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Long Run Relationship in Export Equation: PMG and MG estimates

Abstract.

Aims: Concerning the CEMAC area in Central Africa, about the recovering of parameters estimates in the Long Run Relationship of Exports equation, the conventional cointegration techniques have been used as well as in time series than panel data framework. Nevertheless recent developments in econometrics reveal that this conventional techniques particularly in times series suffers from the issue to be more sensitive to finite sample biases. . Then the aim of this paper is to revisist the Long Run Relationship of Exports equation at the light of this new developments of econometric techniques for assessing long run relationships.

Method: Then the literature now prefers to use the well known approach of ARDL modelling. In fact, this is presented as robust to small sample biases. Then this Modelling have been extendend to a panel data framework with the Pooled Mean Group (PMG) and Mean Group (MG) estimates

Main findings: The data spans the period 1974-2021 for the PMG and the MG estimates and 2009-2019 for the tests of existence of long run relationships among the variables. Globally speaking, from the results obtained here the assumption of unitary foreign demand elasticity is well admitted, the price competitiveness channel holds and the classical result of substitutability between domestic demand and exports is observed contrarely to the liquidity constraint assumption.

Conclusion: The ARDL Modelling is then prove to be an flexible method than can be apply to a wide variety of economic problems as those presented here about the Long Run Relationship in Export Equation as well as in a times series framework than panel data modelling.

Keywords: Export market share, foreign demand, price competitiveness channel, liquidity constraints, long run, panel, MG, PMG

1. Introduction

When we consider the Macroeconomic issue of exports dynamics with the export market share as the main measure of this dynamics, the export market share giving by the difference between exports and the foreign demand, there are mainly three relationships governing the long run term of this dynamics (Esteves and Rua, 2013 ; Bobeica et al., 2015 ; Esteves and Prades, 2016). In the one hand, the hypothesis of unit foreign demand elasticity, in the second the price competitiveness channel, and finally the liquidity constraint channel. Concerning CEMAC¹ area in Central Africa, each of them have received considerable attention, with Kuikeu (2025a) in times series concerning the first, Kuikeu (2025a), Kuikeu (2026a) and Kuikeu (2026b) in times series framework and Kuikeu (2025b) in panel data modelling concerning the second ; contrarely to the framework of this study with the use of export market share equations, Kuikeu (2025b) relies on capacity consrains models of Belke et al (2014, 2013) since the foreign demand variable is at same time scare and costly to compute so that the capacity constraints models of Belke et al (2014, 2013) offers an alternative to Export market share equation. Kuikeu (2025c) in panel data concerning the third.

¹ CEMAC is the monetary union of the six central African countries (Cameroon, Central African Republic, Chad, Congo Republic, Equatorial Guinea and Gabon) which have in common the sharing of the CFA franc as a common currency, issued by BEAC (Bank of Central African States) and pegged by a fixed parity to the French franc, at the rate of 1 French franc per 100 CFA franc since the devaluation of 1994 or since 1st January 2002, with the advent of the euro, at the rate of 1 euro for 655.957 CFA francs, or 1 euro for 6.55957 French francs.

Globally speaking, the first relation states that should there exist a positive relationship between the foreign demand and the exports market share and that this elasticity should be unitary. In fact, the foreign demand express the demand that the main partners address to the foreign partner so that the country makes a comparison between the own exports and the foreign demand to appreciate the country's external competitiveness comparatively to foreign partners and to made this comparison easier the elasticity of this aggregate giving by the foreign demand should be unitary.

Concerning the second long run relationship the Real Exchange Rate as the main measure of country's competitiveness should affect negatively the exports.

Finally the third relation about the liquidity channel of Berman et al. (2011) suggest that in the long run the domestic demand should affect positively the export market share since at this term the agents instrument the sales after a perceive progress in domestic demand so that these one invest and hire to permit a progress in the foreign sales (the exports) in the same time that the observed progress in domestic sales (domestic demand).

Then the aim of this paper is to revisit these long term relations in a panel data framework. In fact, the existing studies concerning CEMAC area in panel data modelling (Kuikeu, 2025b ; Kuikeu, 2025c) builds on the works of Pedroni (2000, 1996, 1995, 1999). While there exists new techniques to assess on long run relationships among variables in panel data thus mainly the Pooled Mean Group (PMG) and the Mean Group (MG) estimates of Pesaran et al (1999). The main terrest of this paper is that, on the one hand it's appear as the extension of Kuikeu (2026b) in a panel data framework as the literature presents the PMG and MG estimates as ARDL Modelling in a panel data framework. In the other hand, to enriche the evenuality of results concerning long run relationships in export equations and to compare them to those obtained into the literature concerning CEMAC area.

This study was organize as follows, in the next section (section 2) we present the Methods, in section 3 the Results, and finally as concluding remarks a summary of the main results.

2. Methods

The first step in assessing the long run relationship in Export equation is to present the Models (the three) underlying long run term in Export equation, the source of the data are then presented in the following.

Econometric Models

As developed precedently there are mainly three models underlying the long run relationships in Export equations. In this section we present the framework for each of them. We consider all the variables measured in log and we adopt the following notation : X as the exports, D as the foreign demand, DD as the domestic demand, $REER$ the Real Exchange Rate.

Then for the first relation we have :

$$X_t = \delta D_t + \gamma REER_t + \varepsilon_t \quad (1)$$

Where δ and γ are parameters to estimate. We must have $\delta > 0$ and $\gamma < 0$.

The second is given by :

$$X_t - D_t = \gamma REER_t + \varepsilon_t \quad (2)$$

The third by :

$$X_t - D_t = \gamma REER_t + \alpha DD_t + \varepsilon_t \quad (3)$$

With $\alpha > 0$.

Method

Kuikeu (2025a) relies on the Residual Based Approach of cointegration of Engle and Granger (1987) and Gregory and Hansen (1996), on the Multivariate Approach of cointegration of Johansen and Juselius (1992, 1990), and GMM (Kim, 2008). Kuikeu (2025b,c) relies on fully modified least squares of Pedroni (1995, 1999). Kuikeu (2026a) and Kuikeu (2026b) rely on the ARDL Modelling (Pesaran et al, 2001). Here we rely on the PMG and MG estimates of Pesaran et al (1999). This one is asymptotic valid for large N and large T so that we can recover different long run relationship for each unit this by running a regression N separate regressions and calculate the coefficient means, which we call the mean group (MG) estimator, or to pool the data and assume that the slope coefficients and error variances are identical. Nevertheless Pesaran et al (1999) with the PMG estimates proposes an estimate that allows error variances to differ across group. Nevertheless PMG and MG estimates are equivalent to have a common long run relationship for each unit in panel data. In fact, the PMG and the MG estimates are only intermediate estimates between different long run relationship for each unit and a common long run relationship for each unit obtained by taking the mean of parameters estimates over N as N and T are large. That is equivalent to have a common long run relationship for each unit as in the ARDL Modelling.

Data

The macroeconomic data set covers 1974 to 2021 in annual frequency thus 42 observations measured in real terms. The time frame is bounded by the availability of real exchange rates series where the data is available between 1973-2021. It were able to use the data coming from the World Bank but in this case this would be done at the cost of missing two countries namely Chad and Congo.

Table 1 presents the variables used in the analysis.

Table 1. List of Variables

Variables	Definition	Units	Abreviation	Source
The exportations of goods and services	The value of all goods and other markets services provided to the rest of the world.	\$ US constant of 2015	X	World Bank, WDI
The foreign demand	The imports of goods and services of the main trading partners. It's computed as the	\$ US constant of 2015	D	World Bank, WDI

	geometric weighted average of the imports in real terms of goods and services of the main trading partners, where the weights correspond to the export shares of the CELAC economies to the respective trading partner countries.			
The real effective exchange rate	The price/cost competitiveness indicator of the home economy compare to the foreign partner. It's defined such as an increase in the real exchange rate will make the consumption of foreign's products relatively more profitable inducing appreciation of the nominal exchange rate (in other terms, of the currency). A decline in the real exchange rate is perfectly symmetrical.	Base 100=2010	<i>REER</i>	Cepii, EQCHANGE ²
The domestic demand	The final demand including private and public consumption and gross fixed capital formation ³ .	\$ US constant of 2015	<i>DD</i>	World Bank, WDI

Source : Author

² Couharde et al. (2018).

³ Esteves and Rua (2013, p. 15).

3. Results

In the first time, we test for the existence of long run relationships among the variables this by using the panel cointegration tests for dependent units described in Di Iorio and Fachin. (2014). The cointegration relationships are allowed to be heterogenous and tests are robust to short- and long-run dependence across units. The test returns three different panel cointegration statistics (mean, median, and maximum of the cointegration statistics for each unit) and their bootstrap p-values.

We made the test with the set of variables $(X_t D_t REER_t)$ concerning the first relation, the set of variables $(X_t - D_t REER_t)$ concerning the second, and the set of variables $(X_t - D_t REER_t DD_t)$ concerning the third. Each of this test is made between 2006-2019 considering the availability of the data.

We begin with the standard IPS (Im, Pesaran and Shin, 1997) unit root test. The results are reported in the following Table 2.

Table 2. Im, Pesaran and Shin (1997) unit root test

	Im-Pesaran-Shin	
	Constant	Trend
<i>REER</i>	-2.41*	-3.05**
<i>D</i>	-3.07***	-3.54***
<i>DD</i>	-1.15	-1.51

As they appear from this Table 2 just the domestic demand aggregate is non stationary. Given the availability of data between 2009-2019 there were not able to done this test with first difference components. Recal that Pesaran et al (1999) consider for the PMG both the case where the regressors are stationary and the case where they follow unit root processes.

Table 3. Panel Cointegration Bootstrap Test for the first Model

H0: no cointegration for all units Bootstrap replications = 1000		
Test	Statistics	p-value
Median HEG	-0.1041	0.2930
Mean HEG	0.1659	0.7700
Max HEG	1.4643	0.8660

Table 4. Panel Cointegration Bootstrap Test for the second Model

H0: no cointegration for all units Bootstrap replications = 1000		
Test	Statistics	p-value
Median HEG	-0.9192	0.0760
Mean HEG	-0.9997	0.0880
Max HEG	0.5439	0.4550

Table 5. Panel Cointegration Bootstrap Test for the third Model

H0: no cointegration for all units Bootstrap replications = 1000		
Test	Statistics	p-value
Median HEG	0.0323	0.7830
Mean HEG	0.64177	0.9870
Max HEG	3.4632	0.9640

In all cases we accept the null of no cointegration. It's just in the second model that there seems to be evidence of long run relationships among the variables.

Despite these results we now proceed with the estimating of long run relationships in each case. In fact, the acceptance of the null of no cointegration in the first and third case can be explained by the small sample size used to done this test considering the availability of obseervations.

Table 6. Long Run estimates for he first Model

PMG estimates Pesaran-Shin-Smith convention Bootstrap replications = 50		Mean-group estimates Pesaran-Shin-Smith convention Bootstrap replications = 50	
<i>X</i>	Coefficients	<i>X</i>	Coefficients
<i>D</i>	0.84*** (0.18)	<i>D</i>	-0.33 (0.89)
<i>REER</i>	-3.03*** (0.61)	<i>REER</i>	-1.03 (0.58)
Statistics			
<i>N</i>	6	<i>N</i>	6
<i>Nobs</i>	116	<i>Nobs</i>	116
<i>Sample</i>	1974-2021	<i>Sample</i>	1974-2021

Source: Author, *** (**, *) null hypothesis is rejected at the 1% (5%, 10%). *Nobs* is available observations, (.) standard deviation

With these results we cannot reject the assumption of unitary foreign demand elasticity since the parameter estimate for this aggregate is closer to unity and the Real Exchange Rate have the right sign. But contrarely to the PMG estimates the MG estimates not perform well.

Table 7. Long Run estimates for the second Model

PMG estimates Pesaran-Shin-Smith convention Bootstrap replications = 17		Mean-group estimates Pesaran-Shin-Smith convention Bootstrap replications = 17	
<i>X - D</i>	Coefficients	<i>X</i>	Coefficients
<i>REER</i>	-2.26*** (0.62)	<i>REER</i>	-1.51 (1.21)
Statistics			

<i>N</i>	6	<i>N</i>	6
<i>Nobs</i>	116	<i>Nobs</i>	116
<i>Sample</i>	1974-2021	<i>Sample</i>	1974-2021

Source: Author, *** (**, *) null hypothesis is rejected at the 1% (5%, 10%). *Nobs* is available observations, (.) standard deviation

Since that the assumption of unitary foreign demand elasticity is not rejected we can then turn to the second model that performs also well since the Real exchange Rates enters the long run relationship with the right sign.

Table 8. Long Run estimates for the third Model

PMG estimates Pesaran-Shin-Smith convention Bootstrap replications = 30		Mean-group estimates Pesaran-Shin-Smith convention Bootstrap replications = 30	
<i>X – D</i>	Coefficients	<i>X</i>	Coefficients
<i>REER</i>	-1.93*** (0.50)	<i>REER</i>	-0.68 (1.16)
<i>DD</i>	-0.33*** (0.10)	<i>DD</i>	-0.03 (0.33)
Statistics			
<i>N</i>	6	<i>N</i>	6
<i>Nobs</i>	108	<i>Nobs</i>	108
<i>Sample</i>	1974-2021	<i>Sample</i>	1974-2021

Source: Author, *** (**, *) null hypothesis is rejected at the 1% (5%, 10%). *Nobs* is available observations, (.) standard deviation

Concerning the third Model the domestic demand variable enters the long run relationship with a negative sign meaning that in CEMAC area in the long run the liquidity channel of Berman et (2011) don't dominates the substitutability effect between domestic demand and exports, that means after a perceive rebound in domestic demand, the foreign sales (exports) and the domestic sales (domestic demand) don't move together in a growing trend, contrarely the foreign sales as given by the exports decline and it's this effect that is named as substitutability effect between domestic and foreign sales.

4. Conclusion

From the results obtained here there is a comparability with those existing into the literature. In fact, the assumption of unitary foreign demand elasticity is well admitted (Kuikeu, 2025a ; Kuikeu, 2025b). The price competitiveness channel holds (Kuikeu, 2025a) and the classical result of substitutability between domestic demand and exports is observed contrarely to the liquidity constraint assumption (Kuikeu 2025c, p. 100).of Berman et al (2011).

Then the PMG as the conventional approaches of cointegration in panel data is an relevant technique to assess on long run relationship among variables as the results obtained in this case are comparatively the same than those of the literature with conventional panel and times series cointegration techniques.

To conclude the ARDL Modelling is then prove to be an flexible method than can be apply to a wide variety of economic problems as those presented here about the Long Run Relationship in Export Equation.

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