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A POOLED MEAN GROUP ESTIMATION OF GOVERNMENT EXPENSES

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Abstract:
This article investigates the relationship between cash payments for operating activities of the government in providing goods and services, subsidies and other transfers, other expenses, interest payments, goods and services expenses, and compensation of employees in five countries over the period 1995-2020 via Pooled Mean Group (PMG) estimator. The series are non-stationary with a time-dependent structure. Bidirectional, unidirectional and independent interactions exist between some indicators in the model. ARDL (1,2,2,2,2,2) for two lags at the constant level trend specification was selected out of the four models that were apparent. The deviation from the long-run equilibrium rate in the government expenses is corrected separately for Belgium, Germany, Netherlands, Norway, and the United Kingdom by 17.41%, 19.82%, 63.37%, 10.18%, and 51.95% the following year; besides, Netherland is more speedily to the adjustment followed by the United Kingdom. All the countries jointly take a speed of -0.325452 to return back to equilibrium; consequently, the deviation from the long-run equilibrium rate in government expenses is determined by 32.55% in the succeeding year. In the long run, subsidies and other transfers, interest payments, goods and services expenses, and compensation of employees resulted in negative effects on government expenses; In contrast, other expenses bring about a positive weight of 35.20% on government expenses. Convincingly, other expenses have a more significant effect on government expenses' fluctuation for the sub-region; interest payments have a more significant effect on subsidies and other transfers' fluctuation for the sub-region; also, compensation of employees have a more significant effect on goods and services expenses' fluctuation for the sub-region.

Keywords: ARDL (1,2,2,2,2,2), Government expenses, Long-run equilibrium, Pooled mean group estimator, Time dependent structure.

Introduction

The unique properties that are not distinguishable in cross-section or time-series antiquities can be foreseen by means of panel data and more compound team up models can be corroborated while imposing smaller amount of restrictions (Pesaran, et al. 1995; Baltagi, et al. 2000; Hsiao, 2003; Martinez-Zarzoso and Bengochea-Morancho, 2004; Baltagi, 2014, 2015). In panel frameworks by means of separate effects, the linkage between the mean differenced regressors and the error duration is stimulating due to unfairness prompted in the review of autoregressive distributed lag, ARDL models. This inequitableness only croaks away for enormous sizes of clarifications which cannot be attuned by cumulating the number of cross-sections (Arellano, 2004). Pesaran, et al. 1999 projected the pooled mean group estimator that takes the cointegration system of the simple ARDL model and acclimatizes it for panel scenery by permitting the intercepts, short-run quantities and cointegrating relations of the cross-sections to fluctuate transversely (Baltagi and Griffin, 1984, 1997; Pesaran, et al. 1997, 1999; Freeman, 2000 Baltagi, et al. 2008).

Government Expense (GE) is cash payments for operating activities of the government in providing goods and services. It includes compensation of employees (such as wages and salaries), interest and subsidies, grants, social benefits, and other expenses such as rent and dividends.

Subsidies and other transfers (SOT) are subsidies, grants, and other social benefits include all unrequited, non-repayable transfers on current account to private and public enterprises; grants to foreign governments, international organizations, and other government units; and social security, social assistance benefits, and employer social benefits in cash and in kind.

Other expense OE) is spending on dividends, rent, and other miscellaneous expenses, including provision for consumption of fixed capital.

Interest payments (IP) include interest payments on government debt-including long-term bonds, long-term loans, and other debt instruments--to domestic and foreign residents.

Goods and services expense (GSE) include all government payments in exchange for goods and services used for the production of market and nonmarket goods and services. Own-account capital formation is excluded.

Compensation of employees (CE) consists of all payments in cash, as well as in kind (such as food and housing), to employees in return for services rendered, and government contributions to social insurance schemes such as social security and pensions that provide benefits to employees.

Material and Methods

If is pragmatic for all nations i=1,...,N (individual-level observations) across all time epochs t=1,...,T (time series observations) with cross-section dimension subscript i and time as subscript t. The reparametrized error correction equation is prearranged as (Anderson and Hsiao, 1981, 1982; Schoenberg, 1997; Baltagi, et al. 2003; Gujarati, 2003; Pedroni, 1999, 2004):

$$\Delta R_{i,t} = \pi_i \theta_{i,t} + \sum_{j=1}^{p-1} \lambda_{i,j} \Delta R_{i,t-j} + \sum_{j=0}^{q-1} \Delta D_{i,t-j} \beta'_{i,j} + \varepsilon_{i,t} \qquad (2.1)$$

where $\pi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right)$ are the adjustment coefficients that ranges between -1 and 0, they are expected to be negative; annually to reach at the steady state.

$\theta_{i,t} = R_{i,t-1} - \mu'_i D_{it}$ is the error-correcting speed of adjustment term and $\mu_i = \frac{\sum_{j=0}^{q} \beta_{ij}}{\left(1 - \sum_{k} \lambda_{ik}\right)}$ are the long-run coefficients; If S_{it} has finite autoregressive representations; then, dependence of instructive variables on the disturbances is allowed when estimating $\theta_{i,t}$;

$\lambda_{ij} = -\sum_{m-j+1}^{p} \lambda_{im}$ for $j = 1, 2, \ldots, p-1$ are (k×1) vector of parameters constant across groups to be estimated on the dependent variable;

$\beta_{ij} = -\sum_{m=j+1}^{q} \beta_{im}$ for $j = 1, 2, \ldots, \mathrm{q}-1$ are (k×1) vector of parameters constant across groups to be estimated on the explanatory variable;

$D_{it} = \left(d_{i1}, \ldots, \mathrm{d}_{iT}\right)'$ are (T×k) possibly time-varying vector of covariate on k instructive variables that can vary across groups and time periods; while, $\Delta D_i = D_i - D_{i-1} = \left(\Delta d_{\mathrm{i},1}, \Delta d_{\mathrm{i},2}, \ldots, \Delta d_{\mathrm{i},\mathrm{T_i}}\right)'$ are j lagged values of ΔD_i ;

$R_{it} = \left(r_{i1}, \ldots, \mathrm{r}_{iT}\right)'$ are (Tx1) vectors of observation on the control variable of the ith group; while, $\Delta R_i = R_i - R_{i-1} = \left(\Delta r_{\mathrm{i},1}, \Delta r_{\mathrm{i},2}, \ldots, \Delta r_{\mathrm{i},\mathrm{T_i}}\right)'$ are j lagged values of ΔR_i ; and

$\varepsilon_{it} = \left(\varepsilon_{i1}, \ldots, \varepsilon_{iT}\right)'$ are time-invariant and accounts for any unobservable individual-specific error term. In order to estimate consistence short-run measurements, it is obligatory that the disturbances are not interrelated with the regressors. The same number of lags is expected in each cross-section for the dependent variable and the regressors; hereafter, the concentrated log-likelihood function is a product of each cross-section's likelihood given as (Wooldridge, 2000; Gujarati, 2003):

$$L_t(\varphi) = -\frac{T_i}{2} \sum_{i=1}^{N} \log\left(2\pi\sigma_i^2\right) - \frac{1}{2} \sum_{i=1}^{N} \frac{1}{\sigma_i^2} \left(\Delta R_i - \pi_i \theta_i\right)' W_i \left(\Delta R_i - \pi_i \theta_i\right) \qquad (2.2)$$

where $\theta_i = \left(\theta_{\mathrm{i},1}, \theta_{\mathrm{i},2}, \ldots, \theta_{\mathrm{i},\mathrm{T_i}}\right)'$, $W_i = \left(I_{T_i} - X_i \left(X'_i X_i\right)^{-1} X'_i\right)^{-1}$ and $X_i = \left(\Delta R_{i,-1}, \ldots, \Delta R_{i,-p+1}, \Delta D_i, \Delta D_{i,-1}, \ldots, \Delta D_{i,-q+1}\right)$ The mean group (MG) intermediate estimator accepts that the intercept, short-run coefficients, and error variances can veer off transversely in the clusters as pronounced by Pesaran, Shin and Smith; while, unweighted arithmetic mean of diverse coefficients are premeditated for the whole panel. The fixed effect (FE) transitional estimator coerces long-run constants to be equivalent across clusters; that is, homogeneity over a single subset of regressors or else countries (Mundlak, 1978; Pesaran, et al. 1995, 1997, 1999; Baitagi, et al. 2000).

Results and Discussion

The sets of 130 panel data points covering periods 1995-2020 for Belgium, Germany, Netherlands, Norway, and the United Kingdom were drawn from World Development Indicator (WDI) database of the World Bank. The choice of these countries was based on accessibility of data and the maritime boarders with UK. The demonstrative figures, probability values, and the consistent quantities of the regression were gotten according to the inscription of Eviews10.

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The time series plots of the logarithm of government expenses (GE), subsidies and other transfers (SOT), other expenses (OT), interest payments (IP), goods and services expenses (GSE), and compensation of employees (COE) in figure 1 showed some ever-changing uncertainties in the mean and variances in the systems. It would be correct to say that the panel time series data are not covariance stationary by positive thinking; since, they are inconsistent over time; i.e., time-dependent structure and non-uniform spontaneity in the time series stick it out. Thus, it is essential to confirm the unit root system of the variables.

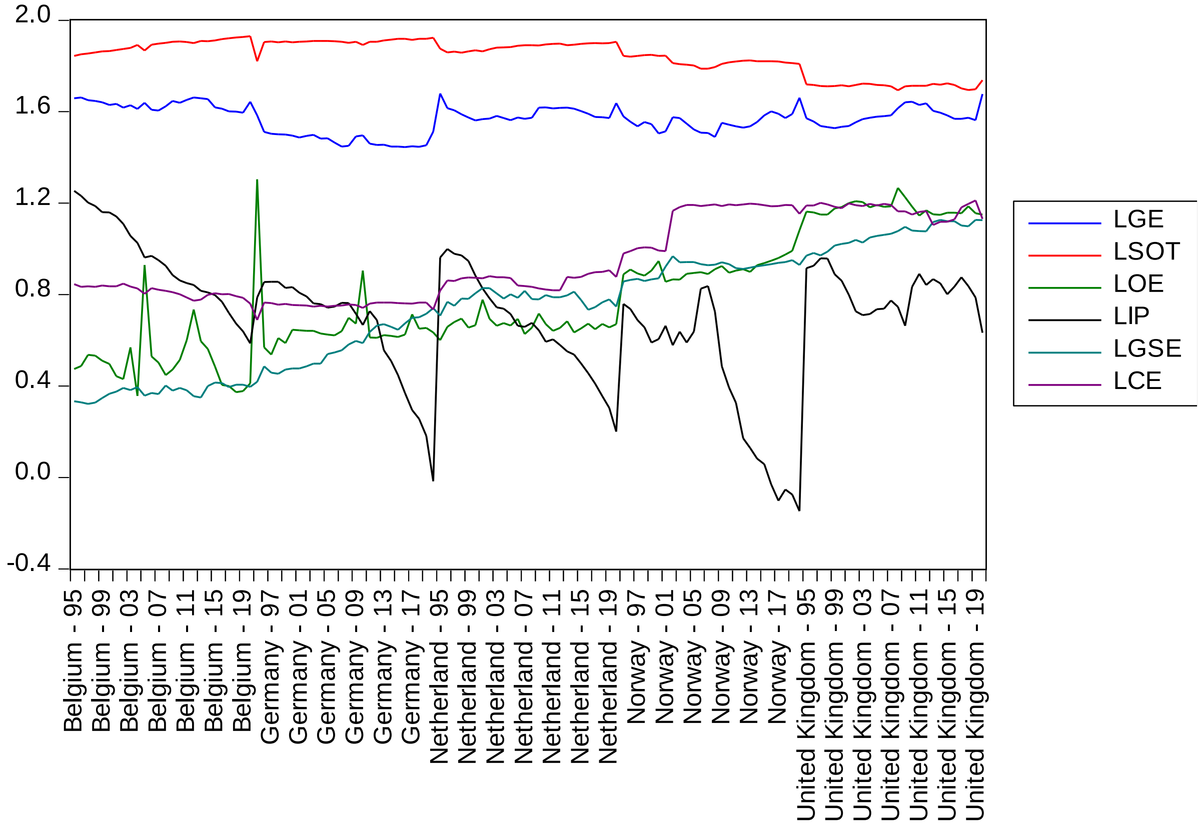

Figure 1: Time series plot of GE, SOT, OE, IP, GSE, and CE

In table 1, the mean and median of the series are within the maximum and minimum boundaries. Negative skewness of -0.372051, -0.840628, -0.945697, and -0.237384 for LGE, LSOT, LIP, and LGSE implies more recurrent large return observation is to the left of the distribution; while, positive skewness of 0.402771 and 0.398375 for and LCE implies more large returns observation is to the right of the distribution. Kurtosis values of 2.334875, 2.285900, 1.975857, 1.762470, and 1.431242 for LGE, LSOT, LIP, LGSE and LCE are lower than 3.0 benchmark of the normal distribution; therefore, their curves are platykurtic with lighter tails (fewer outliers). Black swans are less likely to occur in markets that are platykurtic.; hence, thoughtful investors will focus on investments offering platykurtic returns. Kurtosis values of 3.966156 for LOE is greater than 3.0 benchmark of the normal distribution; therefore, its curve is leptokurtic having long tails (outliers). Thus, LOE depicts a high level of risk but the possibility of higher returns because the stock has typically demonstrated large price movements. In addition, the probability values of 0.000119, 0.010071, 0.000005, 0.008581, and 0.000228 for the Jarque-Bera test of the series one-to-one were seen to be less than the significance level of 0.05 and this suggests that the series are non-normal in distribution; except that of LGE that is normally distributed for p-value of 0.067359. Thus, an empirical distribution test is required to ascertain the distribution of the series.

The kernel density plot of figure 2 displays the notion of the series' distribution. The p-values in table 2 are less than 0.05 targets; hence, all the series failed to account for the normally distributed null hypothesis assumption; as such, the series are confirmed to be non-normal in distribution.

Unit root process for Levin, Lin & Chu t* assumes common unit root process; while, ADF -Fisher Chi-square and PP - Fisher Chi-square assumes individual unit root process. Unit root existed in the series by means of common and individual effects in the series with their probability values higher than 0.05 significance level benchmark in table 3. Likewise; in table 4, the unit root test in first difference of the series were statistically insignificant for unit root with probability values less than 0.05 significance level objective. Hence, the series are non-stationary time series.

The typical clutter procedures of table 5 evaluated four models extemporaneously at exceptional reliant and influential regressors for two lags to attain at ARDL(1, 2, 2, 2, 2, 2) with the least information criteria values. Alkaike information criteria (AIC) make available the minimum value for the second model.

In table 6, the probable Wald coefficients check for the nominated model ARDL(1, 2, 2, 2, 2, 2) are attractively divergent from zero with statistically importance probability value less than 0.05 point of reference. Thus, the coefficients of the model are responsible and can be used to make inference.

Again; in table 7, the coefficients of the controllability interval tests are within 90, 95, and 99 out of each hundred sureness intervals were attainable. Subsequently, the coefficients of the model can be said to be reliable and can be used to make verdicts.

In table 8, the cross-section improvement coefficient to stability of the countries all together is negative as a criterion with significance likelihood value; thus, cointegration exists among the variables and the impact of a shock will be transient and terminate in the long run as the economy carry on to the steady-state. In view of that; at instability, it takes all the nations a speed of -0.325452 to return back to equanimity and the deviation from long-run development proportion is improved by 32.55% the successive year. The coefficients of the independent variables are statistically significance for probability values less than 0.05 conditions. Briefly; in the long-run, a 1% change in the subsidies and other transfers, interest payments, goods and services expenses, and compensation of employees will tend to decrease government expenses by 404.16%, 36.69%, 27.49%, and 128.97% one at a time. The decrease caused by subsidies and other transfers and compensation of employees on government expenses have been extraordinary. In contrast, 1% changes in other expenses will tend to increase government expenses by 35.20%.

In table 9, the adjustment coefficient to equilibrium was negative as required. At disequilibrium, it takes Belgium a speed of -0.174077 to return back to equilibrium and the deviation from long-run improvement rate is corrected by 17.41% the following year.

The adjustment coefficient to equilibrium in table 10 was negative as required. At disequilibrium, it takes Germany a speed of -0.198157 to return back to equilibrium and the deviation from long-run improvement rate is corrected by 19.82% the following year.

In table 11, the adjustment coefficient to equilibrium was negative as required. At disequilibrium, it takes Netherland a speed of -0.633749 to return back to equilibrium and the deviation from long-run improvement rate is corrected by 63.37% the following year.

In table 12, the adjustment coefficient to equilibrium was negative as required. At disequilibrium, it takes Norway a speed of -0.101772 to return back to equilibrium and the deviation from long-run improvement rate is corrected by 10.18% the following year.

In table 13, the adjustment coefficient to equilibrium was negative as required. At disequilibrium, it takes United Kingdom a speed of -0.519506 to return back to equilibrium and the deviation from long-run improvement rate is corrected by 51.95% the following year.

The pairwise Dumitrescu and Hurlin (2012) tests for two lags in table 14 allows all coefficients to be different across cross-sections. It can be seen that bidirectional, unidirectional and independent interactions exist between some indicators in the model. In view of that, other expenses homogeneously cause government expenses and vice versa. Again, interest payments homogeneously cause subsidies and other transfers and vice versa. More so, compensation of employees homogeneously cause goods and services expenses and vice versa. Interest payments homogeneously cause government expenses; government expenses homogeneously cause compensation of employees; other expenses homogeneously cause subsidies and other transfers; subsidies and other transfers homogeneously cause compensation of employees; other expenses homogeneously cause interest payments; other expenses homogeneously cause compensation of employees; and compensation of employees homogeneously cause interest payments. Convincingly, other expenses have a more significant effect on government expenses' fluctuation for the sub-region; interest payments have a more significant effect on subsidies and other transfers' fluctuation for the sub-region; also, compensation of employees have a more significant effect on goods and services expenses' fluctuation for the sub-region.

Table 1. Descriptive Statistics

Statistics	**LGE**	**LSOT**	**LOE**	**LIP**	**LGSE**	**LCE**
Mean	1.568217	1.843377	0.787188	0.695043	0.742373	0.947537
Median	1.573218	1.867920	0.677321	0.745232	0.782827	0.872927
Maximum	1.679540	1.930980	1.303869	1.253787	1.126886	1.211371
Minimum	1.445650	1.693527	0.356405	-0.147701	0.322133	0.688733
Std. Dev.	0.060329	0.073503	0.251575	0.287214	0.250697	0.178844
Skewness	-0.372051	-0.840628	0.402771	-0.945697	-0.237384	0.398375
Kurtosis	2.334875	2.285900	1.975857	3.966156	1.762470	1.431242
Jarque-Bera	5.395429	18.07303	9.196228	24.43366	9.516456	16.76897
Probability	0.067359	0.000119	0.010071	0.000005	0.008581	0.000228
Sum	203.8682	239.6390	102.3345	90.35558	96.50848	123.1799
Sum Sq. D	0.469501	0.696956	8.164411	10.64142	8.107529	4.126086
Observation	130	130	130	130	130	130

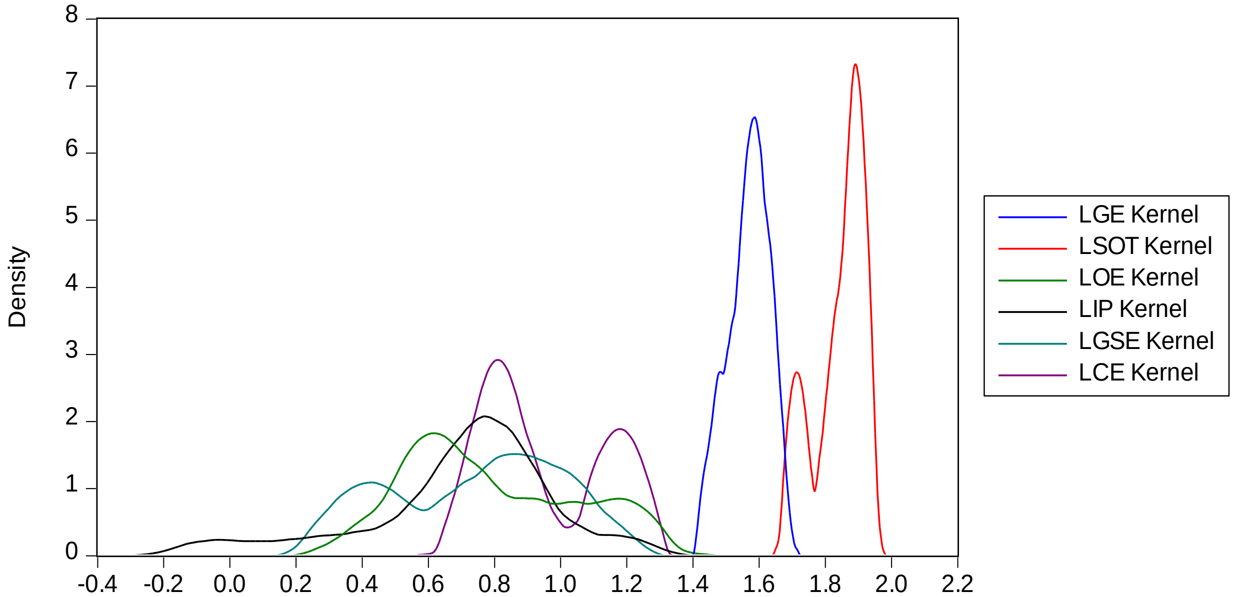

Figure 2: Kernel Density plot of LGE, LSOT, LOE, LIP, LGSE, and LCE

Table 2: Experimental Distribution Tests

	METHODS			
Variables	Statistics	Cramer-von Mises (W2)	Watson (U2)	Anderson-Darling (A2)
LGE	Value	0.172328	0.150872	1.174386
	Adj. Value	0.172991	0.151452	1.181317
	p-value	0.0119	0.0151	0.0044
LSOT	Value	1.173732	1.038039	7.768534
	Adj. Value	1.178247	1.042032	7.814386
	p-value	0.0000	0.0000	0.0000
LOE	Value	0.718611	0.682946	4.145807
	Adj. Value	0.721375	0.685573	4.170277
	p-value	0.0000	0.0000	0.0000
LIP	Value	0.631639	0.541934	3.522595
	Adj. Value	0.634068	0.544018	3.543387
	p-value	0.0000	0.0000	0.0000
LGSE	Value	0.437588	0.423361	2.986857
	Adj. Value	0.439271	0.424989	3.004487
	p-value	0.0000	0.0000	0.0000
LCE	Value	1.601003	1.556822	9.817038
	Adj. Value	1.607160	1.562810	9.874982
	p-value	0.0000	0.0000	0.0000

Table 3. Panel Unit Root Tests in Levels

	METHODS			
Variables	Statistics	Levin, Lin & Chu t*	ADF -Fisher Chi-square	PP - Fisher Chi-square
LGE	Stats	0.64176	2.84178	4.61457
	Prob	0.7395	0.9849	0.9154
LSOT	Stats	3.25227	2.34758	2.61448
	Prob	0.9994	0.9929	0.9891
LOE	Stats	0.50636	4.39208	8.93870
	Prob	0.6937	0.9279	0.5379
LIP	Stats	3.20329	2.20235	1.56252
	Prob	0.9993	0.9945	0.9987
LGSE	Stats	0.02126	9.88305	15.5595
	Prob	0.5085	0.4508	0.1130
LCE	Stats	-0.98169	7.32341	6.54340
	Prob	0.1631	0.6946	0.7677

Table 4. Panel Unit Root Tests in First Difference

	METHODS			
Variables	Statistics	Levin, Lin & Chu t*	ADF -Fisher Chi-square	PP - Fisher Chi-square
LGE	Stats	-6.14969	47.2970	75.2287
	Prob	0.0000	0.0000	0.0000
LSOT	Stats	-8.50378	70.9615	100.018
	Prob	0.0000	0.0000	0.0000
LOE	Stats	-11.9242	107.244	134.784
	Prob	0.0000	0.0000	0.0000
LIP	Stats	-2.52479	24.5303	34.4564
	Prob	0.0058	0.0063	0.0002
LGSE	Stats	-7.21041	61.3259	109.123
	Prob	0.0000	0.0000	0.0000
LCE	Stats	-7.02403	58.6143	109.563
	Prob	0.0000	0.0000	0.0000

Table 5. Summary of Model Selection Criteria

Model	**LogL**	**AIC***	**BIC**	**HQ**	**Specification**
2	400.390481	-5.589841	-4.079950	-4.976667	ARDL(1, 2, 2, 2, 2, 2)
4	402.184099	-5.536402	-3.910365	-4.876061	ARDL(2, 2, 2, 2, 2, 2)
3	367.652101	-5.377535	-4.332226	-4.953030	ARDL(2, 1, 1, 1, 1, 1)
1	360.181471	-5.336358	-4.407194	-4.959020	ARDL(1, 1, 1, 1, 1, 1)

Table 6. Wald Coefficient Restriction Test

Test Statistic	Value	df	Probability
F-statistic	18.13889	(5, 65)	0.0000
Chi-square	90.69446	5	0.0000

Null Hypothesis: C(1)=C(2)=C(3)=C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(1)	-4.041617	0.763100
C(2)	0.352049	0.143594
C(3)	-0.366860	0.071656
C(4)	-0.274904	0.115323
C(5)	-1.289746	0.166391

Table 7. Coefficient Confidence Intervals Test

		90% CI		95% CI		99% CI	
Variable	Coefficient	Low	High	Low	High	Low	High
LSOT	-4.041617	-5.314953	-2.768281	-5.565633	-2.517602	-6.066582	-2.016652
LOE	0.352049	0.112443	0.591655	0.065272	0.638826	-0.028992	0.733090
LIP	-0.366860	-0.486428	-0.247292	-0.509967	-0.223753	-0.557007	-0.176713
LGSE	-0.274904	-0.467337	-0.082471	-0.505221	-0.044587	-0.580927	0.031119
LCE	-1.289746	-1.567392	-1.012101	-1.622051	-0.957441	-1.731281	-0.848211

Table 8. Estimates of Panel ARDL (1, 2, 2, 2, 2, 2) Model

Dependent Variable: D(LGE)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Long Run Equation				
LSOT	-4.041617	0.763100	-5.296315	0.0000
LOE	0.352049	0.143594	2.451701	0.0169
LIP	-0.366860	0.071656	-5.119724	0.0000
LGSE	-0.274904	0.115323	-2.383766	0.0201
LCE	-1.289746	0.166391	-7.751311	0.0000
Short Run Equation				
COINTEQ01	-0.325452	0.105322	-3.090064	0.0029
D(LSOT)	0.791850	2.244438	0.352805	0.7254
D(LSOT(-1))	0.950262	1.788516	0.531313	0.5970
D(LOE)	-0.252387	0.211841	-1.191401	0.2378
D(LOE(-1))	-0.179354	0.225030	-0.797022	0.4283
D(LIP)	-0.114469	0.134451	-0.851380	0.3977
D(LIP(-1))	0.197705	0.174351	1.133946	0.2610
D(LGSE)	-0.104542	0.247913	-0.421690	0.6746
D(LGSE(-1))	0.345548	0.277451	1.245438	0.2174
D(LCE)	-0.861305	0.288815	-2.982200	0.0040
D(LCE(-1))	0.012634	0.350592	0.036036	0.9714
C	3.385225	1.099077	3.080061	0.0030
Mean dependent var	0.001922	S.D. dependent var		0.022471
S.E. of regression	0.013496	Akaike info criterion		-5.159854
Sum squared resid	0.011839	Schwarz criterion		-3.726086
Log likelihood	400.3905	Hannan-Quinn criter.		-4.577266

Table 9. Cross-Section Short-Run Coefficients for Belgium

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.174077	0.004675	-37.23915	0.0000
D(LSOT)	3.988689	1.373281	2.904495	0.0623
D(LSOT(-1))	-2.776505	1.141824	-2.431640	0.0932
D(LOEXP)	0.112892	0.003722	30.33230	0.0001
D(LOEXP(-1))	-0.241355	0.006178	-39.06616	0.0000
D(LIP)	0.160905	0.049384	3.258209	0.0472
D(LIP(-1))	-0.114446	0.039499	-2.897407	0.0626
D(LGSEXP)	0.588282	0.023704	24.81782	0.0001
D(LGSEXP(-1))	0.094090	0.023719	3.966899	0.0286
D(LCOE)	-1.371732	0.059542	-23.03822	0.0002
D(LCOE(-1))	-1.052140	0.081573	-12.89816	0.0010
C	1.832721	0.557044	3.290082	0.0461

Table 10. Cross-Section Short-Run Coefficients for Germany

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.198157	0.008003	-24.76072	0.0001
D(LSOT)	7.505401	12.15301	0.617575	0.5806
D(LSOT(-1))	0.209014	0.572603	0.365024	0.7393
D(LOEXP)	0.388593	0.036786	10.56349	0.0018
D(LOEXP(-1))	0.042399	0.003045	13.92628	0.0008
D(LIP)	0.245090	0.033341	7.351081	0.0052
D(LIP(-1))	0.154048	0.006160	25.00877	0.0001
D(LGSEXP)	0.356320	0.040675	8.760068	0.0031
D(LGSEXP(-1))	0.056755	0.012884	4.405239	0.0217
D(LCOE)	-1.620995	0.121475	-13.34432	0.0009
D(LCOE(-1))	0.231015	0.537936	0.429447	0.6966
C	2.045564	0.896339	2.282132	0.1067

Table 11. Cross-Section Short-Run Coefficients for Netherlands

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.633749	0.008352	-75.88086	0.0000
D(LSOT)	-4.769128	6.169741	-0.772987	0.4958
D(LSOT(-1))	7.537264	9.668228	0.779591	0.4925
D(LOE)	-0.587629	0.032176	-18.26274	0.0004
D(LOE(-1))	0.407023	0.052404	7.767048	0.0044
D(LIP)	-0.402908	0.037302	-10.80120	0.0017
D(LIP(-1))	0.846315	0.065708	12.88003	0.0010
D(LGSE)	-0.594603	0.041054	-14.48332	0.0007
D(LGSE(-1))	0.586861	0.087868	6.678899	0.0068
D(LCE)	-0.046526	0.061175	-0.760541	0.5022
D(LCE(-1))	1.059919	0.090431	11.72069	0.0013
C	6.686596	1.688482	3.960124	0.0288

Table 12. Cross-Section Short-Run Coefficients for Norway

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.101772	0.008311	-12.24533	0.0012
D(LSOT)	-2.975859	3.531928	-0.842559	0.4613
D(LSOT(-1))	1.287884	4.110269	0.313333	0.7745
D(LOEXP)	-0.499226	0.071989	-6.934734	0.0061
D(LOEXP(-1))	-0.141590	0.138960	-1.018925	0.3833
D(LIP)	-0.368965	0.018380	-20.07457	0.0003
D(LIP(-1))	0.201401	0.016174	12.45216	0.0011
D(LGSEXP)	-0.240834	0.184999	-1.301808	0.2839
D(LGSEXP(-1))	1.298145	0.239604	5.417867	0.0123
D(LCOE)	-0.811244	0.280736	-2.889703	0.0630
D(LCOE(-1))	0.194920	0.188907	1.031830	0.3780
C	1.062642	0.879464	1.208283	0.3135

Table 13. Cross-Section Short-Run Coefficients for United Kingdom

Variable	Coefficient	Std. Error	t-Statistic	Prob. *
COINTEQ01	-0.519506	0.014404	-36.06774	0.0000
D(LSOT)	0.210145	1.855444	0.113258	0.9170
D(LSOT(-1))	-1.506348	1.611281	-0.934876	0.4188
D(LOEXP)	-0.676566	0.173314	-3.903705	0.0298
D(LOEXP(-1))	-0.963245	0.146157	-6.590472	0.0071
D(LIP)	-0.206467	0.028291	-7.297888	0.0053
D(LIP(-1))	-0.098795	0.025662	-3.849928	0.0309
D(LGSEXP)	-0.631877	0.087271	-7.240395	0.0054
D(LGSEXP(-1))	-0.308113	0.127123	-2.423742	0.0939
D(LCOE)	-0.456028	0.108373	-4.207940	0.0245
D(LCOE(-1))	-0.370544	0.134544	-2.754078	0.0705
C	5.298604	1.168320	4.535234	0.0201

Table 14: Pairwise Dumitrescu-Hurlin Panel Causality Tests

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.	Decision	Causality
LSOT does not homogeneously cause LGE	3.22897	0.88321	0.3771	accept	independent
LGE does not homogeneously cause LSOT	1.31802	-0.81530	0.4149	accept	independent
LOE does not homogeneously cause LGE	4.64778	2.14429	0.0320	reject	bidirectional
LGE does not homogeneously cause LOE	7.11927	4.34103	1.E-05	reject	
LIP does not homogeneously cause LGE	4.49866	2.01175	0.0442	reject	unidirectio...
LGE does not homogeneously cause LIP	3.63623	1.24520	0.2131	accept	independent
LGSE does not homogeneously cause LGE	2.24612	0.00963	0.9923	accept	independent
LGE does not homogeneously cause LGSE	1.77617	-0.40808	0.6832	accept	independent
LCE does not homogeneously cause LGE	2.29378	0.05198	0.9585	accept	independent
LGE does not homogeneously cause LCE	4.76230	2.24608	0.0247	reject	unidirectio...
LOE does not homogeneously cause LSOT	8.82444	5.85664	5.E-09	reject	unidirectio...
LSOT does not homogeneously cause LOE	2.64268	0.36210	0.7173	accept	independent
LIP does not homogeneously cause LSOT	5.15832	2.59807	0.0094	reject	bidirectional
LSOT does not homogeneously cause LIP	6.48428	3.77663	0.0002	reject	
LGSE does not homogeneously cause LSOT	3.87226	1.45499	0.1457	accept	independent
LSOT does not homogeneously cause LGSE	2.82637	0.52537	0.5993	accept	independent
LCE does not homogeneously cause LSOT	1.34702	-0.78953	0.4298	accept	independent
LSOT does not homogeneously cause LCE	5.03420	2.48776	0.0129	reject	unidirectio...
LIP does not homogeneously cause LOE	2.61444	0.33699	0.7361	accept	independent
LOE does not homogeneously cause LIP	7.20876	4.42057	1.E-05	reject	unidirectio...
LGSE does not homogeneously cause LOE	1.13413	-0.97875	0.3277	accept	independent
LOE does not homogeneously cause LGSE	3.62095	1.23161	0.2181	accept	independent
LCE does not homogeneously cause LOE	2.06986	-0.14704	0.8831	accept	independent
LOE does not homogeneously cause LCE	9.37907	6.34961	2.E-10	reject	unidirectio...
LGSE does not homogeneously cause LIP	2.43890	0.18097	0.8564	accept	independent
LIP does not homogeneously cause LGSE	3.22936	0.88356	0.3769	accept	independent
LCE does not homogeneously cause LIP	6.25886	3.57627	0.0003	reject	unidirectio...
LIP does not homogeneously cause LCE	3.54984	1.16841	0.2426	accept	independent
LCE does not homogeneously cause LGSE	4.93296	2.39777	0.0165	reject	bidirectional
LGSE does not homogeneously cause LCE	7.05643	4.28517	2.E-05	reject	

Conclusion

This article study the cross section and time series effects of cash payments for operating activities of the government in providing goods and services, subsidies and other transfers, other expenses, interest payments, goods and services expenses, and compensation of employees in five countries over the period 1995-2020 via Pooled Mean Group (PMG) estimator. The series are non-stationary with a time-dependent structure. ARDL (1,2,2,2,2,2) for two lags at the constant level trend specification was selected out of the four models that were apparent. The deviation from the long-run equilibrium rate in the government expenses is corrected separately for Belgium, Germany, Netherlands, Norway, and the United Kingdom by 17.41%, 19.82%, 63.37%, 10.18%, and 51.95% the following year; besides, Netherland is more speedily to the adjustment followed by the United Kingdom. All the countries jointly take a speed of -0.325452 to return back to equilibrium; consequently, the deviation from the long-run equilibrium rate in government expenses is determined by 32.55% in the succeeding year. In the long run, a 1% adjustment in the subsidies and other transfers, interest payments, goods and services expenses, and compensation of employees will tend to decrease government expenses by 404.16%, 36.69%, 27.49%, and 128.97% separately. In contrast, a 1% variation in the other expenses will tend to increase government expenses 35.20%. Bidirectional, unidirectional and independent interactions exist between some indicators in the model. Influentially, other expenses have a more significant effect on government expenses' fluctuation for the sub-region; interest payments have a more significant effect on subsidies and other transfers' fluctuation for the sub-region; also, compensation of employees have a more significant effect on goods and services expenses' fluctuation for the sub-region.

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Authors Contributions

Olorunpomi Temitope Olubunmi Analyzing, producing the results and writing the paper.

Ethics

This is the original manuscript; there will be no expectation of any ethical problems after the publication. The three authors have read and approved the manuscript.

Ajare Emmanuel Oloruntoba , Job Eunice Ohunene works on the contents and flow of the paper.
Adefabi Adekunle works on the contents and flow of the paper.

References

1. Anderson, T. W. & Hsiao, C. (1981). Estimation of dynamic models with error components. Journal
2. of the American Statistical Association, 76, 598-606.
3. Anderson, T.W. & Hsiao, C. (1982). Formulation and estimation of dynamic models using panel data.
4. Journal of Econometrics, 18, 47-82.
5. Arellano M., (2004), Panel Data Econometrics. Advanced Texts in Econometrics, Oxford University Press.
6. Baltagi, B.H. & Griffin, J.M. (1984). Short and Long-run Effects in Pooled Models. International Economic Review, 25, 631-645.
7. Baltagi, B.H. & Griffin, J.M. (1997). Pooled Estimators versus their Heterogeneous Counterparts in the context of dynamic demand for gasoline, Journal of Econometrics, 77, 303-327.
8. Baltagi, B.H, Griffin, J.M. & Xiong, W. (2000). To pool or not to pool: homogeneous versus heterogeneous estimators applied to cigarette demand, Review of Economics and Statistics, 82, 117-126.
9. Baltagi, B.H, Bresson, G., Griffin, J.M. & Pirotte, A. (2003). Homogeneous, Heterogeneous or Shrinkage Estimators? Some empirical evidence from French regional gasoline consumption. Empirical Economics, 28, 795-811.
10. Baltagi, B.H, Bresson, G. & Pirotte, A (2008). To pool or not to pool, p517-546 of Matyas & Sevestre eds The Econometrics of Panel data, 3rd edition, Springer-Verlag, Berlin.
11. Baltagi B. H., (2014), Econometric Analysis of Panel Data, 5th edition, Wiley.
12. Baltagi, B. H. (ed.), (2015). The Oxford Handbook of Panel Data, Oxford University Press.
13. Barbara, C. (1998). "Mahbub ul Haq, 64, Analyst and Critic of Global Poverty. The New York Times. p. 2. Retrieved 10 August 2012.
14. Gujarati, D.N. (2003). Basic Econometrics. 4th Edition. Mc Graw Hill Higher Education. New York, USA.
15. Hsiao, C. (2003). Analysis of Panel Data. 2nd edition. Cambridge University Press, Cambridge, UK.
16. Martinez-Zarzoso, I., & Bengochea-Morancho A. (2004). Pooled Mean Group Estimation of an Environmental Kuznets Curve for CO2. Economics Letters 82, 121-126.
17. Mundlak, Y. (1978). On the Pooling of Time Series and Cross section Data. Econometrica, 46, 69-85.
18. Pedroni, P. (1999). Critical Values for Cointegration Tests in Heterogeneous Panels with Multiple Regressors. Oxford Bulletin of Economics and Statistics, 61, 653–70.
19. Pedroni, P. (2004). Panel Cointegration; Asymptotic and Finite Sample Properties of Pooled Time Series

20. Tests with an Application to the PPP Hypothesis. Econometric Theory, 20, 597–625.
21. Pesaran, M.H. & Smith, R.P. (1995). Estimating Long-run relationships from Dynamic Heterogenous Panels, Journal of Econometrics, 68, 79-113.
22. Pesaran, M. H., Shin, Y. & Smith, R.P. (1997). Estimating long-run relationships in Dynamic Heterogeneous Panels. DAE Working Papers Amalgamated Series 9721.
23. Pesaran, M.H., Shin, Y. & Smith, R.P. (1999). Pooled Mean Group Estimation of Dynamic Heterogenous Panels, Journal of the American Statistical Association, 94, 621-634.
24. Pesaran, M.H. (2007) A simple panel unit root test in the presence of cross section dependence, Journal of Applied Econometrics, 22(2)., Pp.265-312.
25. Pesaran, M.H. (2012) On the Interpretation of Panel Unit Root Tests", Economics Letters. Vol. 116, 545-546.
26. Pesaran M.H. (ed.), (2015). Time Series and Panel Data Econometrics, Oxford University Press.
27. Pesaran, M.H. (2015) Time-series and panel data econometrics for macroeconomics and finance. Oxford University Press.
28. Schoenberg, R. (1977). Dynamic models and cross-sectional data: the consequences of dynamic misspecification. Social Science Research 6, 133-144.\
29. Wooldridge, J. M. (2010). Econometric Analysis of Cross Section and Panel Data. 2nd edition. The MIT Press.