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TESTING THE VALIDITY OF OKUN'S LAW FOR AFRICAN COUNTRIES: A PANEL COINTEGRATION ANALYSIS

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Abstract

The purpose of this paper is to test the validity of the Okun's Law for some African countries. We made use of data for 15 countries covering the period 1960-2014. The methodology employs new panel unit root tests and Panel Cointegration analysis that takes into account cross-section dependence. The empirical specification of our model uses employment level as dependent variable and population, stockof capital, and real GDP as independent variables. Our results show no evidence of validity of Okun's Law when taking into account cross-section dependence. In contrast, the population size and the stock of capital have a significant impact on employment level in the long-run. So to promote employment, demand side policies may not be effective.

Keywords: Okun Law, Panel data, Pooled Mean Group Estimator, cross-section dependence,Cointegration.

1. INTRODUCTION

Since the seminal paper of Okun (1962), many studies have been undertaken on the relationship between the market of goods and services and that of labor market. Using U.S data, Okun showed that for a one percentage point of unemployment greater than 4 percent, output gap decreases by 3%. Okun's Law is estimated in two versions: the differenced one and the gap one. Among the extensive studies of Okun's Law, there are only a few papers using panel data. Moreover, although a broad literature exists for developed countries and for African countries, there are not enough.

The literature shows that works on Okun's relationship give mixed conclusions.While some paperssupport its validity (Apergis and Rezitis, 2003; Noor et al., 2007; Dritsaki and Dritsakis, 2009; Irfan et al.,2010; Tatoglu, 2011, Makun and Azu 2015), others disputed it (Babalola et al., 2013; Moroke et al., 2014; Sadiku et al., 2015; Abu, 2016; Udude and Nnachi, 2017).

These different results led to critics of Okun's Law. For example, it is argued that the first difference version may give biased estimates if the series are cointegrated (Huang & Yeh, 2013). In addition, the coefficients, estimated with the gap version, differ with the method of filtering (Lee, 2000; Freeman,2003; Adanu, 2005). Another critic of the Okun Law is that the relationship between unemployment and production is not linear (Fouqueau, 2008; Valdakhani and Smyth, 2015).

To account for criticisms of the difference and the gap models, Huang and Yeh (2013) employed the Pooled Mean Group Estimator (PMG) to directly estimate Okun's relationship in the short and long run. Their estimates apply to both OECD and non-OECD countries. They also explore Okun's relationship within US states. However, Huang and Yeh (2013) did not study the possibility of correlation between countries. Yet, because of common response to shocks or common unobserved factors due to for example neighbourhood, cross-countries errors may be correlated. Ignoring such cross-section dependency may lead to biased and inconsistent estimators of Okun coefficients.

The purpose of this study is to shed more light on the Okun's relationship by using heterogeneous Panel Cointegration analysis applied to data for African countries. In lieu of unemployment rate, we use the employment level. Indeed, the problem of estimating Okun's relationship for African countries entails not only the lack of long time series on unemployment rate, but also the variability of the definition of unemployment. This is why, in general, for African Countries, the works are focused on the relationship between employment and growth (Kapsos, 2005, Kamgnia, 2009). We also added in our analysis two variables that may influence employment: population and capital stock.

Our conclusions suggest that assuming cross-section independence when data exhibit cross-section dependence may give inconsistent Okun coefficients and misleading policy advices.

The rest of the paper is organized as follows: section 2 gives a brief literature review of the relationship between employment and growth. In section 3, we developed the methodology. Section 4 is devoted to the presentation of the data. The results are presented in section 5. Section 6 concludes the paper.

2. LITERATURE REVIEW

Okun's relationship with employment as a dependent variable is used to estimate the employment intensity of growth. The advantage of this specification is also that it avoids ambiguities related to the variability of the definition of unemployment. In addition, it gives the possibility of estimating the employment response to output by sector, region, age group and gender.

Boltho and Glyn (1995) examined this relationship from OECD countries data from 1960 to 1993. The main findings of their research show that there is a strong relationship between employment and growth. In addition, Pianta, Evangelista and Perani (1996) analyzed the relationship between value added and employment and productivity in secondary sectors of G7 countries (excluding Canada) over the period 1980- 1992. They found a positive relationship between growth in value added and employment growth. Padanilo and Vivareli (1997) investigated the employment intensity of growth in different sectors of the G7 economies. They show that in the industrial sector, the employment elasticity is generally negative, whereas it is positive for the service sector. Kamgnia (2009) studied the relationship between growth, the ratio of credit to the private sector, the foreign direct investment ratio, and employment from a panel of35 African countries. She uses as an estimation method, a dynamic Panel model, and found a positive relationship between real GDP and the level of employment.

Perugini (2009) studied the relationship between employment and output growth in Italy over the period 1970-2004. He found that in Italy, over the period, a 1% economic growth leads to an increase in employment of 0.2%; however, he noted a variation by region. Sodipe and Ogunrinola (2011) estimated for Nigeria a first difference model and a gap model. Both models give positive coefficients between employment and growth rate. Ezahid and El Alaoui (2014) focus on Morocco over the period 1991-2011. They used a simple linear regression model and found a positive relationship between employment and growth. Ningaye et al. (2015) estimated the elasticity of employment to economic growth and analyze the macroeconomic determinants of this elasticity in Cameroon. They also found a positive relationship between employment and economic growth.

Sahin et al. (2013) focused on Turkey in regards to the overall relationship between output andemployment and the link between sectoral employment and overall output, over 1988-2008. They usedcointegration method and found no cointegration relationship between total output and total employment. Slimane (2015) studied the relationship between growth and employment for some 90 developingcountries over the period 1991-2011. He used a linear regression model and found positive employmentelasticities for growth in almost all African countries.

Consequently, studies dealing with panel data omitted to take into account the problem of cross-countries error correlation. Yet, countries may have similar characteristics and might have a significant influence on each other. If this is true, estimation that do not correct for cross-section dependence may give inconsistent results and thus misleading advices. Consequently, we use in this paper a methodology that can estimate short and long-run Okun coefficients while taking into account cross-section dependence.

3 THE METHODOLOGY

To estimate the Okun's relationship, we assume that employment level is explained by the level of production measured by Gross Domestic Product. We also assume that labor force in a country relies on the size of the population. So country with higher population size has higher labor force. We also consider that when the stock of capital incorporates high productive technology, the demand of high-skilled labor increases while that of low-skilled labor decreases. So in a country with abundant low-skilled labor, there can be a negative relationship between the stock of capital and employment if the stock of capital incorporates more productive technologies.

Here, we start with the following long-run relationship:

$$\ln L_{it} = \mu_i + \Phi_{0t} + \Phi_{1t} \ln Y_{it} + \Phi_{2t} \ln POP_{it} + \Phi_{3t} \ln K_{it} + \varepsilon_{it} \quad (1)$$

Where i=1,…,N ; t=1,…, T. N represents the number of branches in the Panel, T the number of years, and ^{i} is the fixed effect parameter. Before estimating equation (1), we first tested the unit root of the data by using Panel unit roots tests of first and second generations. Then we proceed with the Panel Cointegration analysis and estimated the long-run equation (1). In addition, we estimated an error correction model to obtain short-run dynamics and give confirmation of cointegration.

3.1. Cross-section dependence and Panel Unit Root Tests

The methodology of Panel unit root tests follows two steps: first we test for the presence of cross-section dependence in the data. Cross-section dependence test is important to undertake appropriate Panel unit root-tests. We employ the Peasaran (2004) CD test of cross-section dependence as shown below:

Let ρ_{ij} be the correlation between the country i and the country j of a variable.

The Peasaran's (2004) statistic of cross-sectional independence is given as:

$$CD = \left[\frac{2}{N(N-1)}\right]^{1/2} \left[\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \sqrt{T_{ij}\rho_{ij}}\right] \quad (2)$$

Where T_{ij} is the number of observations used to calculate the correlation coefficient. The CD statistic follows a standard normal distribution under the null hypothesis of cross-section independence

After testing for cross-section dependence, we conducted Panel unit root tests. There are two generations of tests: first-generation and second-generation one. The first-generation tests assume cross-sectional independence of errors (Hurlin and Mignon, 2007). We made use of two types of first generation tests: the Maddala and Wu (WM) test (1999) and the IPS test of Im, Peasaran and Shin (1997, 2003). Second generation tests release the hypothesis of cross-section independence. One of the most used tests is the Peasaran CIPS test (2007).

3.2 Cointegration Analysis

After analyzing stationarity of the data, we make use of the Westerlund (2007) and Persyn and Westerlund (2008) methodology to test for cointegration between lnL, lnY, lnPOP, and lnK. The Westerlund test defines two groups of tests: Group-mean tests and Panel tests. For each group, two statistics are calculated: one with standard error standard (Gt, Pt) and another with standard error (Ga, Pa) calculated from the method of Newey-West (1994). The advantage of the Westerlund test is that, by using the bootstrapping procedure, it is applicable even in case of cross-section dependence.

For estimating the long-run equation (1) along with the short run-dynamics, we proceed as opined by Huang and Yeh (2013) using Pooled Mean group (Peasaran et al., 1999) and Mean Group (Peasaran & Smith, 1995) estimations (Thereafter PMG and MG).

Following Peasaran et al. (1999) and Frank (2005), in this paper, we take the maximum lag as being one. So a standard PMG model without cross section dependence is estimated by the dynamic version ARDL (1,1,1,1) of the long-run model as follows:

$$\ln L_{it} = \delta_{10i} \ln Y_{it} + \delta_{11i} \ln Y_{it-1} + \delta_{20i} \ln POP_{it} + \delta_{21i} \ln POP_{it-1} + \delta_{30i} \ln K_{it} + \delta_{31} \ln K_{it-1} + $$
$$+ \lambda \ln L_{it-1} \mu_i + \varepsilon_{it} \qquad (3)$$

The error correction representation of this equation is given as:

$$\Delta \ln L_{it} = \phi_i (\ln L_{it} - \Phi_{0i} - \Phi_{1i} \ln Y_{it} - \Phi_{2i} \ln POP_{it} - \Phi_{3i} \ln K_{it}) + \delta_{0i} + \delta_{11i} \Delta \ln Y_{it} + $$
$$\delta_{21i} \Delta \ln POP_{it} + \delta_{31i} \Delta \ln K_{it} + \varepsilon_{it} \qquad (4)$$

Where: ln is the natural logarithm, Δ is the difference operator,

$$\phi_i = -1(1-\lambda_i); \Phi_{0i} = \frac{\mu_i}{1-\lambda_i}; \Phi_{1i} = \frac{\delta_{10i} + \delta_{11i}}{1-\lambda_i}; \Phi_{2i} = \frac{\delta_{20i} + \delta_{21i}}{1-\lambda_i}; \Phi_{3i} = \frac{\delta_{30i} + \delta_{31i}}{1-\lambda_i}.$$

φi is the speed of adjustment toward the equilibrium. If φi<0, this gives confirmation of the existence of the long-run relationship.

In addition to this type of model, we estimate a Common Correlated Effects (CCE) of the PMG (or MG) model to take into account cross-section dependence (Peasaran, 2006; Chudik & Peasaran, 2015; Ditzen, 2016). The Common Correlated Effects estimates the model by adding cross sectional means of the dependent and all independent variables. These cross sectional means are proxies for unobserved common factors (Ditzen, 2016). The Peasaran CD test is used to check for cross-section dependence after estimation. In addition, the choice between a PMG model and a MG Model is done by using the Hausman test below.

H0: There is homogeneity in the long-term parameters,

HA: There is heterogeneity in the long-run parameters.

$$H = [b-B]' [V(b) - V(B)]^{-1} [b-B] \qquad (5)$$

b= coefficient under the MG Model

B=coefficient under the PMG Model The statistic H follows a $\chi 2$ distribution under the null hypothesis of parameters homogeneity in the long-run.

3. DATA

This study uses annual data for 15 sub-Saharan African countries obtained from the Penn World Table 9.0 database (Feenstra et al., 2015). The time period is 1960-2014. The number of countries is due to the fact that we wanted to have the longest time series. Consequently, countries for which data were not available for this period were not included. The countries selected for this study are: Burkina Faso, Côte d'Ivoire, Cameroon, Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Mali, Mozambique, Mozambique, Malawi, Niger, Nigeria, Senegal, South Africa, and Zambia. Table 1 presents the descriptive statistics of the variables in level.

Table 1 Definition and descriptive statistics of the variables

Variable	Definition	Total Observations	Mean	Standard deviation
lnL_{it}	Number of persons engaged (in millions)	825	8.1722	9.2815
lnY_{it}	Output-side real GDP at chained PPPs (inmillions. 2011 US$)	825	62, 697.12	128, 472.9
$lnPOP_{it}$	Population (in millions)	825	22.9106	26.7391
lnK_{it}	Capital stock at constant 2011 national prices (in millions. 2011 US$)	825	111, 908.7	254, 721.1

5. EMPIRICAL RESULTS

5.1 Stochastic Properties

In this section, we provide the results of the cross-section dependence test, the Unit root-test, and the cointegration test.

The results of the Peasaran cross-section dependence test are reported in Table 2. The test is performed for the level and first differenced data and one lag order. We can notice that the correlations coefficients of the variables in level are high. Moreover, apart from the variable ΔlnPOPit, the hypothesis of cross-section independence was strongly rejected.

Table 2: Cross-section dependence Test

	CD stat.	Prob.	Corr.	Abs.(corr.)
lnL_{it}	74.70	0.000	0.983	0.983
lnY_{it}	52.74	0.000	0.694	0.738
$lnPOP_{it}$	75.42	0.000	0.992	0.992
lnK_{it}	64.47	0.000	0.848	0.848
ΔlnL_{it}	4.42	0.000	0.059	0.231
ΔlnY_{it}	4.08	0.000	0.054	135
$\Delta lnPOP_{it}$	0.11	0.911	0.001	0.348
ΔlnK_{it}	19.78	0.000	0.263	0.369

Note: Peasaran (2004) CD test is conducted under the null hypothesis of cross- section independence.

Tables 3 and 4 present the results of unit root tests. The tests are performed based on specifications with constant and trend respectively. Significance levels are given in parentheses. Table 3 is relative to the first generation tests, namely the IPS and Maddala and

Wu tests. These tests are used for the variable, ΔlnPOPit , since the CD test did not reject the cross-section independence hypothesis for this variable. For the other variables, the CIPS test of Peasaran is used. A maximum lag of three was retained for the Maddala and Wu test and the Peasaran CIPS test. With regard to the IPS test, the optimal lag has been obtained by the AIC statistic starting from a maximum lag of 5.

Tables 4 shows that for the variables in level, the unit root hypothesis cannot be rejected. All the variables have a non-significant CIPS statistic except the lnPOP variable which is significant at the 1% level only with a 1-order ..lag. On the other hand, the unit root is strongly rejected with the differentiated variables. For all the lags, the CIPS statistic is significant at the 1% level. We can therefore conclude that our variables are I (1).

Table 3. First generation Panel Unit root test of ΔlnPOPit

Lags	IPS		Maddala and Wu		
	No Trend	Trend	Lags	No Trend	Trend
			0	71.317(0.000)	47.408 (0.023)
			1	158.60(0.000)	138.868 (0.000)
2	-4.904(0.000)	-3.903 (0.000)	2	65.639(0.000)	49.160(0.015)
			3	65.028(0.000)	49.350(0.014)

Note: The null hypothesis of IPS and Maddala and Wu tests is no stationarity; P-value in parenthesis.

The results of the cointegratéion test are given in Table 5. The table shows the four (4) statistics of Westerlund and the Robust P-values. The statistics have been calculated without a trend and with a trend and a bootstrapping using 100 replicates. The robust statistics strongly rejected the hypothesis of no cointegration for a specification without trend. We can conclude that our three variables, lnL, lnY, lnPOP, and lnK, are cointegrated. With the standard PMG model, this induces an increase of 0.031 percent in employment level.

Table 4 Second Generation Panel Unit root test

Without Trend						With Trend		
Lags	0	1	2	3	0	1	2	3
lnL_{it}	0.997	0.378	0.541	0.468	1.00	0.735	0.711	0.529
lnY_{it}	0.99	0.916	0.935	0.591	0.999	0.989	0.965	0.434
$lnPOP_{it}$	1.000	0.000	0.985	0.418	1.000	0.000	1.000	0..998
lnK_{it}	1.000	0.908	0.753	0.792	1.000	0839	0.753	0.790
ΔlnL_{it}	0.000	0.000	0.001	0.002	0.000	0.000	0.030	0.253
ΔlnY_{it}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ΔlnK_{it}	0.000	0.000	0.001	0.001	0.000	0.004	0.0036	0.023

Note: The values in the tables are the P-values. The null hypothesis of the CIPS test is no stationarity.

Table 5 Westerlund Cointegration test result

	Value	Z-value	P-value	Robust P-value
Without Trend				
Gt	-2.572	-1.391	0.082	0.050
Ga	-15.369	-2.424	0.008	0.000
Pt	-5.652	1.690	0.955	0.620
Pa	-9.139	-0.992	0.161	0.000
With Trend				
Gt	-2.660	0.196	0.578	0.440

Ga	-4.944	5.101	1.000	1.000
Pt	-7.523	2.143	0.984	0.750
Pa	-4.538	3.880	1.000	0.980

Note: Gt and Ga are group mean tests and Pt and Pa are panel test. Average lag length 1.2 and lead length 0.2 determined by AIC criterion. Bootstrap replications 100. The null Hypothesis is no Cointegration.

5.2 Okun Coefficients and the Problem of Cross-section Dependence

Table 6 reports the results of the long-run and short run estimations of the Okun's relationship, the cross- section dependence and the Hausman tests. The second column is for the standard MG and PMG models. The two models are developed considering a maximum lag of one for the cross-section dependence test. The result of the Hausman test shows that we cannot reject the hypothesis of homogeneity in the long-run parameters. This indicates that the PMG model is more robust than the MG regression. In this model, real GDP has a positive and significant impact on employment in the short-run. But it does not impact employment in the long-run. However, the country's population has a significant impact on employment in the short and the long-run. These findings are however inconsistent since the CD statistic of cross- section dependence is not significant. So we cannot reject the null hypothesis of cross-country error dependence. We thus turn to the CCE models that accommodate with cross-section dependence. Results are reported in the third column of Table 6. We also used a maximum lag of one for the cross-section dependence test and conduct hausman test. The hausman statistic rejects the null hypothesis of long-run parameters homogeneity; whereas the CD statistic indicates cross-section independence and consistency of the estimations. The appropriate estimation is thus the CCE-MG model. The CCE-MG model gives confirmation to the existence of a long-run equilibrium relationship. The error correction coefficient φ_i (-0.312) is negative and highly significant. The coefficient of real GDP is however not significant neither inthe short run nor in the long-run. While, in the long-run the coefficient of the population variable is positive and significant at 5% level and that of the stock of capital is negative and significant at 1%. Sowe can conclude that the Okun's relationship does not hold for these African countries. Besides, the valueof the coefficient of the stock of capital is -0.104. Ceteris paribus, when, the stock of capital increases by one percent, the employment level decreases by 0.104 percent. Employment and stock of capital are thus substitutes. As we hypothesized, these countries are low skilled labor abundant and investment in the long-run incorporates high skilled technology. So increasing investment in the long-run reduces the demand for low skilled labor and consequently, the employment level.

The individual countries coefficients of the CCE-MG regression are displayed in table 7 (see appendix). Three important informations emerge in the table. First, in all the countries except for three, in the short run, real GDP does not impact significantly employment. The three countries are: Ghana, Mali and South Africa. The coefficient for Mali is negative. A one percent increase in real GDP induces a reduction in employment of 0.068 percent. Consequently, in the short run there is jobless growth in this country. In South Africa and Ghana employment is driven by economic growth. The coefficient of South Africa is positive and suggests that a one percent increase in real GDP induces an increase in employment by 0.142percent. In Ghana, a one percent increase of real GDP induces an augmentation of the level of employment by 0.10 percent.

The second information is that, in the long-run, in only two countries (Mali and Nigeria) Okun's law is valid. The Okun's coefficient is of 0.208 for Mali and 0.04 for Nigeria. In Mali,

in the long-run, a one percent increase in real GDP leads to an augmentation of the level of employment by 0.208 percent. In Nigeria the response is lower. Indeed, an increase of real GDP by one percent leads to a 0.04 percent increase in employment.
The third important information is given by the coefficient of the speed of adjustment. This parameter shows us how the labor market adjusts to its equilibrium level after a shock. This can thus be an indication of the quantitative labor market flexibility since when the speed of adjustment is low; the adjustment costs in the labor market are high. In seven (7) out of fifteen (15) countries, the coefficient of the speed of adjustment is significant and negative: Ghana, Kenya, Mali, Mozambique, Malawi, Nigeria and South Africa. In addition we have two groups of countries. One group where after a disequilibrium it would take around three (3) years for employment to adjust to its equilibrium value. In this group we have five countries: Ghana, Kenya, Mozambique, Malawi, and South Africa. The second group of countries where the delay of adjustment is lower. Indeed after a shock it would take around two years for employment to reach its equilibrium level. These countries are: Mali and Nigeria. We can notice that these are the two countries where real GDP impacts positively and significantly employment in the long- run. So the validity of Okun's law in the long-run may also depend on the importance of the Labor market's flexibility.

Table 7 Individual countries coefficients of the CCE-MG regression

Countries	ΔlnL_{it-1}	ΔlnY_{it}	$\Delta lnPOP_{it}$	ΔlnK_{it}	Cst	φ_i	lnY_{it}	$lnPOP_{it}$	lnK_{it}
Burkina Faso	0.037	0.049	0.541	0.136	2.139[a]	-0,207	-0.355	-0.106	-0.194
Côte d'Ivoire	0.186	-0.011	0.429	-0.006	-0.332	-0,26	0.052	0.614	-0.016
Cameroon	0.683	0.036	-0.155	-0.008	-0.462	-0,088	-0.429	6.042	0.096
DR of the Congo	0.527	0.0002	-0,.155	0.002	-0.064	-0,352	0.00008	1.377	-0.011
Ethiopia	0.306	-0.009	0.638	-0.055	-0.728	-0,292	0.055	0.349	0.002
Ghana	-0.078	0.1[c]	-0.556	0.124	-2.01[b]	-0,307[c]	0.102	0.295	-0.369
Kenya	0.144	-0.005	-2.249	-0.09	-0.877	-0,318[a]	0.115	-0.707	-0.06
Mali	0.256[b]	-0.068[b]	-0.446	-0.073	3.452[c]	-0,587[c]	0.208[b]	1.563[c]	-0.404[c]
Mozambique	0.446	-0.024	0.162	0.119	0.994	-0,559[a]	0.073	1.112[c]	-0.003
Malawi	0.034	0.004	0.624[b]	0.002	-1.986	-0,357[c]	0.17	1.736[c]	-0.153[c]
Niger	0.342	-0.007	1.635	-0.0006	0.255	-0,192	0.04	1.257	-0.042
Nigeria	0.27[b]	-0.002	-1.115	0.014	-0.29[c]	-0,627[c]	0.041[a]	3.973[c]	0.003
Senegal	0.003	0.031	-1.275	0.041	0.424	-0,21	-0.023	-0.189	-0.309[c]
South Africa	0.163	0.142[a]	3.863[b]	-0.029	2.356	-0,292[c]	-0.252	-1.024	0.025
Zambia	-0.03	0.041	0.41	0.045	-0.888	-0,025	-0.743	0.775	-0.125

Note: [a],[b] and [c] indicate significance at 10, 5 and 1% respectively

5 CONCLUSION

The purpose of this paper is to estimate the Okun coefficient for some African countries It utilizes dataon long time series and a Panel of 15 countries The methodology is based on cointegration analysis and estimation of PMG and MG models The results reveal that cross-section dependence between African countries is important It also gives no evidence of Okun's law validity, which corroborate with the findings of Abu (2016), Sadiku et al (2015), Moroke et al (2014), Babalola et al (2013), and Udude and Nnachi (2017).

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Appendix

Table 6 Estimates of PMG and MG models

		Models
	Mean Group	CCE Mean Group
Short-run		
	0.335	0.220
ΔlnL_{it-1}	(6.10)***	(3.92)***
ΔlnY_{it}	0.027	0.018
	(1.88)*	(1.39)
$\Delta lnPOP_{it}$	0.628	0.157
	(1.61)	(0.44)
ΔlnK_{it}	-0.04	0.015
	(-0.22)	(0.83)
Cst.	-0.163	0.132
	(-2.92)***	(0.33)
Long-run		
Error correction coefficient		
ϕ_i	-0.137	-0.312
	(-4.6)***	(-7.05)***
lnY_{it}	-0.518	-0.063
	(-1.08)	(-0.3)
	(-0.90)	(-2.65)***
$lnPOP_{it}$		
	3.393	1.138
	(1.40)	(2.44)**
	Pooled Mean Group	CCE Pooled Mean Group
lnKit	-0.744	-0.104
	(-0.90)	(-2.65)***
CD Statistic	1.58	-2.53**
Short-run		
	0.403	0.187
ΔlnLit-1	(6.13)***	(3.37)***
ΔlnYit	0.031	0.020
	(2.85)***	(2.00)**
ΔlnPOPit	0.618	0.244
	(2.01)**	(0.51)
ΔlnKit	-0.001	-0.014
	(-0.10)	(-0.73)
Cst.	-0.057	-0.147
	(-7.0)***	(-0.50)
Long-run		
Error Correction coefficient		
ϕ_i	-0.050	-0.218
	(-5.82)***	(-8.45)***
lnYit	0.027	0.057
	(0.62)	(2.06)*
lnPOPit		
	1.018	0.925
	(17.72)***	(3.93)***
lnKit		

	-0.026	-0.027
	(-0.75)	(-1.21)
CD Statistic	1.09	-3.68***
Hausman Test	2.91	149.19***
Number of countries	15	15
Number of Observations	810	810

Note: The dependent variable is lnL_{it} for the long-run equation and ΔlnL_{it} for the short-run equation. ϕ_i is the error correction term. Cross-section lag is one. The CD test is conducted under the null hypothesis of cross-section dependence. The values in parentheses are t-statistics. The null hypothesis for the Hausman test is PMG Model (Homogeneity in long-run parameters).*, ** and *** indicate significance at 10, 5 and1% respectively.