariate relationship between savings rate and dependency ratio, Figure 1 plots the evolution of the variables over time. Each variable is measured in its own scale, savings rate on the left and age dependency ratio on the right. From the visual inspection, savings rates have been oscillating during the period 1960 to 2005. We can observe downward trends in the age dependency ratio for most of the countries after 1995, except Sierra Leone and Niger. This signifies that the population aged between 15 and 64 has increased less rapidly than that of the non-working population. Thus, most Sub-Saharan African countries have started their demographic transition induced by the decline in fertility rates. This is a good new for economic growth as the economy is expected to reap what has been called the demographic dividend (Brander and Dowrick, 1994; Ashford, 2007).

The correlation coefficients between the two variables show that savings rate and dependency ratio are positively related in 8 countries, and negatively linked in two countries. Correlation, however, does not say anything about cointegration and causality and thus leaves unsettled the debate concerning the long-run effects of age dependency rate on savings rate for African countries.

EMPIRICAL RESULTS

Unit root test

Before we proceed with our empirical analysis, it is important to investigate the order of integration of the series using unit root tests. While much of the empirical works applying the bounds test put forward that test for unit roots is not necessary, we considered it advisable to avoid misleading inferences because the bounds test is developed on basis that the variables are I(0) or I(1). Thus, critical values are not valid in presence of I (2) series.

Before testing data for unit root, we verify whether variables are normally distributed. We apply the Jarque-Bera, Lilliefors, Cramer-von Mises and Anderson-Darling empirical distribution tests. These tests are based on the comparison between the empirical distribution and the specified theoretical distribution function, here normal distribution. The results are reported in Table A1. As can be seen, the results are mixed. We cannot reject the null hypothesis of normality of savings rate for Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Kenya, Nigeria, Sierra Leone and Zimbabwe. For the age dependency ratio, the null hypothesis of normality can be rejected for all countries except for Togo. However, the Jarque-Bera test suggests normality in ten countries.

To test for unit roots, we apply the more efficient univariate unit root tests of Elliott et al. (1996) and Kwiatkowski et al. (1992). These tests are denoted as DF-GLS and KPSS, respectively. The results displayed in Table 2 indicate that all the variables show a stationary process after taking the first difference, with the exception of dependency ratio for Mali, South Africa and Zambia. For these three countries, the dependency ratio is a I(2) process. Therefore, we will consider its first difference in the empirical analysis on these three countries. On the basis of the results of the unit root tests, the second step in our empirical analysis is to test for a long-run relationship among the variables.

Cointegration and long-run coefficients

We focus our analysis on the long-run relationship between age dependency ratio and savings. This is because the age dependency rate does not vary enough in short-run; its variations are perceived in the long-term. We apply the bounds approach to cointegration. We use a general-to-specific modelling approach and AIC to select the lags order. An important innovation in our application is that we calculate critical values specific to our sample size via stochastic simulations using 40 000 replications. The F-statistics together with the exact critical values are reported in Table 3. As this table shows, the computed F-statistics are above the 5% upper critical values in all countries except for Burkina Faso, Mali, Mauritania, Senegal and South Africa.

A number of diagnostic tests were performed on the selected ARDL model specification for each country. Both the Breusch-Godfrey LM test and Ljung-Box Q-statistics for serial correlation failed to reject the null hypothesis of no serial correlation. In addition, both the CUSUM and

Table 1. Summary statistics of variables of interest.

	SAVGDP				AGERATIO				
Country	**Min**	**Mean**	**SD**	**Max**	**Min**	**Mean**	**SD**	**Max**	**Correlation**
Benin	-12.35	1.73	3.84	6.94	88.36	96.15	3.15	100.15	-0.21
Burkina Faso	-8.027	1.74	4.76	11.58	80.10	96.41	8.87	106.15	0.36*
Cameroon	10.76	18.93	4.95	29.09	82.12	89.98	4.59	95.98	0.65*
Cote d'Ivoire	10.38	22.93	5.94	33.62	82.22	90.48	3.62	95.94	-0.37*
Ghana	1.25	8.26	3.81	17.13	74.47	88.00	4.70	92.55	0.01
Kenya	9.08	16.91	4.33	27.02	82.89	103.94	9.92	112.53	0.69*
Mali	-4.61	4.81	6.33	14.04	89.22	101.27	6.78	109.15	0.26**
Mauritania	-33.26	11.58	23.63	88.86	78.33	88.53	3.99	94.20	0.31*
Niger	-1.64	5.39	4.41	17.69	95.81	102.38	2.28	104.97	0.04
Nigeria	3.48	20.09	10.18	42.32	86.25	91.85	2.64	95.97	0.36*
Senegal	-9.10	6.18	4.84	14.36	84.21	93.98	4.60	99.29	-0.17
Sierra Leone	-13.26	7.68	10.09	27.31	74.62	80.15	3.25	85.48	-0.68*
South Africa	16.76	24.84	4.96	37.88	58.35	74.97	9.92	85.49	0.78*
Togo	-2.16	14.62	11.04	53.50	87.27	93.97	3.29	98.72	0.13
Zambia	0.32	22.18	14.52	50.94	90.16	95.12	3.07	100.36	0.01
Zimbabwe	0.62	15.92	5.33	24.74	75.50	97.46	10.45	107.86	0.54*

Note: * (**) indicates statistical significance at the 5%(10%) level .Source: Author's calculation from the World Development Indicators (World Bank, 2008).

CUSUMSQ plots lie within the 5% critical bounds thus providing evidence that the estimated coefficients of the model are stable over the sample period (figures are not reported here to save space).

Given that for 11 countries, we find evidence of cointegration, we next estimate the long-run effect of dependency ratio on savings rate. The results on the long-run coefficients are reported in Table 4. The long-run coefficient estimates show that in the long-run dependency ratio has a statistically significant negative effect on savings rate in Benin and Zimbabwe. This finding implies that demographic structure play an important role in explaining the long-run savings behaviour in these countries, and the savings rate will increase when the non-working population size is decreasing. On the contrary, dependency ratio has a statistically significant and positive effect on savings rate in Cameroon, Kenya, Niger, Sierra Leone, and Zambia. For the remaining countries, dependency ratio has no long-run effect on savings rate.

An additional important result is the expected positive coefficient on the real per capita income variable in six countries except Benin and Kenya, suggesting that economic growth is one of the most powerful determinants of saving over the long-run. Results for Benin and Kenya seem to support the permanent income hypothesis.

Granger causality test results

To investigate the long-run causality between savings rates and dependency ratios, we implement the Toda and Yamamoto procedure described above. Prior to estimation, we have to determine the order of the VAR model. This is a crucial step because the causality test results may depend crucially on the choice of the lag structure (Thornton and Batten, 1985). We initially set k_{max}=5, and we use the Akaike Information Criterion (AIC) and the final prediction error (FPE) to select the optimal lag[4]. The VAR system is estimated with the seemingly unrelated regression (SUR) method (Rambaldi and Doran, 1996). Table 5 reports the results of the causality tests. As can be learned from the significance of the p-values of the wald-statistics, we can reject the null hypothesis that dependency ratio does not cause savings rate for 11 countries: Benin, Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Kenya, Mauritania, Nigeria, Sierra Leone, Zambia and Zimbabwe. For nine of these countries (Benin, Burkina Faso, Cote d'Ivoire, Ghana, Kenya, Mauritania, Nigeria, Zambia and Zimbabwe) there is a negative causality, implying that increased age dependency lead to lower savings. These findings are consistent with the life-cycle prediction and also Rossi's (1989) study for developing countries, but contradict with Gupta (1971) who argued that dependency ratio does not appear to play any role in the low income per capita countries.

Conclusion and implications

The life cycle model suggests that the age structure of

[4] In small sample study (T<60), AIC and Final Prediction Error (FPE) are superior to other information criterion (see Lütkepohl, 1991; Liew, 2004).

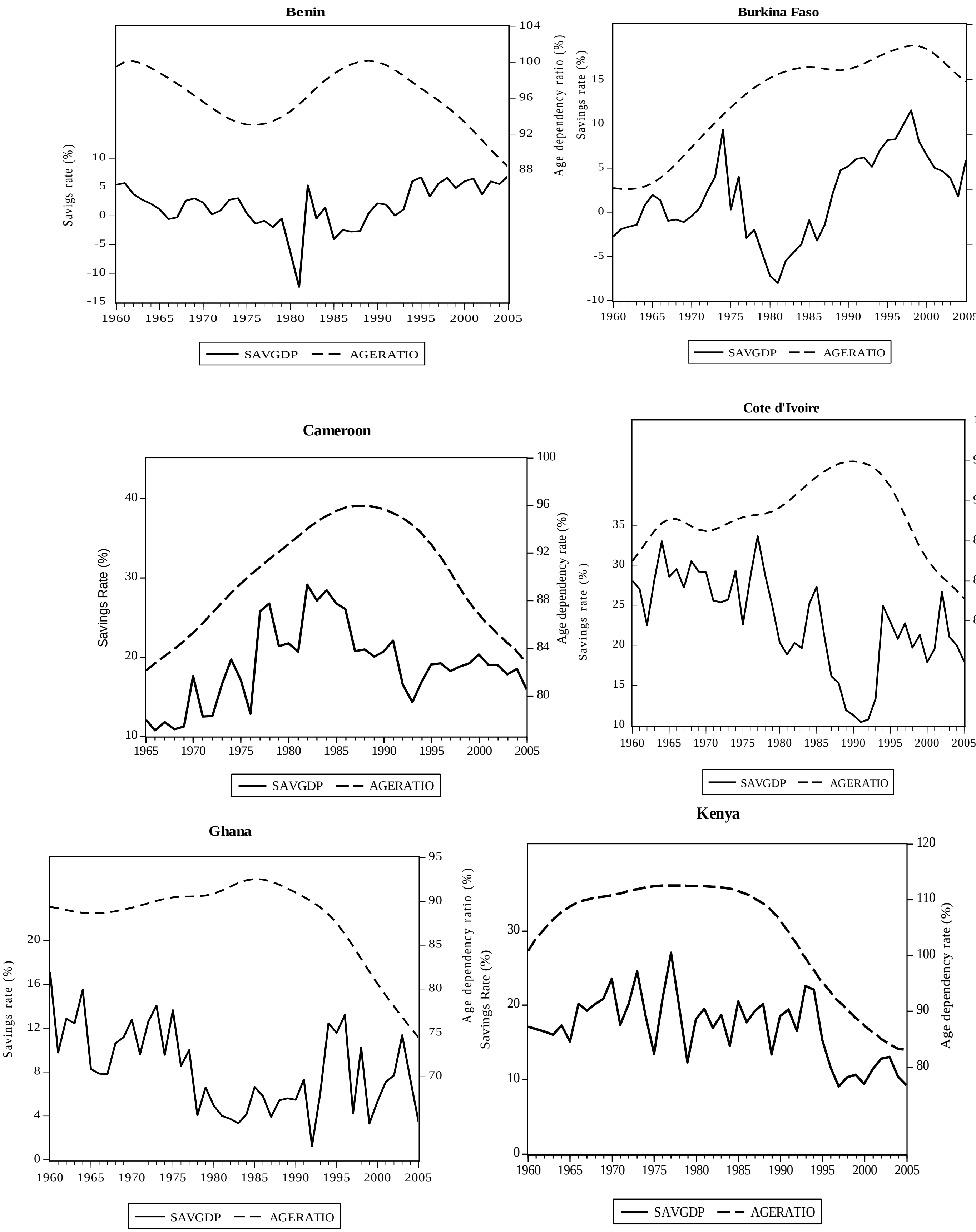

Figure 1. Domestic savings and Age Dependency Rates over time.

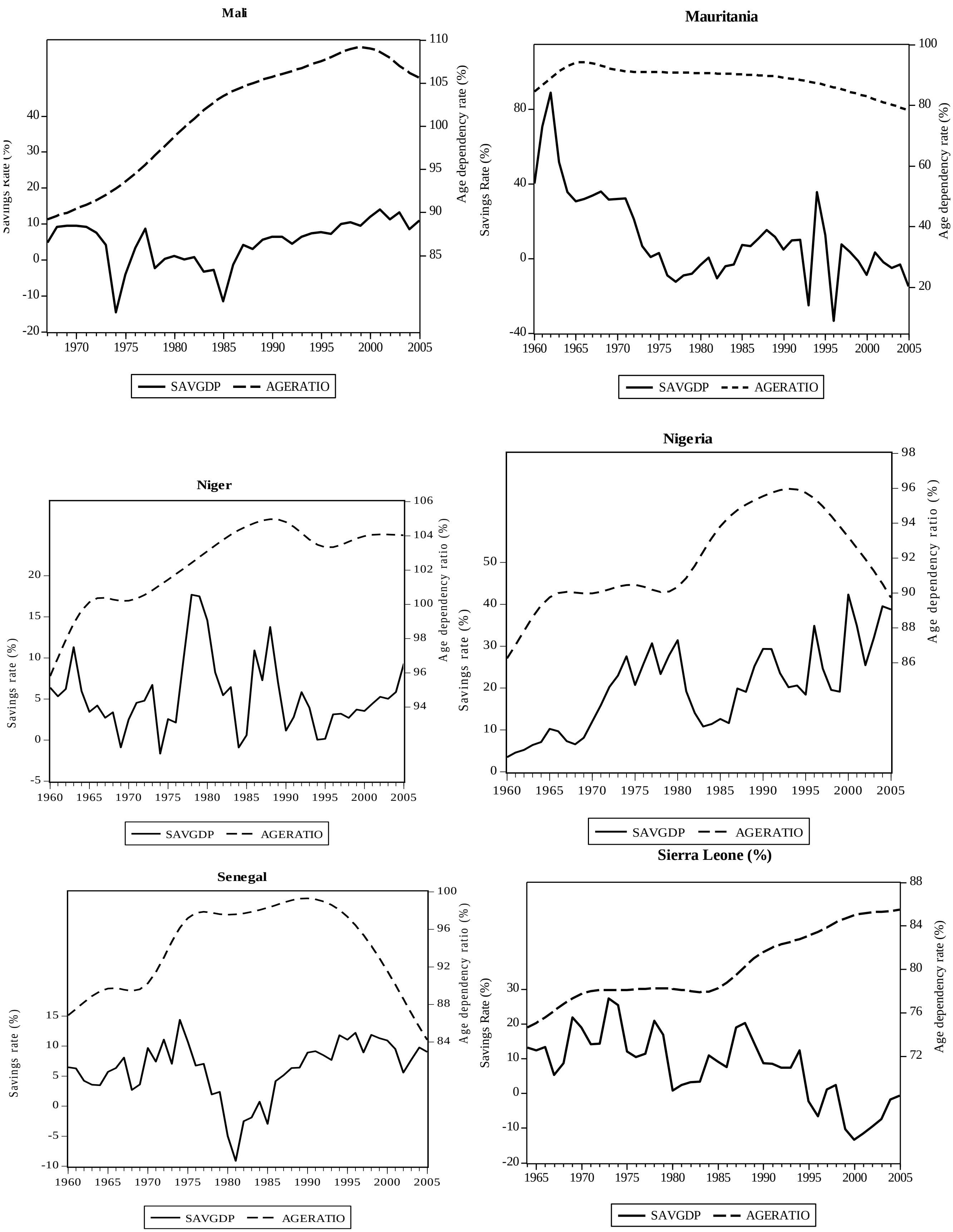

Figure 1. Contd.

Table A1. Normality tests of variables of interest.

Country	SAVGDP				AGERATIO			
	JB	D	W2	A2	JB	D	W2	A2
Benin	20.16* (0.000)	0.087 (> 0.1)	0.068 (0.284)	0.634** (0.092)	2.58 (0.27)	0.101 (> 0.1)	0.105** (0.091)	0.777* (0.040)
Burkina Faso	1.20 (0.54)	0.095 (> 0.1)	0.061 (0.355)	0.321 (0.518)	6.35* (0.04)	0.221* (0.000)	0.526* (0.000)	3.012* (0.000)
Cameroon	0.79 (0.67)	0.097 (> 0.1)	0.088 (0.156)	0.625** (0.096)	3.50 (0.17)	0.116 (> 0.1)	0.147* (0.024)	1.024* (0.009)
Cote d'Ivoire	1.48 (0.47)	0.096 (> 0.1)	0.058 (0.388)	0.440 (0.277)	1.40 (0.49)	0.129** (0.060)	0.102** (0.099)	0.706** (0.060)
Ghana	2.21 (0.33)	0.092 (> 0.1)	0.093 (0.134)	0.589 (0.118)	16.86* (0.000)	0.288* (0.000)	0.688* (0.000)	3.681* (0.000)
Kenya	0.71 (0.69)	0.088 (> 0.1)	0.078 (0.209)	0.477(0.226)	7.82* (0.02)	0.215* (0.000)	0.623* (0.000)	3.575* (0.000)
Mali	11.07* (0.00)	0.136**(0.064)	0.155* (0.018)	0.967* (0.013)	4.35 (0.11)	0.174* (0.004)	0.299* (0.000)	1.793* (0.000)
Mauritania	12.21* (0.00)	0.157* (0.005)	0.216* (0.003)	1.193* (0.003)	7.45* (0.02)	0.174* (0.001)	0.367* (0.000)	1.944* (0.000)
Niger	9.50* (0.00)	0.134* (0.044)	0.203* (0.004)	1.198* (0.003)	4.45 (0.10)	0.207* (0.000)	0.365* (0.000)	1.985* (0.000)
Nigeria	1.56 (0.45)	0.094 (> 0.1)	0.054 (0.443)	0.383 (0.383)	2.04 (0.35)	0.191* (0.000)	0.294* (0.000)	1.628* (0.000)
Senegal	11.00* (0.00)	0.139* (0.025)	0.152* (0.021)	0.967* (0.013)	4.59 (0.10)	0.214* (0.000)	0.407* (0.000)	2.316* (0.000)
Sierra Leone	0.96 (0.61)	0.105 (> 0.1)	0.048 (0.523)	0.309 (0.543)	3.26 (0.19)	0.243* (0.000)	0.356* (0.000)	1.904* (0.000)
South Africa	0.63 (0.72)	0.133* (0.038)	0.131* (0.040)	0.849* (0.026)	5.56** (0.06)	0.172* (0.001)	0.414* (0.000)	2.599* (0.000)
Togo	14.01* (0.00)	0.106 (> 0.1)	0.102 (0.100)	0.781* (0.039)	2.27 (0.32)	0.087 (> 0.1)	0.065 (0.312)	0.526 (0.170)
Zambia	3.74 (0.15)	0.132* (0.040)	0.229* (0.002)	1.309* (0.001)	2.86 (0.23)	0.120** (0.089)	0.131* (0.040)	0.812* (0.032)
Zimbabwe	4.76** (0.09)	0.115 (> 0.1)	0.079 (0.203)	0.523 (0.172)	5.28** (0.07)	0.232* (0.000)	0.458* (0.000)	2.636* (0.000)

Note: JB=Jarque-Bera; D=Lilliefors; W2=Cramer-von Mises; A2=Anderson-Darling. * (**) indicates statistical significance at the 5%(10%) level. Source: Author's calculation from the World Development Indicators (World Bank, 2008).

Table 2. Results of unit root and stationarity tests.

I. DF-GLS unit root test						
Country	S_t	D_t	y_t	ΔS_t	ΔD_t	Δy_t
Benin	-3.478*	-1.781	-2.090	-9.628*	-4.005*	-5.922*
Burkina Faso	-2.398	-2.486	-3.903*	-3.523*	-2.400	-8.683*
Cameroon	-2.373	-6.648*	-2.382	-7.095*	-3.152*	-1.921**
Cote d'Ivoire	-3.042**	-2.258	-1.216	-6.924*	-2.932**	-5.302*
Ghana	-2.425	-2.124	-1.192	-2.215*	-2.341*	-4.762*
Kenya	-3.985*	-2.051	-1.176	-8.598*	-1.815	-4.772*
Mali	-3.037**	-2.984**	-1.581	-6.380*	-2.046	-6.551
Mauritania	-2.611	-3.725*	-0.738	-1.282	-2.989**	-0.789
Niger	-3.299*	-0.797	-2.310	-7.018*	-2.189	-5.828*

Table 2. Contd.

Nigeria	-3.354*	-1.430	-2.679	-6.958*	-2.199	-4.061*
Senegal	-2.495	-3.654*	-1.970	-8.620*	-0.908	-8.309*
Sierra Leone	-2.088	-5.823*	-1.490	-7.827*	-2.469*	-4.977*
South Africa	-1.951	-1.940	-1.732	-6.571*	-1.826	-3.697*
Togo	-1.375	-3.637	-1.190	-9.769*	-2.915**	-4.50*
Zambia	-3.116**	-1.286	-1.606	-9.340*	-7.035*	-2.878
Zimbabwe	-2.396	-0.998	-2.004	-8.075*	-3.136**	-4.465*
			II. KPSS Test			
Benin	0.228	0.117	0.095	0.352	0.159	0.096
Burkina Faso	0.101	0.213*	0.087	0.053	0.116	0.060
Cameroon	0.171*	0.231	0.151*	0.500*	0.126**	0.137
Cote d'Ivoire	0.110	0.180	0.175*	0.079	0.114	0.140
Ghana	0.151*	0.208*	0.180*	0.500*	0.189*	0.323
Kenya	0.172*	0.226*	0.214*	0.500*	0.112	0.295
Mali	0.171*	0.189*	0.124**	0.358**	0.171*	0.150
Mauritania	0.169*	0.201*	0.144	0.033	0.094	0.431**
Niger	0.088	0.204*	0.102	0.119	0.072	0.075
Nigeria	0.087	0.140	0.096	0.394	0.133	0.091
Senegal	0.104	0.252	0.191*	0.075	0.128	0.369
Sierra Leone	0.121**	0.138**	0.150*	0.304	0.143	0.093
South Africa	0.182*	0.209*	0.186*	0.239	0.173*	0.215*
Togo	0.157*	0.222	0.198	0.219	0.131**	0.131**
Zambia	0.130**	0.179	0.121**	0.178	0.162	0.149*
Zimbabwe	0.105	0.203*	0.138	0.181	0.107	0.086

Notes: The DF-GLS statistic are compared to the critical values ERS (1996, Table 1). The bandwidth for KPSS test is selected using the Newey-West Bartlett kernel. Figures in parentheses are the 5% critical values. The critical values for KPSS test are obtained from Kwiatkowski et al. (1992, Table 1). *(**) denotes the rejection of the null hypothesis at the 5 % (10%) significance level. Source: Author's calculation from the World Development Indicators (World Bank, 2008).

the population has a significant impact on the saving rate and in particular that the dependency ratio has a negative impact on the savings rate. The central aim of this paper was to test whether such prediction holds in the context of African countries. We investigate this issue for a group of 16 African countries. We use the bounds approach of cointegration developed by Pesaran et al. (2001) and the Granger causality due to Toda and Yamamoto (1995). Of these 16 countries, we find a cointegration relationship between savings rate, dependency ratio and per capita income for 11 countries. The results from Granger causality tests reveal that dependency rate negatively causes savings rate in nine countries (Benin, Burkina Faso, Cote d'Ivoire, Ghana, Kenya, Mauritania, Nigeria, Zambia and Zimbabwe). Therefore, decrease in age dependency ratio for these countries could have positive impact on the long-run savings rates. The causal relation is found to be positive in two countries (Cameroon and Sierra Leone). For the remaining five countries (Mali, Niger, Senegal, South Africa and Togo) there is no evidence of

Table 3. Results of the bounds F-test for cointegration**.**

Country	F -statistic	Exact critical values			
		5%		10%	
		I(0)	I(1)	I(0)	I(1)
Benin	26.054^{4*}	4.304	5.154	3.635	4.395
Burkina Faso	2.795^{4}	4.304	5.154	3.635	4.395
Cameroon	15.354^{4*}	4.442	5.230	3.719	4.455
Cote d'Ivoire	7.964^{4*}	4.298	5.082	3.628	4.322
Ghana	12.515^{4*}	4.319	5.092	3.619	4.343
Kenya	17.013^{1*}	2.893	4.134	2.264	3.371
Mali	3.493^{3}	4.126	5.343	3.356	4.411
Mauritania	4.200^{4}	4.304	5.154	3.635	4.395
Niger	8.908^{3*}	4.127	5.274	4.363	4.371
Nigeria	4.937^{4*}	4.298	5.082	3.628	4.322
Senegal	2.904^{3}	4.067	5.137	3.338	4.314
Sierra Leone	19.924^{4*}	4.367	5.185	3.663	4.376
South Africa	4.122^{4}	4.304	5.154	3.635	4.395
Togo	10.088^{4*}	4.250	5.055	3.604	4.309
Zambia	6.848^{3*}	4.185	5.232	3.390	4.376
Zimbabwe	7.461^{4*}	4.321	5.179	3.642	4.376

Notes: [1], [3] and [4] denote cases I, III and IV, respectively, in Pesaran et al. (2001). Exact critical values for F-statistics are calculated using stochastic simulations based on 40 000 replications (see Pesaran et al. page 301). denotes statistical significance at the 5% level. Source: Author's calculation from the World Development Indicators (World Bank, 2008).

Table 4. Long-run coefficients.

Country	DR_t	y_t
Benin	-0.871^{*} (-5.104)	-27.741^{*} (-4.681)
Cameroon	0.349^{*} (12.859)	14.482^{*} (22.378)
Cote d'Ivoire	-0.168 (-0.758)	11.867^{*} (3.338)
Ghana	0.046 (0.470)	20.622^{*} (9.836)
Kenya	0.370^{*} (8.013)	-2.161^{*} (-4.584)
Niger	1.653^{*} (2.222)	8.294^{**} (1.854)
Nigeria	-0.189 (-0.512)	33.292^{*} (7.643)
Sierra Leone	5.763^{*} (6.959)	56.732^{*} (9.782)
Togo	-0.360 (-0.993)	44.856^{*} (4.628)
Zambia	7.214^{*} (2.341)	46.706^{*} (6.527)
Zimbabwe	-0.439^{*} (-2.488)	36.006^{*} (5.010)

Note: Asterisks * and ** denote statistical significance at the 5% and 10% levels, respectively. Source: Author's calculation from the World Development Indicators (World Bank, 2008).

causality running from dependency ratio to savings. This suggests that policies that lower the dependency ratio will have no impact on the savings rates.

Overall, our results show that one cannot argue that demographics do not matter for savings behaviour in African countries. There is a need for more individual country studies on the relationship between demographics and savings rate since results are country specific. Our findings also indicate pessimism regarding the possibility of increasing the savings rates of some African countries unless dependency rates are reduced. Most developing countries are at an earlier stage in the demographic transition induced by lower rates of fertility and mortality. However, the dependency ratios remained high compared to Asian countries. Even so, the decline in fertility is good news for savings and economic growth. Programs that will make available less costly and painful birth-reducing methods should be expanded, particularly

Table 5. Results of Toda and Yamamoto Granger non-causality tests.

Country	*k*	d_{max}	*p*-value	Sum of lagged coefficients
Benin	5	0	0.007*	-0.172
Burkina Faso	5	1	0.000*	-41.187
Cameroon	5	1	0.000*	10.359
Cote d'Ivoire	4	1	0.026*	-39.953
Ghana	4	1	0.000*	-49.368
Kenya	4	1	0.001*	-27.883
Mali	3	2	0.683	-75.355
Mauritania	5	1	0.000*	-93.552
Niger	4	1	0.481	4.724
Nigeria	4	0	0.001*	-1.310
Senegal	4	1	0.721	-6.272
Sierra Leone	4	1	0.002*	5.690
South Africa	4	2	0.796	1.884
Togo	5	1	0.110	-149.802
Zambia	5	2	0.000*	-144.2097
Zimbabwe	5	1	0.002*	-14.36736

Notes: *k* is the lag length of the level VAR and d_{max} is the maximal order of integration of the series in the system. Lag length selection was based on AIC and FPE criteria. Asterisks * denotes statistical significance at the 5% level, i.e. Granger non causality is rejected. Source: Author's calculation from the World Development Indicators (World Bank, 2008).

in rural areas where the motivation for fewer births is not yet present. In these areas, it will also be beneficial to create conditions for new attitudes toward births reduction.

Before closing, we offer some promising topics for future investigation. First, in this study we have examined the relationship between dependence ratio and savings rate within a trivariate setting. What the evidence may suggest is that there may be a number of factors at work that differ significantly across countries that account for the findings of this study. Re-examining the topic within a multivariate framework by incorporating some of these factors may be a line of inquiry that can help us understand the relationship between savings and demographics. Second, another interesting research topic to be examined in depth is the impact of income on the effect of dependency ratio on savings by using non-linear models. It is argued that demographic factors, like the dependency ratios, becomes operative and significant only when the per capita income reaches a level where it can provide more than a minimum level of living, thus generating potential savings. We intend to address these topics in future research.

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