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ANALYSIS OF THE RELATIONSHIP BETWEEN MILITARY EXPENDITURE AND INVESTMENT IN THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES: A HETEROGENEOUS PANEL DATA APPROACH

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Abstract: West Africa has been grappling with various security challenges prompting governments' intervention via military expenditure both at the country and regional level. Given the sporadic surge in military expenditure in the region and the potential effect such expenditure may exert on investment which is a sin qua non to the development process of any economy or region, this study utilizes the augmented mean group (AMG) approach and the Granger non-causality test in investigating the impact and causal relationship between investment and military expenditure in the Economic Community of West African States (ECOWAS) between 1980 and 2020. With country-specific cross-dependence and heterogeneity adequately accounted for, the study found that military expenditure has a dampening impact on investment at both the panel and country levels; unemployment adversely impacts investment; whereas economic growth stimulates investment (catalytic effect) in the ECOWAS, although at differing levels of significance. The study also established a long-run relationship among the variables; with only economic growth Granger causing investment. The study thus recommends that country-specific and regional-based military policies be established to glean economic growth through viable investment.

Keywords: expenditure; military; panel; ECOWAS; investment.

JEL Codes: F21, F52, H5.

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1. Introduction

Military expenditure (hereafter MILEXP) impact, catalytic or detrimental, on investment, is a complex and debated topic. *MILEXP* and investment are both critical aspects of a country's economic and security policies. The growth and development trajectory of any economy hinges on an enabling environment to carry out economic activities. Regions and countries that possess high levels of insecurity can hardly progress economically (see Dada et al., 2023; Boly & Kéré, 2023; Wang et al., 2022; Shaaba & Ngepah, 2019). This reiterates the drive behind huge budgets around the globe. Through the years, countries both in developed and developing countries have continued to invest huge financial resources in military infrastructure to ensure that their economic activities are carried out in a serene and peaceful environment. *MILEXP* could have either a favorable or negative impact. *MILEXP* has an adverse impact on economic growth if it lowers government spending in the real sector; on the other hand, if it boosts investor confidence by providing security for risk-free investments, it would have a positive impact. For instance, in a stable economic climate, local and foreign investors will increase their investments if military spending increases investor confidence.

Africa is not isolated from security challenges, with the ECOWAS sub-region taking a pole position in recent years. The ECOWAS region is one with a range of emerging security challenges and threats that border on state sovereignty. As the region enters 2023, it faces a phase of instability following security challenges and threats orchestrated by coup d'état in ECOWAS economies such as Burkina Faso, Mali, Guinea, and Niger. Dismally, the region has experienced five successful coups in the last three years before the recent episode in 2023 that has to do with Niger. The notable surge in high-intensity conflicts in the ECOWAS region has coincided with two significant developments: the growth of transnational terrorist networks, and the increase in foreign military installations which is occurring amidst escalating geopolitical tensions between China and the United States. This international competition for power projection has led to the emergence of proxy conflicts spreading throughout the ECOWAS region. One factor that has escalated the security challenges in the region is the divide across colonial ties and loyalties. The region consists of lusophone, anglophone, and francophone nations, making it difficult to have a comprehensive regional security template and infrastructural framework.

A frequently employed policy approach to mitigate conflict and turmoil within a region involves exponentially increasing *MILEXP*. For instance, in the ECOWAS region, the rising security challenges and threats have resulted in an octuple increase in *MILEXP* (SIPRI, 2023). Nevertheless, the upsurge in military outlays and expenditure carries with it associated trade-offs, including over-gloated government

spending, an increase in borrowing (externally and internally), a tax increase, and an explosion in inflation rates (Dunne et al., 2005).

Extensive attention has been expended on understanding the economic impacts of *MILEXP*. *MILEXP* possesses the capacity to exert influence on the economy via several channels, although the emphasis has been on the demand-side effect. This effect exerts prominence over the supply-side and security effects since *MILEXP* has a crowding-out effect on the level of investment in an economy (Dunne et al., 2005; Smith, 1980). In other words, high levels of *MILEXP* can crowd out private-sector investment. When a government allocates substantial resources to defense, it may compete for resources (such as skilled labor and capital) that could otherwise be used by the private sector for productive investments. This can lead to reduced private sector growth and hinder overall economic development. This effect has long-run economic implications (Bond et al., 2010; Levine & Renelt, 1992). The links between *MILEXP* and investment are essential for economic policy, owing that investment is a strong determinant of growth.

In volatile security environments such as the ECOWAS region, the impact of expenditure on investment has been a constant debate. The debate has been that there are two complementary effects, namely, crowding-in and crowding-out effects. It is imperative to note that several empirical studies have been carried out to evaluate the *MILEXP*-investment relationship (Kentor et al., 2023; Raifu, 2022; Effiong et al., 2022; Dunne & Smith, 2019; Ukwueze et al., 2019; Aziz & Khalid, 2017). The empirical studies have resulted in contrasting evidence as regards the *MILEXP*-investment nexus. For instance, while some empirical studies found a negative nexus (see Kennedy, 2021; Aziz & Khalid, 2017), others found a positive relationship (see Adeyeye et al., 2016; Üçler, 2016; Atesoglu, 2004). Interestingly, other studies maintained a neutral stance as to the *MILEXP*-investment nexus (Dunne & Smith, 2020; Dunne & Smith, 2019), and as Kollias and Paleologue (2019) asserted, the nexus is dependent on the country's income classification.

Despite these empirical shreds of evidence, there is a paucity of empirical studies in the ECOWAS region. Most studies are country-specific in the region, and they are focused on the impact of *MILEXP* on growth (Effiong et al., 2022; Raifu, 2022; Ukwueze et al., 2019; Ebere et al., 2019). Drawing from this, this study aims to empirically investigate the relationship between *MILEXP* and investment in the ECOWAS region. Importantly, this study contributed to the empirical literature in four ways. First, this study contributes to the existing literature by employing a panel data methodology, thus incorporating a more extensive range of countries within the estimation process and a more comprehensive dataset. Additionally, the study addresses issues of cross-sectional dependence and incorporates considerations of long-run country-specific heterogeneity. This comprehensive approach offers

valuable insights into the interrelationships among variables, providing up-to-date information that can inform viable policy decisions (Efayena et al., 2023). Furthermore, by accounting for possible long-run cross-specific heterogeneity, the findings of our study are more robust and reliable. Ultimately, the findings from this study suggest economic policies that will enhance investment viability while controlling the rate of *MILEXP* in the ECOWAS region.

The subsequent sections encompass a concise review of the existing literature, an outline of the utilized methodology and data, a presentation and interpretation of results, and a conclusion accompanied by pertinent policy suggestions.

2. Literature review

There is a plethora of empirical studies that have investigated the growth effect of *MILEXP* (Alam & Mingque, 2018; Azam, 2020; Alam et al., 2017; Abdel-Khalek et al., 2019; Haider & Anwar, 2014; Ajmair et al., 2018; Zulfiqar et al., 2014; Arshad et al., 2017; Ullah & Rahman, 2014), but relatively few examine the *MILEXP*-investment nexus both at country and regional levels. The nexus has remained a controversial one. Our review is thematized based on the findings of these studies. For instance, among studies that found a positive nexus, Aziz and Khalid (2017) utilized a panel of 60 developing economies between 1990 and 2013 within time-variant long-run models. The study found that *MILEXP* dampens foreign direct investment (FDI) in the absence of security breaches. Malizard (2015) adopted a simple Keynesian model in investigating the *MILEXP*-investment nexus in France between 1980 and 2010. The study found that expenditure crowds out investment, although the study concludes that both *MILEXP* and investment are complementarily related. Using 13 OECD economies between 1971 and 2012, Hou and Chen (2014) found a crowding-out (negative) effect of *MILEXP* on investment. On their part, Kentor et al. (2023) recently estimated a 2-way fixed effects model for a sample of 129 economies in the period 2001–2017 and found that MILEXP does not stimulate investment.

As previously highlighted, most studies on the MILEXP-investment nexus are country-specific. For instance, Raifu (2022) investigated the nexus in Nigeria between 1970 and 2019, utilizing the autoregressive distributed lag (ARDL) and variance autoregressive methods. The study found that although there were observed crowding-in and crowding-out effects in both the short-run and long-run, respectively, *MILEXP* negatively impacted investment. Effiong et al. (2022) also adopted the ARDL method and found a negative nexus in both the short- and long-run. Ukwueze et al. (2019) employed the ARDL model and had previously obtained a similar outcome. Such a conclusion was earlier reached by Pacific et al. (2017), which employed a Cameroonian dataset between 1996 and 2014.

On the part of studies that found a positive nexus between *MILEXP* and investment, Ebere et al. (2019) found a positive and significant relationship between *MILEXP* and investment utilizing, FDI as a proxy. Similarly, Adeyeye et al. (2016) employed the cointegration technique in analyzing the nexus in Nigeria between 1985 and 2015. The study found that the expenditure variable has a positive long-run relationship with investment. Other studies in this category include Workneh (2020), Anyanwu (2012), and Jakobsen (2010), among others.

Other studies maintained a neutral stance on the *MILEXP*-investment nexus debate. For instance, Dunne and Smith (2019), using a panel of both developed and developing economies between 1960 and 2014, found that there are no strong relationships between the variables. The study by Smith and Dunne (2001) focuses on 28 countries between 1960 and 1997. Unconventionally, the study found no strong relationship between *MILEXP* and investment. There are other studies with similar conclusions (Dunne & Smith, 2020; Kollias & Paleologue, 2019; among others). Specifically, Kollias and Paleologue (2019) employed the data from 65 countries between 1971 and 2014 in a PVAR (panel vector autoregression) framework. The study also disaggregated the sample based on income levels. Similarly, Oukhallou (2019) found that *MILEX* exerts an adverse crowding-out effect on investment, and the effect was more prevalent among high- and middle-income economies.

Regarding the ECOWAS region, there is a paucity of empirical studies that consider the issue under consideration as a panel. To the best of our knowledge, this study is the first to investigate the *MILEXP*-investment nexus in the ECOWAS region using a panel approach rather than a country-specific approach. This appears surprising, considering the security challenges facing the region over the years. The advantages of employing panel techniques are emphasized in previous studies (Boly & Kéré, 2023; Efayena et al., 2022; Azam, 2020; Arshad et al., 2017; Bayar, 2016).

In the issue of causality, there is a paucity of existing studies that investigated the causal relationship between *MILEXP* and investment. Most studies focus on the causal relationship between *MILEXP* and economic growth (Raifu & Aminu, 2023; Su et al., 2020; Ortiz et al., 2019; Raju et al., 2019; Saba & Ngepah, 2019; Zhao et al., 2017; among others). On the causal relationship between *MILEXP* and investment, Karamanis (2022) found a bidirectional causality between *MILEXP* and investment among 25 involved in the Permanent Structured Cooperation (PESCO) for the period 1994–2018. Üçler (2016) investigated the causal link between *MILEXP* and private investment in Turkey. Utilizing the Hacker and Hatemi-J (2012) bootstrap causality test, the study found that there was no causal relationship running from *MILEXP* to private investment. The study of Jibrilla et al. (2016) adopted the Granger causality test in investigating the *MILEXP*-investment causal

relationship. The study established unilateral causality. This result differs from those of Aderemi et al. (2018), which found a bidirectional causal link.

From the above review, it is imperative to state that the relationship between *MILEXP* and investment remains inconclusive. This study is thus a concerted effort to unravel the nexus on a regional basis while accounting for any likelihood of cross-sectional dependence, which is prevalent among panel studies. Therefore, to investigate the MILEXP-investment nexus in the ECOWAS region, the following hypotheses were developed:

H1: MILEXP does not significantly impact investment in the ECOWAS region;
H2: MILEXP does not Granger cause investment in the ECOWAS region;
H3: Investment does not Granger cause MILEXP in the ECOWAS region;
H4: There is no long-run relationship between MILEXP and investment in the region.

3. Research methodology

3.1. The theoretical model

In investigating the *MILEXP*-investment nexus, the study adopted a modified Smith (1980) model. The fundamental concept of the Smith (1980) model rests on the premise that investment and the military sector vie for a corresponding share of the total output in an economy. Smith (1980) posits that consumption can be divided into two categories: private and public components. The model further posits that the demand side of the economy is based on Keynesian theory. By implication, aggregate demand is a function of *MILEXP* (Hou & Chen, 2014). This can be expressed as:

$$Q_A = Q_P - Q_G = CON + INV + MILEXP + BOT \quad (1)$$

where Q_A and Q_P refer to actual and potential output, respectively; Q_G is the difference (gap) between Q_A and Q_P; *CON* refers to aggregate consumption; *INV* is an aggregate investment with private and private components (public and private); *MILEXP* refers to military expenditure in real terms; and *BOT* refers to the balance of trade. The variables on both sides of Equation (1) can be expressed as a share of potential output:

$$inv = 1 - \left[q_g + con + milexp + bot\right] \quad (2)$$

Where *inv* is an investment as a share of potential output; q_g is Q_G as a share of potential output; *the con* is consumption as a share of potential output; *milexp* is military expenditure as a share of potential output; and *the bot* is a balance of trade

as a share of potential output. The *con* (share of consumption) variable in Equation (2), according to Smith (1980), can be expressed as:

$$con = \gamma_0 - \gamma_1 unemp - \gamma_2 g \tag{3}$$

where *unemp* is the unemployment rate, and g is the actual output growth rate. It should be noted that there is a resulting decrease in the share of consumption of potential output when there is a surge in *unemp* and g. The resulting model can be written as:

$$inv = (1 - \gamma_0) + \gamma_1 unemp + \gamma_2 g - milex - \left[q_g + bot\right] \tag{4}$$

The balance between potential supply and domestic demand given as $[q_g + bot]$ can be expressed as a function of *un*kempt as given below:

$$\left[q_g + bot\right] = \delta unemp \tag{5}$$

Therefore, Equation (4) can be expanded to arrive at the model:

$$inv = (1 - \gamma_0) + (\delta - \gamma_1) unemp + \gamma_2 g - milex \tag{6}$$

Equation (6) is the standard Smith (1980) model and is highly appropriate to examine the *MILEXP*-investment nexus given that it adequately captures all the variables of interest in its framework.

3.2. Model specification

Based on Equation (6), we derive the model to explore the *MILEXP*-investment nexus as follows:

$$inv_{it} = \delta_0 + \delta_1 unemp_{it} + \delta_2 g_{it} + \delta_3 milex_{it} + \varepsilon_{it} \tag{7}$$

and $\varepsilon_{it} = \eta_{it} + \sigma_i f_t + \nu_{it}$

In Equation (7), slope parameters are captured by δ_1, δ_2, and δ_3 and are country-specific; η_{it} captures time-invariant heterogeneity across countries; unobserved common factor, f_t, captures time-invariant heterogeneity and cross-sectional dependence, and it eradicates the latter's effects. Equation (7) shows that investment is a function of *MILEXP* in addition to other explanatory variables (unemployment

and growth). The error term represents the vector of variables not included in the model.

3.3. Data and sources

The study utilized a balanced panel of nine (9) ECOWAS economies spanning 1980 to 2020. The countries included in this study comprise Benin, Burkina Faso, Ghana, Liberia, Mali, Niger, Nigeria, Senegal, and Togo. Our choice of these economies is influenced by data availability. The adapted variables are operationalized in Table 1.

Table 1 Variable description

Variable	Description	Previous studies adopted	Source*
investment (*inv*)	The private gross fixed capital formation. it is computed in real terms.	Hou & Chen (2014)	WDI (2021)
unemployment rate (*unemp*)	Unemployment rate	Hou & Chen (2014)	ILO (2021)
economic growth (*g*)	Annual growth rate of GDP	Dada et al. (2023); Ebere et al. (2019)	WDI (2021)
military expenditure (*milexp*)	Military expenditure as a share of GDP	Dunne & Smith (2019); Dunne & Smith (2020)	WDI (2021)

Source: Authors' compilation
Notes: *WDI denotes World Development Indicators; ILO denotes International Labour Organization

3.4. Data analysis

To estimate the specified model (Equation 7), the study utilizes the augmented mean group (AMG) technique. This method was developed to account for cross-sections and periods. The method also accounts for possible cross-sectional heterogeneity (Teal & Eberhardt, 2010; Bayer, 2016). Dumitrescu and Hurlin's (2012) Granger non-causality test was utilized in determining causality among the variables.

To ensure the viability of our results, both first-generation and second-generation panel unit root tests were utilized. The first-generation panel unit root tests include the Im, Pesaran, and Shin (IPS) unit root test, the Levin, Lin, and Chu (LLC) unit root test, and the PP-Fisher unit root test (Im et al., 2003; Levin et al., 2002; Maddala & Wu, 1999; and Choi, 2001). The study also incorporated the CIPS unit root test, classified as a second-generation panel unit root test according to Pesaran (2007). In addition, cross-sectional dependence between the error terms across the ECOWAS

economies was evaluated to avoid bias in the estimation. Hence, the study utilized four tests for cross-sectional dependence: the Breusch-Pagan Lagrangian Multiplier (LM) test, the Pesaran LM test, the bias-corrected scaled LM test, and the Pesaran cross-sectional dependence (CD) test. Following an evaluation of the statistical properties of the utilized dataset, the study conducted panel cointegration tests. These tests included Pedroni, Kao, Johansen-Fisher, and Westerlund panel cointegration tests (Pedroni, 1999; Pedroni, 2004; Kao, 1999; Maddala & Wu, 1999; Westerlund, 2007; Persyn & Westerlund, 2008).

4. Empirical results

4.1. Descriptive statistics

We presented the dataset's descriptive statistics in Table 2. The dataset has a total of 205 observations. Table 2 shows that the investment variable (*inv*) has an average value of 4.62 and minimum and maximum values of -0.1631 and 6.0159, respectively. These variables show a substantial variation in investments among ECOWAS economies.

Table 2 Descriptive statistics

Variable	Mean	Min.	Max.	Standard deviation
inv	4.6215	-0.1631	6.0159	0.8317
unemp	7.6779	1.3193	21.5731	0.6861
g	5.1099	-2.8217	8.7321	0.5013
milexp	3.0481	1.3902	5.8614	0.3443
observations	369	369	369	369

Source: Authors' compilation

The unemployment rate variable (*unemp*) exhibits an average value of 7.68 and minimum and maximum value of 1.3193 and 21.5731, respectively. This variable shows that the unemployment rate is relatively high in the ECOWAS economies. The economic growth variable (*g*) shows an average value of 5.11 and minimum and maximum value of -2.8217 and 8.7321, respectively. This substantial disparity implies that the ECOWAS sub-region has a wide gap in economic growth among the countries. The military expenditure variable (*milexp*) has an average value of 3.05 and minimum and maximum value of 1.3902 and 5.8614, respectively.

4.2. Panel unit root tests

The panel unit root test results are presented in Table 3. The panel unit root results under the first-generation category showed some interesting points. Under the LLC test, investment in the intercept equation is stationary only in the first differences. However, in the intercept and trend specification, it was stationary at both level and

first differences. The results of the IPS test showed a similar trend. The employment variable was only stationary at its first differences in both the LLC and IPS in both the intercept and, intercept and trend specifications. LLC results showed that *milexp* under the trend specification is insignificant at level but is significant at first differences. The same trend was observed in the intercept and trend specification.

Table 3 Panel unit root

Panel A: First Generation				
	LLC			
Variable	**Intercept**		**Intercept & trend**	
	Levels	**First diff.**	**Levels**	**First diff.**
inv	0.391	-5.187$^{\alpha}$	-2.087$^{\beta}$	-5.987$^{\alpha}$
unemp	1.098	-4.589$^{\alpha}$	-0.875	-3.781$^{\alpha}$
g	2.632	-2.092$^{\beta}$	-0.527	-3.995$^{\alpha}$
milex	-0.901	-5.529$^{\alpha}$	-1.285	-6.308$^{\alpha}$
			IPS	
	Intercept		**Intercept & trend**	
	Levels	**First diff.**	**Levels**	**First diff.**
inv	1.194	-9.286$^{\alpha}$	-2.641$^{\alpha}$	-11.632$^{\alpha}$
unemp	2.117	-7.319$^{\alpha}$	1.135	-6.881$^{\alpha}$
g	1.637	-4.300$^{\alpha}$	-0.131	-5.082$^{\alpha}$
milex	-0.352	-6.011$^{\alpha}$	0.285	-6.644$^{\alpha}$
Panel B: Second Generation				
	PP-Fisher			
Variable	**Intercept**		**Intercept & trend**	
	Levels	First diff.	Levels	First diff.
inv	11.061	188.561$^{\alpha}$	28.437$^{\alpha}$	361.388$^{\alpha}$
unemp	5.718	131.052$^{\alpha}$	3.061	122.943$^{\alpha}$
g	2.502	141.132$^{\alpha}$	16.911	109.881$^{\alpha}$
milex	13.027	174.983$^{\alpha}$	13.081	325.011$^{\alpha}$
	CIPS			
	Intercept		**Intercept & trend**	
	Levels	**First diff.**	**Levels**	**First diff.**
inv	-2.077$^{\delta}$	-5.738$^{\alpha}$	-3.953$^{\alpha}$	-5.092$^{\alpha}$
unemp	-2.261$^{\beta}$	-5.499$^{\alpha}$	-2.011	-5.982$^{\alpha}$
g	-1.311	-5.838$^{\alpha}$	-2.289	-5.611$^{\alpha}$
milex	-1.043	-4.892$^{\alpha}$	-2.103	-5.792$^{\alpha}$

Source: Authors' compilation

Note: $^{\alpha}$, $^{\beta}$, and $^{\delta}$ denote 1 percent, 5 percent, and 10 percent statistical significance, respectively. *inv*, *unemp*, *g*, and *milexp* denote investment, unemployment, growth, and military expenditure, respectively.

The IPS results perfectly mirror the LLC results. The economic growth variable, *g*, followed a similar pattern in its unit root test. It is important to state that the panel unit root tests are essential to check the statistical properties of the employed dataset. The second-generation panel unit root is present in panel B. In the PP-Fisher unit root test, the investment variable is only stationary at the first difference when considering the intercept specification. However, under the intercept and trend specification, it is stationary both at the level and at the first difference. The variable was stationary at both levels and the first difference at all levels of specifications in the CIPS unit root test. The employment variable under the PP-Fisher unit root test was stationary only at the first differences in both the intercept as well as the intercept and trend specifications. Within the framework of the CIPS unit root test, the employment variable displays stationarity at both the level and the first difference in the intercept specification. In the context of the CIPS unit root test, the investment variable exhibits stationarity solely at the first difference in the intercept and trend specification. Both the CIPS and PP-Fisher tests showed that the growth variable, *g*, exhibits stationarity at the first difference in the intercept and, intercept and trend specifications. The military expenditure, *milexp*, follows a similar pattern.

4.3. Cross-sectional dependence tests

In testing for cross-sectional dependence, the outcomes of the estimated tests are presented in Table 4. The Breusch-Pagan LM, Pesaran scaled LM, and Bias-corrected scaled LM tests are statistically significant at the 1 percent level, thus suggesting the presence of cross-sectional dependence.

Table 4 Cross-sectional dependence tests

Tests	Stat.	Prob.
Breusch-Pagan LM	76.947$^{\alpha}$	0.000
Pesaran scaled LM	9.410$^{\alpha}$	0.000
Bias-corrected scaled LM	9.158$^{\alpha}$	0.000
Pesaran CD	-1.815$^{\beta}$	0.047

Source: Authors' compilation
Note: $^{\alpha}$ and $^{\delta}$ denote 1 percent and 10 percent levels of statistical significance, respectively.

The Pesaran CD is found to be statistically significant even at the 10 percent level. This also denotes the presence of cross-sectional dependence in the model. Such presence may be attributed to a high level or degree of economic and political integration in the ECOWAS sub-region, especially when it has to do with military interventions and missions. For instance, the ravaging military challenges and threats in Niger have attracted the intervention of ECOWAS.

4.4. Cointegration test

Given the outcomes of the unit root and cross-sectional dependence tests, it is imperative to test the long-run nexus or relationship in the specified model. The outcome will have a significant impact on the long-run effectiveness and efficiency of economic policies designed to enhance investment in the ECOWAS region. The results of the several cointegration tests are presented in Table 5. The Pedroni cointegration test shows the presence of cointegration, given that only the *rho-statistic* is statistically insignificant (*see* Table 1: Panel A).

Table 5 Cointegration test

Panel A: Pedroni Test (Deterministic intercept & trend)			
	Within-Dimension (Panel)		**Between-Dimension (Group)**
	Statistics	**Weighted statistics**	**Statistics**
v-statistic	-2.791$^{\delta}$	-1.811$^{\beta}$	
Rho-statistic	1.629	1.769$^{\beta}$	1.633$^{\delta}$
PP-statistic	-5.891$^{\alpha}$	-4.084$^{\alpha}$	-6.147$^{\alpha}$
ADF-statistic	-6.477$^{\alpha}$	-1.736$^{\beta}$	-1.519$^{\delta}$
Panel B: Johansen-Fisher Test (Linear deterministic trend)			
Hypothesized No. of CE(s)	**Trace test**	**Maximum Eigen Test**	
None	169.041$^{\alpha}$	110.547$^{\alpha}$	
At most 1	140.362$^{\alpha}$	73.050$^{\alpha}$	
At most 2	71.538$^{\alpha}$	49.172$^{\alpha}$	
At most 3	37.815$^{\alpha}$	26.588$^{\beta}$	
At most 4	17.920	17.033	
At most 5	11.537	10.992	
Panel C: Kao Test (Ho: no cointegration/deterministic trend			
	t-statistics	**p-value**	
ADF	-4.719$^{\alpha}$	0.000	

Source: Authors' compilation
Note: $^{\alpha}$, $^{\beta}$ and $^{\delta}$ denotes 1 percent, 5 percent and 10 percent level of statistical significance, respectively.

The results in Table 5 also show four cointegrating equations in both the trace and maximum eigenvalue tests in the Johansen-Fisher panel cointegration test (see Table 5, Panel B). In addition, the Kao test implies the presence of cointegration given its statistical significance (see Table 5, Panel C). These outcomes signify a long-run relationship among the variables in the specified model.

4.5. Augmented mean group (AMG) analysis

The presence of a long-run relationship among the variables suggests that the AMG is the appropriate estimation technique given that it accounts for or corrects for cross-sectional dependence. The outcomes are presented in Table 6. The results showed that for the full panel (9 ECOWAS economies), unemployment (*unemp*) has a negative and significant impact on investment (*inv*) in ECOWAS. Economic growth (*g*) significantly increases ECOWAS' investment. This finding is in line with Azam (2020), Abdel-Khalek et al. (2019), and Alam and Mingque (2018). The main variable of interest, *MILEXP*, has a negative and significant impact on investment. Specifically, a one percent increase in *MILEXP* reduces investment by about 48 percent in the ECOWAS. This finding is in tandem with previous studies (see Kentor et al., 2023; Aziz & Khalid, 2017; Malizard, 2015), but contrasts those of Ebere et al. (2019) and Adeyeye et al. (2016). Thus, this is indicative that the increase in *MILEXP* has not positively impacted investment in the ECOWAS region, since such expenditure has not spurred existing and potential investors to believe that the regional governments are serious about creating and maintaining a secure environment where investments can thrive.

A cursory country-specific approach presents intriguing aspects of the *MILEXP*-investment nexus in ECOWAS. In Benin, unemployment has an insignificant negative impact on investment. A similar impact was exhibited in Ghana and Mali. Unemployment has a significant negative impact on investment in Burkina Faso, Liberia, Niger, Nigeria, Senegal, and Togo. Although economic growth has a positive impact on investment, the impact was only statistically significant in Benin, Ghana, Liberia, Mali, Nigeria, and Senegal.

Table 6 AMG test estimates

Panel A

Variable	Full Sample	Benin	Burkina Faso	Ghana	Liberia
unemp	-0.328$^{\alpha}$	-0.007	-0.045$^{\beta}$	-0.103	-0.081$^{\beta}$
	(0.000)	(0.251)	(0.004)	(0.438)	(0.016)
g	2.065$^{\beta}$	0.783$^{\alpha}$	1.893	0.045$^{\delta}$	0.006$^{\beta}$
	(0.021)	(0.000)	(0.139)	(0.073)	(0.021)
milexp	-0.483$^{\alpha}$	-0.032$^{\delta}$	-0.192$^{\alpha}$	-0.201	-0.005$^{\alpha}$
	(0.000)	(0.081)	(0.000)	(0.135)	(0.000)
_con	-12.902$^{\alpha}$	-10.489$^{\alpha}$	-6.301$^{\alpha}$	-15.081$^{\alpha}$	-4.296$^{\alpha}$
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)

Panel B

	Mali	Niger	Nigeria	Senegal	Togo
unemp	-0.006	-0.427$^{\alpha}$	-0.006$^{\beta}$	-0.327$^{\beta}$	-0.009$^{\alpha}$
	(0.291)	(0.000)	(0.026)	(0.020)	(0.000)
g	0.639$^{\alpha}$	1.021	0.721$^{\alpha}$	0.541$^{\delta}$	0.083
	(0.000)	(0.462)	(0.000)	(0.061)	(0.159)
milexp	-0.011	-0.271$^{\alpha}$	-0.047$^{\beta}$	-0.170	-0.013$^{\alpha}$
	(0.281)	(0.001)	(0.029)	(0.732)	(0.001)
_con	-7.035$^{\alpha}$	-3.945$^{\alpha}$	-6.317$^{\alpha}$	-3.085$^{\alpha}$	-11.943$^{\alpha}$
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Wald	17.947$^{\alpha}$				
	(0.000)				
Obs.	369	40	40	40	40

Source: Authors' compilation
Note: $^{\alpha}$, $^{\beta}$ and $^{\delta}$ denote 1 percent, 5 percent and 10 percent levels of statistical significance, respectively. Investment (inv) is the dependent variable.

Individual country-level analyses reveal that the main variable of interest, *MILEXP*, exerts a mitigating influence on investment in Benin, Burkina Faso, Liberia, Niger, Nigeria, and Togo. The most significant effect was evident in Niger, with Burkina Faso following closely. Specifically, a one-percent increase in *MILEXP* decreases investment by 3.2 percent, 19.2 percent, 0.5 percent, 27.1 percent, 4.7 percent, and 1.3 percent in Benin, Burkina Faso, Liberia, Niger, Nigeria, and Togo, respectively. This finding is in tandem with previous studies such as Raifu (2022), Effiong et al. (2022), and Ukwueze et al. (2019), but contrasts with those of Workneh (2020), Ebere et al. (2019), and Adeyeye et al. (2016), which assert that *MILEXP* positively impacts investment.

4.6. Granger non-causality test

The outcomes of the Dumitrescu and Hurlin (2012) Granger non-causality test presented in Table 7 indicate that both unemployment and *MILEXP* do not possess the ability to Granger-cause investment within the ECOWAS region. This finding contrasts previous studies such as Karamanis (2022) and Aderemi et al. (2018), which found a bidirectional causality between *MILEXP* and investment, as well as the study of Jibrilla et al. (2016), which found a unilateral causality. However, the findings of the study conform to those of Üçler (2016), who investigated the linkage in Turkey. These findings suggest that neither unemployment nor *MILEXP* can be considered causal factors influencing investment in ECOWAS.

Table 7 Dumitrescu & Hurlin (2012) Granger non-causality test

Null Hypothesis	W-bar	Z-bar	Prob.
unemp → inv	1.2010	0.518	0.690
g → inv	3.6231	4.945	0.021
milexp → inv	1.3703	0.729	0.437

Source: Authors' compilation
Note: 4 lags estimation; null hypothesis of no causality; 100 bootstrap replications employed to compute probability values.

Conversely, economic growth has the capacity to Granger cause investment in ECOWAS. This implies that economic growth in the region can adequately predict investment outcomes.

5. Conclusions

By utilizing Smith's (1980) demand-side model, this study conducted a comprehensive examination of the influence of *MILEXP* on investment across nine economies within ECOWAS, spanning the years 1980 to 2020. The variables considered encompassed investment (proxied by private gross fixed capital formation), unemployment, GDP growth, and *MILEXP* (represented by military expenditure as a share of GDP). Leveraging the Augmented Mean Group technique was a strategic choice, as it permits the simultaneous estimation of both panel- and unit-specific (country-level) factors while accommodating cross-sectional interdependence.

The study's findings revealed a negative impact of *MILEXP* on investment in the ECOWAS region. Similar adverse effects were evident in the case of the unemployment variable. Notably, the unemployment variable exhibited a consistently negative impact on investment across the various countries within ECOWAS in the country-specific estimations. While the degree of significance varied, the economic growth variable demonstrated a positive influence on investment, both at the panel and country-specific levels.

Furthermore, the results from the Granger non-causality test indicated that economic growth possesses the capacity to Granger-cause investment, implying its predictive power for investment outcomes within ECOWAS. Conversely, the opposite pattern emerged for unemployment and *MILEXP*, suggesting that they lack the predictive capability for investment in this context.

Based on the outcomes of this study, it becomes imperative for countries within the ECOWAS region to collaborate or synergize in exploring military strategies that not only secure the area but also maintain financial resources for investment purposes.

It is worth emphasizing that the influence of *MILEXP* on investment is intricate and divergent, contingent upon the unique circumstances of each country.

Attaining equilibrium between defense requirements and investments in productive domains emerges as a pivotal factor in fostering sustainable economic advancement, bolstering security, and ensuring lasting prosperity. In the end, governments must meticulously deliberate on their priorities, security conditions, and the potential trade-offs between military expenditures and investments in alternative sectors. By doing so, the encumbrance effect of *MILEXP* in the ECOWAS region can be mitigated.

This study serves as a springboard for further research. Specifically, it opens the possibility of incorporating the heterogeneity of *MILEX* in evaluating the relationship between defense spending and investment. Studies can be carried out on the individual effects of disaggregated defense spending (its different components) on investment. Conversely, the different investment types and sources can be further x-rayed in evaluating the *MILEX*-investment nexus. This study can be further extended to sub-Saharan Africa.

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Author Contributions

OOE conceived the study and was responsible for the design and development of the data analysis. EHO and OOE were responsible for data collection and analysis and also for data interpretation. EHO was responsible for the literature review section.

Disclosure statement

The authors do not have any competing financial, professional, or personal interests from other parties.

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