

THE FIFTH ANNUAL CONFERENCE ON REGIONAL INTEGRATION IN AFRICA (ACRIA 5)

July 1-3, 2014

THEME: ACCELERATED ECONOMIC GROWTH IN WEST AFRICA

PAPER: Growth Accounting in ECOWAS Countries: A
Panel Unit Root and Panel Cointegration Approach

BY

Prof. Mohamed B.O Ndiaye*

and

Dr. Robert Dauda Korsu*

*** West African Monetary Agency, Freetown, Sierra Leone**

OUTLINE

1.INTRODUCTION

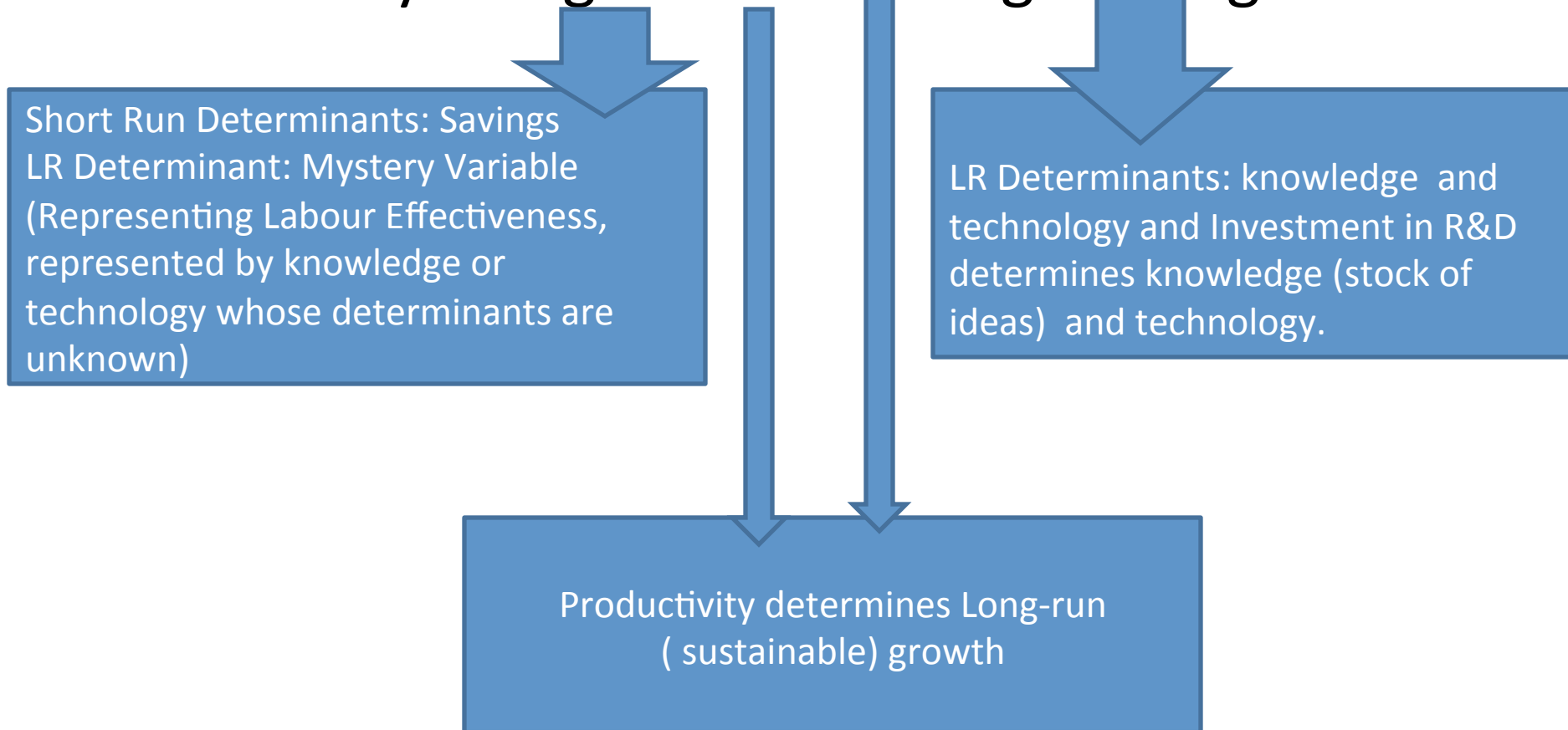
2.METHODOLOGY

3.EMPIRICAL RESULTS

4. CONCLUSION & POLICY IMPLICATIONS

1.INTRODUCTION

Growth Theory: Exogenous & Endogenous growth



1. INTRODUCTION

- The ECOWAS Countries have grown impressively in at least the last five years (with an average growth that is more than 5 percent) though there are growth differences across countries.

E.g Ghana's Growth (2011): 15.0 % , Sierra Leone(2012): 15.2 %

- **The Big Question**

The big question is: What is the source of the growth?

More of factor productivity or factor accumulation?

1. INTRODUCTION

□ Objective

- To investigate the contributions of capital, labour and their productivity (Total Factor Productivity-TFP) to growth in the ECOWAS region

□ Importance

For sustainable growth and development emphasis has to be on TFP

In spite of numerous common ECOWAS Agenda, dearth of studies on this issue for all the ECOWAS countries (partly due to lack of readily available data on capital stock for many countries in SSA in general). Output and labour data are available but employment data is also a challenge.

Dike (1995) and Kallon (2013) are country specific examples (Nigeria and Sierra Leone, respectively).

2. METHODOLOGY

- Estimation of contributions of accumulation of factors of production and factor productivity draws from the Cobb-Douglas production function with constant returns to scale.

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Estimation of contributions of accumulation of factors of production and factor productivity draws from the Cobb-Douglas production function with constant returns to scale.

$$Y = AK^\alpha L^{1-\alpha}$$

Hence,

$$\frac{\partial \ln Y}{\partial t} = \frac{\partial \ln A}{\partial t} + \alpha \frac{\partial \ln K}{\partial t} + (1-\alpha) \frac{\partial \ln L}{\partial t}$$

This implies:

$$\frac{\partial \ln A}{\partial t} = \frac{\partial \ln Y}{\partial t} - \alpha \frac{\partial \ln K}{\partial t} + (1-\alpha) \frac{\partial \ln L}{\partial t}$$

How is the α determined ?

2. METHODOLOGY

In terms of output per worker and capital per worker we have.

$$\frac{Y}{L}_t = A \left(\frac{K}{L} \right)_t^\alpha$$

Taking logarithm on both sides gives :

$$y = a + \alpha k \quad (1)$$

Annual Data: 1980 to 2012 for real GDP, real gross capital formation (GCF), labour force for all the ECOWAS countries, except Liberia (data availability issue on GCF)

Use perpetual inventory method to obtain K series (from the investment data (GFC data))

METHODOLOGY

□ How equation (1) is estimated

- Data from 1980 to 2012: Time dimension (T) is 33)
- Number of Countries is 14: Cross section dimension(N) is 14
- Hence, this is a macro panel with large T. The estimates of parameters would be subject to the spurious regression common in pure time series regression.
- Thus we apply panel unit root tests : Homogeneous panel tests-LLC, Breitung and Hadri and Heterogeneous panel tests-IPS, Maddala-Wu and Choi

3. EMPIRICAL RESULTS

Results of the Panel Unit Root Tests

	LLC	Breitung	Hadri	IPS	Maddala-Wu	Choi	Conclusion
Lny	0.9057	0.9947	0.0000	0.9908	0.3884	0.9845	Lny is I(1)
First Difference of LnY	0.0000*	0.0003*	0.0000	0.0000*	0.0000*	0.0000*	
Lnk	0.0000*	0.9956	0.0000	0.0402*	0.0001*	0.0427*	Lnk is I(2)
First Difference of LnK	0.4331	0.7365	0.0000	0.2194	0.2560	0.2247	
Second Difference of Lnk	0.0000*	0.0000*	0.0429*	0.0000*	0.0000*	0.0000*	

Note: The figures in the table are the probability of failing to reject the null. Hence, a p-value that is higher than 0.05 implies that we fail to reject the null hypothesis of the existence of unit root (the null of stationarity- in the case of the Breitung test). Asterisks have been placed on cases of rejection of the null hypothesis.

The Results Suggests the need for Cointegration tests, as the variables have unit root.

3. EMPIRICAL RESULTS

☐ Cointegration Tests

Methods Used:-

- Kao----- No Cointegration (CI)
- Pedroni--- No Cointegration (CI)
- Johansen Fisher– Cointegration (joint test)
- --No Cointegration (individual, except
- Benin and Ghana
- Westerlund Panel Error Correction Cointegration test—No
CI

3. Empirical Results

❑ Implication of the CI Result

No need to estimate a Panel Error Correction Model(PECM), a Dynamic Ordinary Least Squares (DOLS) or a Fully Modified Least Squares (FMOLS) Model.

❑ We have to estimate the **Fixed Effect** (One-way fixed effect and not the two-way fixed effect, given the long time dimension) and the **Random Effect model** (One way error component model and not the two-way error component model) **to account for the individual heterogeneity which is the hallmark of panel data technique.**

❑ The Hausman Test is applied to make the appropriate choice, though in large T the two yield the same result.

The Result of the Fixed Effect Model

Dependent Variable: DLNYPW				
Sample (adjusted): 1982 2012				
Periods included: 31				
Cross-sections included: 14				
Total panel (balanced) observations: 434				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
DDLNKPW	0.948601	0.135957	6.977209	0.0000
C	0.007081	0.002183	3.243196	0.0013
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.201688	Mean dependent var		0.006916
Adjusted R-squared	0.175014	S.D. dependent var		0.050072
S.E. of regression	0.045480	Akaike info criterion		-3.309159
Sum squared resid	0.866653	Schwarz criterion		-3.168386
Log likelihood	733.0876	Hannan-Quinn criter.		-3.253593
F-statistic	7.561224	Durbin-Watson stat		1.956798
Prob(F-statistic)	0.000000			

Note : The Within Estimator is used

3. The Random Effect Estimator

Dependent Variable: DLNYPW Sample (adjusted): 1982 2012 Periods included: 31 Cross-sections included: 14 Total panel (balanced) observations: 434 Swamy and Arora estimator of component variances				
Variable	Coefficient	Std. Error	t-Statistic	Prob
DDLNKPW	0.946777	0.135907	6.966378	0.0000
C	0.007080	0.004747	1.491475	0.1366
Effects Specification				
			S.D.	Rho
Cross-section random			0.015772	0.1074
Idiosyncratic random			0.045480	0.8926
Weighted Statistics				
R-squared	0.101153	Mean dependent var		0.003180
Adjusted R-squared	0.099072	S.D. dependent var		0.047873
S.E. of regression	0.045440	Sum squared resid		0.891977
F-statistic	48.61561	Durbin-Watson stat		1.901087
Prob(F-statistic)	0.000000			
Unweighted Statistics				
R-squared	0.091392	Mean dependent var		0.006916
Sum squared resid	0.986390	Durbin-Watson stat		1.719121

Note: The GLS is used

3. EMPIRICAL RESULTS

Contributions of Capital, Labour and TFP to Growth

Country	Contribution of Capital to Growth	Contribution of Labour to Growth	Contribution of TFP to Growth	Actual GDP Growth	Actual Growth of Capital	Actual Growth of Labour
Benin	2.2	0.2	1.6	4.0	2.4	3.2
Burkina	6.6	0.1	-1.6	5.1	6.9	2.8
Cape Verde	7.8	0.1	-0.4	7.5	8.2	1.6
Cote D'voire	-1.9	0.1	3.2	1.5	-2.0	2.8
Gambia	1.7	0.2	1.5	3.5	1.8	3.5
Ghana	8.9	0.1	-4.7	4.4	9.4	2.7
Guinea	6.9	0.1	-3.6	3.4	7.3	3.0
Guinea Bissau	1.3	0.1	1.3	2.7	1.4	2.2
Mali	4.3	0.1	-0.9	3.5	4.5	2.5
Niger	3.0	0.2	-0.6	2.5	3.1	3.4
Nigeria	-2.7	0.1	6.3	3.7	-2.8	2.6
Senegal	4.9	0.1	-1.8	3.3	5.1	2.9
Sierra Leone	1.4	0.1	0.8	2.3	1.5	2.0
Togo	1.9	0.1	0.1	2.2	2.0	2.8

3. EMPIRICAL RESULTS

- TFP was negative in 7 of the 14 countries
- TFP's contribution to growth was however strong only in Nigeria (6.3 %) and Cote d'Ivoire (3.2 %). However, in both countries real capital accumulation was negative. Suggesting that capital declined in real terms but its productivity increased.
- Countries that had high contribution of capital accumulation, which are Cape Verde (7.8 %), Ghana (8.9 %), Guinea (6.9 %), Mali (4.3 %) and Senegal(4.9 %) are the countries with negative contributions of total factor productivity. Hence, they observed decay in capital quality rather than increase in its quality or productivity.

3. EMPIRICAL RESULTS

- Out of all the countries that had higher than 3 % growth rate (9 countries) during the period 1980 to 2012, it was only Benin, Gambia and Nigeria that experienced positive contribution of TFP to growth.
 - This suggests that higher growing economies in ECOWAS are not factor-productive bias. A reflection of poor standard of living since it is increase in the productivity of factors of production, including labour, that has a long term welfare impact on the people/economy.

3. EMPIRICAL RESULTS

- In spite of differences in real GDP growth among the countries, the contribution of labour growth to growth in all the countries is 0.1 %, with the exception of Benin, Gambia and Niger where it was 0.2.
- This suggests a limit to the contribution of growth of labour to output growth in the region and it also suggests that there is no relationship between labour growth and its productivity. That is, in spite of growth in the number of workers, for which the labour force is the proxy here, the contribution of its growth to growth of output is very limited.

4. POLICY IMPLICATIONS

- As capital accumulation is the greatest contributor to growth in the ECOWAS region, it is imperative for the policy makers to design strategies for labors' contribution to increase as this would ameliorate income inequality problem between abundant capital sector and little capital sectors. This rests on the idea that ECOWAS Countries are labour surplus and capital scare and a majority of the people are employed in the agricultural sector, which do not involve huge capital.
- Supply side policy should be directed to putting weight on increasing the productivity of labour, which would not only reduce income inequality problem but would also help to reduce poverty, hence contributing to inclusive growth by sustaining long run growth. This requires efforts at expanding access to quality education; ensuring increased access to health care that is affordable; and increased investment in rural infrastructure.
- Raising productivity growth should also involve strong weight on technological progress, which can be easily achieved in the case of the ECOWAS countries through technological transfer rather than innovation. This requires efforts at building good governance, the legal framework, political stability and attractive package for foreign direct investments in the agricultural sector.

THE END

THANK YOU FOR YOUR ATTENTION