

Volume 44, Issue 2

Empirical investigation of the relationship between terrorism, public debt and economically active women in the ECOWAS zone

Essosinam Franck Karabou
University of Kara

Komlan Ametowoyo Adeve
University of Kara

Abstract

The objective of this research is to determine the impact of terrorism on the level of indebtedness of West African countries by highlighting the role and interactions of the proportion of economically active women in this relationship over the period 2010 to 2019. The methodology adopted is based on generalized methods of moments (GMM) in a dynamic panel system. After estimation, the results of the two models revealed that the increase in terrorism worsens the region's public debt by 0.006% and the proportion of economically active women decreases the debt level by 0.823%. However, the interaction between terrorism and the proportion of economically active women increases the debt level by 0.0061%, revealing that although the female labor force (proportion of economically active women) contributes positively to the economy of the ECOWAS zone, terrorism inhibits the positive contribution of the female force.

Editor's Note: This paper was originally submitted on 07/09/2021 and accepted on 5/15/2022. It was to be published in Volume 44, Issue 2, 9/30/2022. Due to a technical flaw on the part of the journal, this failed. The paper has therefore been administratively resubmitted and published in Volume 44, Issue 2.

Citation: Essosinam Franck Karabou and Komlan Ametowoyo Adeve, (2024) "Empirical investigation of the relationship between terrorism, public debt and economically active women in the ECOWAS zone", *Economics Bulletin*, Volume 44, Issue 2, pages 528-543

Contact: Essosinam Franck Karabou - kfranck2008@gmail.com, Komlan Ametowoyo Adeve - fadeve@yahoo.fr.

Submitted: July 04, 2024. **Published:** June 30, 2024.

1. Introduction

Terrorism and violent extremism have been major threats to the global economy and in particular to the economy of sub-Saharan Africa in recent years. In recent decades, the phenomenon of terrorism has undergone a remarkable evolution globally and particularly in African countries, which has created considerable and complex problems of cost and scale (Efobi and Asongu, 2016). Today, there is a growing consensus to describe current African conflicts as regionally dominant, with multiple and cross-border effects on many actors, and complex in nature, in which it is often difficult to distinguish the share of state interests from the private economic sector, criminal networks, and combatants on the ground (Cilliers, 2004). However, West Africa, despite a prolonged period of conflict, social unrest, and political instability, has made considerable progress in democracy, economic growth, and development over the past decade (GAFI, 2013). Nevertheless, there are concerns about the resurgence of terrorism and its adverse effects on peace, security, state finances (public debt) and development in the subregion. The frequency and deadly nature of attacks in some West African countries are indications of the sophistication of terrorist groups in the subregion. The phenomenon is sustained by political instability, ethnic and community violence, endemic corruption, rampant poverty and high unemployment.

This is compounded by the increasing radicalization and southward migration of terrorists and extremists, particularly members of Al Qaeda in the Islamic Maghreb (AQIM) across the Sahel to Mali, Mauritania, and Niger. Lacher (2012) attributes the growing presence of AQIM, MUJAO and other groups in the region to the development of a highly lucrative kidnapping industry. Indeed, Foster-Bowser and Sanders (2012) note that ransom payments appear to be the most important source of funding for terrorist groups in the Sahelo-Saharan region. Thus, if terrorist activity can provide income (extortion, kidnapping, sponsorship, bounties paid to the terrorist or his family, etc.) greater than what an individual obtains or could obtain in the legal economic sphere, the likelihood of joining a terrorist organization is high. Thus, poverty and a low level of education would encourage terrorism, which in turn has a negative impact on the public finances of the states concerned. Indeed, Wintrobe (2002) indicates that the loss of social capital induced by poverty can lead an individual to seek greater solidarity within violent organizations. Whatever the argument, one could deduce that a reduction in poverty and a higher level of education could lead to a reduction in terrorist violence and, in turn, an improvement in public finances. In this line, Abid and Sekrafi (2020) show in their work that the rise of terrorism and the informal economy lead to an increase in public debt. Therefore, the link between terrorism and public debt goes through the decrease in the pace of economic activity due to violence, the budgetary cost via the increase in certain public expenditures such as military expenditures.

On the other hand, there is a broad consensus that terrorist attacks always inflict great suffering and sometimes colossal material damage. Beyond the loss of life and destruction of infrastructure, they repel foreign capital, cause uncertainty and distortions in the allocation of domestic resources, as well as indirect costs from the security measures to be put in place. In 2016, the economic cost of terrorism in Africa was US\$15.5 billion, more than ten times the 2007 figure of US\$1.54 billion UNDP (2019). From 2007 to 2016, terrorism cost the African continent at least US\$119 billion. In fact, this figure is significantly higher when GDP losses and informal sector activities, additional security expenditures, and the costs associated with refugees and displaced persons are taken into account. This considerable economic damage is, however, only one of the consequences of terrorism. There are other consequences, such as those on the public finances of the states concerned, in this case the burden of these terrorist acts on the public debt of these states. Indeed, terrorist acts are not without consequences on the major macroeconomic aggregates, in this case the public debt. Already burdened by heavy

debt stocks from the HIPC initiative, terrorism is certainly not likely to improve the situation. According to the UNDP (2019) report on the economic consequences of violent extremism in Africa, states experiencing violent extremism have low economic growth compared to other countries. Regarding economic growth in countries identified as target countries, the gap between the most affected countries and those least affected by terrorism is 64%. Furthermore, between the year 2002 and the year 2016, the average gross domestic product per capita of the countries considered at risk and secondary countries increased by 47% and 36%, respectively, while this rate decreased by 17% in the epicenter countries.

For the ECOWAS countries included in this research, the number of victims of terrorist violence in Burkina Faso, Mali and Niger has increased fivefold since 2016. In 2019 alone, there were 4,000 deaths, compared to 770 in 2016, while attacks are moving eastward from Mali to Burkina Faso and now threaten coastal states. At the same time, the number of displaced people has increased tenfold, reaching half a million, not counting the 25,000 who have sought refuge in other countries.

If terrorism generates high costs for the affected countries with a drop in their level of growth, one is entitled to ask what effect terrorism has on development and, moreover, on the public debt of the countries, especially since the African responses have not slowed down the terrorist flow. The objective of this paper is to determine the impact of terrorism on the level of indebtedness of West African countries by highlighting the role and interactions of the proportion of working women in this relationship over the period 2010-2019. The major contributions made through this research are essentially based on three elements. The first contribution is that we are trying to find an empirical validation of the hypothesis that an increase in the level of terrorism would lead to an increase of debt level of the subregion's economies, and the second relates to the determination of the role of the working women proportion in the improvement of debt level. In the third place, the interaction between the proportion of working women and the terrorism indicator has a negative impact on the region's public debt, but less proportionately. In order to find solutions to the objectives posed, we rely on the following research hypotheses: (H₁) terrorism increases the public debt ratio; (H₂) the proportion of working women contributes to reduce the public debt ratio; (H₃) the interaction between the proportion of working women and the terrorism indicator leads to an increase in public debt.

In order to provide some answers, we organize the rest of the paper as follows: Section 1 presents the literature review. In section 2, we present the econometric approach and the estimation method. In section 3, we present and discuss the results of our estimations. Finally, in section 4 we conclude and highlight the policy implications in section 5.

2. Theoretical framework

Women's economic activity contributes to the state's tax revenues, which in turn contribute to a large part of the state's income, some of which is used to pay off the debt. Also, the intervention of terrorism in this relationship creates distortions.

Terrorism has attracted the attention of economists like Ismail and Amjad (2014) in studying the various economic causes and consequences of terrorism. The literature on the effects of terrorism on different compartments of the economy is rich with largely convergent findings but also with some contradictory findings at times. Empirical studies have generally focused on the economic effects of terrorism and have found that it has a negative influence on economic growth and its determinants, such as domestic investment, public debt, foreign direct investment flows, women's economic participation, total factor productivity, technological progress, tourism, and financial development (banking sector and stock market development) (Koh, 2007; Araña and León, 2008; Shahrestani and Anaraki, 2008; Chesney, Reshetar, and

Karaman, 2011; Meierrieks and Gries, 2013; Hyder, Akram, and Padda, 2015; Shahzad et al. , 2016). Among the relationships between terrorism and the determinants of economic growth, two hold our attention in this research, on the one hand, the relationship between terrorism and the issue of public debt which has been the subject of several research works following the example of the works of Abid and Sekrafi (2020), Jaidane-Mazigh, Khefacha and Chamakh (2019), Procasky and Ujah (2016) ; on the other hand, the relationship between terrorism and the issue of women's economic participation addressed in many works, such as Hudock and al. (2016) ; Berrebi and Ostwald (2016) ; Fernández, Ibáñez, & Peña (2014).

Regarding the particular case of terrorism in relation to economically active women, it has its source on the one hand in the management of terror theory (TMT) which suggests that individuals may withdraw or withdraw from the labor market in face of a threat (Becker 1971, 1973) and on the other hand in the feminist theory of peace and conflict. Indeed, relative to the former theory, Thomas (2003) found strong evidence that women wanted to remain in contact with their loved ones after the reality of attacks had set in. Furthermore, in an environment of heightened threat, there may be heightened anxiety about leaving the home, children, or property unprotected, thus, women may take on these responsibilities and choose to stay home and take care of the house and family.

The second theory, that of war and conflict, states that war has always had a negative impact on women, so the lack of security imprisons them or forces them to move to another location. The work of several authors focused on individual countries such as, Hudock and al. (2016), Shemyakina (2015) has shown that the intensification of conflict and violence is directly associated with a decline in women's employment. Similarly, Berrebi and Ostwald (2016), using terrorism data from 1980 to 2007 covering 165 countries, find that terrorist attacks decrease women's economic participation and increase the gap between male and female labor force participation. For Weber (2006), feminist peace and conflict theory recommends broader measures to address women's security issues, as gender issues or violence against women, such as domestic, societal, state, and interstate violence, all have dimensions of gender-based discrimination. Also, there is a broad consensus that terrorist attacks always inflict great suffering and sometimes colossal material damage. Beyond the loss of human life and the destruction of infrastructure, they repel foreign capital, create uncertainty and distort the allocation of domestic resources, as well as the indirect costs of security measures. In conclusion, terrorism not only has direct repercussions on the public finances of the states concerned, but also causes loss of human life, creates a climate of terror and, in a singular way, has repercussions on the economic participation of women.

3. Econometric Approach and Estimation Methodology

3.1. Estimation techniques

This paper seeks to capture the impact of terrorism on public debt in the countries of Sub-Saharan Africa, so the econometric estimation method adopted is based on dynamic panel techniques founded on the work of Arellano and Bond (1991), the generalized methods of moments (GMM) in dynamic panels. The choice of this technique is justified by the fact that it provides solutions to the problems of simultaneity bias, endogeneity, reverse causality, over-instrumentation bias and omitted variables. For our model, we have chosen a GMM estimation on a dynamic panel, i.e. a model in which at least one lag of the dependent variable appears as explanatory variables.

3.2. Empirical specification

To assess the relationship between terrorism and public debt as well as the role of the proportion of working women, we start from the existing literature Abid and Sekrafi (2020) on the relationship between debt and terrorism discussed above which leads us to the general empirical formulation as follows:

$$\mathbf{debt} = f(\mathbf{terrorism, proportion\ of\ working\ women, X}) \quad (1)$$

Where **debt** represents the public debt of the countries concerned; **terrorism** is the terrorism indicator; **proportion of women in the labor force** is the economically active female population; and **X** represents the vector of socio-economic variables (control variables).

However, the methodological approach follows a panel data model for African countries covering the period from 2000 to 2019. Under the assumption of a linear relationship between debt, terrorism and the female economically active population, equation (1) is specified as follows :

$$\begin{aligned} DETOT_{it} = & \partial_0 + \partial_1 DETOT_{it-1} + \partial_2 PIBTET_{it} + \partial_3 INVPR_{it} + \partial_4 POPACT_{it} + \partial_5 DEPMIL_{it} \\ & + \partial_6 INFLA_{it} + \partial_7 POP_{it} + \partial_8 CONCORR_{it} + \partial_9 TERROR_{it} + \partial_{10} STAPOL_{it} \\ & + \varepsilon_{it} \end{aligned} \quad (2)$$

$$\begin{aligned} DETOT_{it} = & \partial_0 + \partial_1 DETOT_{it-1} + \partial_2 PIBTET_{it} + \partial_3 INVPR_{it} + \partial_4 POPACT_{it} * TERROR_{it} \\ & + \partial_5 DEPMIL_{it} + \partial_6 INFLA_{it} + \partial_7 POP_{it} + \partial_8 CONCORR_{it} + \partial_9 STAPOL_{it} \\ & + \varepsilon_{it} \end{aligned} \quad (3)$$

The *DETOT* variable represents the total debt burden (it is the dependent variable). Over the last two decades, the composition of public debt has shifted from external to internal in a number of developing countries (Panizza, 2008), including African countries (Ncube, Shimeles and Verdier-Chouchane, 2013). Therefore, we consider it appropriate to consider total public debt instead of external debt; *DETOT_{it-1}* is the lagged debt variable (period t-1); *PIBTET_{it}* is the gross domestic product per capita for each country *i* at time *t*; *TERROR* is the terrorism indicator affecting public debt and other macroeconomic variables (Abid and Sekrafi, 2020; Procasky and Ujah, 2016); *POPACT* is the proportion of women in the labor force capturing the female employment rate (Agbanyo, 2020; Ahmed and Mahran, 2009); *X_{it}* is a vector of control variables with *POP*, the population growth rate. An increase in capital, physical and/or human, leads to an increase in economic growth Ben Ltaief (2014). *INVPRIV*, is the ratio of private investment to GDP for each country *i* at time *t*. It is captured by gross fixed capital formation in the private sector. An increase in private investment would have a positive effect on economic growth and thus inverse with debt (Gritli and Charfi, 2019). *DEPMIL*, military expenditures. For Asongu and Amankwah-Amoah (2016), military expenditures as a percentage of GDP is necessary to reverse the effects of terrorism; *INFLA*, uncertainty is central to firms' investment decisions (Price, 1996; Dehn, 2000). Corruption control (*CONCORR*) and political stability (*STAPOL*) were also included in the model to capture the effect of institutional factors. Following the work of Belaïd, Gasmi and Recuero Virto (2009), many recent studies have shown that the quality of a country's institutions is an important explanatory factor of its economic development; ε_{it} , the error term. *i* = 1....., *N* represents the countries and *t* = 1....., *T* represents time.

3.3. Data and variable definition (Appendix 1)

The data used for the estimates come in part from the World Bank database (World Development Indicators, 2021). The data for the measures used in the institutional quality

measurement are from the (World Governance Indicators, 2021). For the other variables, we used the African Development Bank database (AFDB Socio Economic Database, 2021). For data on terrorism, the Global Terrorism Database (GTD, 2021) was used. Based on the data collected in the Global Terrorism Database (GTD, 2021), the Institute of Economics and Peace (IEP) launched the Global Terrorism Index (GTI) in 2012, which ranks countries according to their terrorist activities and analyzes the associated economic and social dimensions. Four factors are used for each country each year to derive the country index: the total number of terrorist incidents, the total number of deaths caused by terrorists, the total number of injuries caused by terrorists, a measure of total property damage caused by terrorist incidents. These factors are weighted between 0 and 3, and then a five-year weighted average is used. The first report was launched in 2012, the second in 2014, and continues to be published annually. Today, 163 countries are analyzed and 99.7% of the world population is covered. This research covers the fifteen (15) countries of the Economic Community of West African States (ECOWAS), namely: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Also, the time period covered by this research is from 2010 to 2019 due to low data availability. In order to be used, the data were leveled and some of the data log-linearized to reduce the size effect.

3.4. Descriptive statistics (Appendix 2)

The descriptive statistics of the variables show heterogeneity among ECOWAS countries. The average per capita income is 1152.90 ± 849.58 , with a minimum GDP per capita of 474 and a maximum GDP per capita of 3539 US dollars. The terrorism index ranges from 0 to 8 with an average of 1.82. The average rate of the proportion of economically active women is 45.18% with a minimum rate of 38.51% and a maximum rate of 50.34%. As for public debt as a percentage of GDP, its average is $21.79 \pm 22.20\%$ with a minimum rate of 5.94% and a maximum rate of 97.10%. The other statistics can be seen in appendix 2.

3.5. Interpretation and discussion of results (Appendix 3)

Appendix 3 presents the results of the estimates of the terrorism index and the proportion of women on public debt in the ECOWAS countries in equation 2 as well as the results presenting the effect of the terrorism index and the proportion of women measured jointly (interaction between terrorism index and proportion of women) on public debt in equation 3.

According to the results of equation 2 presenting the effect of the terrorism index and the proportion of women on public debt, we note that any increase in terrorism leads to an increase in public debt in ECOWAS countries. An increase in the terrorism index of 1% leads to an increase in public debt of 0.006% at the 5% significance level. These results, confirmed by a series of previous studies (Blomberg, Hess and Orphanides, 2004; Abid and Sekrafi, 2020), can be explained by the fact that terrorist acts strongly discourage the normal course of economic activities as well as investors, leading to a drop in income and, consequently, to a loss of tax revenue. The combination of lower government revenues and higher public expenditures leads to the use of debt to finance public expenditures.

Concerning the proportion of economically active women, we note an inverse relationship between this variable and the public debt. An increase of 1% in the economically active female population leads to a decrease in the public debt of 0.82% at the 1% significance level. This situation can be explained by the importance of women in economic activities, especially in the informal sector. The informal sector accounts for a large share of economic growth in Sub-Saharan African countries, particularly in the ECOWAS zone, and women hold significant power in this sector (WB, 2019). Women empowerment is very important in Africa where most

households are headed by women who excel in the informal sector especially since, the contribution of the economically active female proportion has beneficial effects on public finances.

The question of the proportion of working women's role in improving the debt level has been approached theoretically, but the empirical development has not been sufficiently explored. As a result, the economic potential of women is not sufficiently exploited on public debt. Therefore, the new element introduced in this research is the empirical formalisation of the role of women's economic participation in the labour force in reducing public debt, especially in Sub-Saharan Africa.

Long marginalised in labour market, this paper aims to empirically demonstrate the critical role that economically active women can play in growth and their contributions to public debt reduction in Sub-Saharan African countries. According to the AfDB (2015), "eliminating gender inequality and empowering women could increase the productive potential of one billion Africans and significantly boost the continent's development potential".

Also, work conducted by the IMF (2019) highlights the significant costs of gender inequality to the global economy. Estimates of economic losses resulting from women's marginalisation range from 10% of GDP in advanced countries to over 30% in the least developed countries. Recent studies suggest that the benefits of increased female labour force participation are greater than previously estimated. For Ostry and al. (2018), while progress has been made in increasing women's labour force participation (WLFP) over the past 20 years, large gaps still remain. The latest research from the International Monetary Fund shows that improving gender diversity can lead to greater economic gains than previously thought. Also, diversity, i.e. the integration of women into the labour force, has an economic benefit in addition to that of increasing the number of (male) workers. All in all, the gain from women's economic participation provides resources to pay off the public debt.

Regarding the population growth rate, there is an inverse and significant relationship at the 1% level with the public debt. According to the results obtained, every 1% increase in the population leads to a 0.13% decrease in public debt. Indeed, the increase in the population is understood as an increase in the workforce that contributes to the state's revenues and therefore to the state's expenses. According to theoretical and empirical models of economic growth, an increase in capital, physical or human, leads to an increase in economic growth. These results are close to those obtained by Ben Ltaief (2014).

The results obtained indicate a positive and significant relationship between military expenditures and public debt. Indeed, a 1% increase in military expenditures leads to a 0.02% increase in public debt. These results are easily understandable given that in a context marked by terrorism, states are forced to increase their military spending to adapt to the situation, thus aggravating the public debt. These results are confirmed by the work of McLoughlin and al. (2020), who show that, like growth, public finances deteriorate sharply after a conflict, with real tax revenues falling by more than 10% on average in the case of high-intensity conflicts than in the absence of conflict. These results do not suggest that conflicts have a statistically significant effect on total government expenditures, but they do show that, in general, there is a shift in the composition of spending from capital to military spending. As a result, the budget balance deteriorates and public debt increases significantly during a conflict.

Considering Per capita gross domestic product and private investment, they are positively correlated with public debt, which is the opposite of what would be expected. These results can be explained by the fact that the levels of gross domestic product per capita and private investment in ECOWAS countries are not yet high enough to reduce the level of debt. These results are confirmed by the work of Gürbüz (2001) and Benayed and Gabsi (2020).

About inflation, it also has a positive impact on the level of public debt with a coefficient (0.10) that is significant at the 1% level ($P > |z| = 0.003$). Thus, any 1% increase in the level of inflation leads to a 0.10% increase in the stock of debt. This confirms the results of Bouzou (2010) who estimates that the appearance of inflation in a modern economy does not necessarily relieve debt repayment. There are two reasons for this. The first reason is that part of the remuneration of public debt is indexed to inflation. The second reason is that the debt-bond markets on which public debt securities are traded are much more efficient than they were during the 30 glorious years. So an increase in inflation would almost immediately translate into an increase in the cost of variable-rate borrowing and new borrowing.

As for the institutional factors that are significant at the 1% threshold for corruption control and 5% for political stability, a 1% variation in corruption control leads to a 0.10% decrease in the level of debt and a 1% variation in political stability leads to a 0.04% decrease. Institutional factors referring to institutional quality and political stability impact public debt through the quality of governance. As Edison (2003) points out, countries with good institutional quality are on a sustainable development path. This, in turn, will allow all other things being equal to repay debts. Indeed, institutional factors affect the level of debt through the quality of governance and the way regulations are applied and enforced. The institutional variable also tells us about the direction of the relationship between political stability and public debt. The more political stability there is in developing countries (the ECOWAS zone), the lower the stock of debt will be because political stability is appropriate in promoting sustained and equitable economic growth.

The results obtained in model 2 and those obtained in model 3 are quite close and similar.

Also, according to model 3, the interaction between the terrorism index and the proportion of economically active women has a positive and significant relationship with public debt at the 1% threshold. Thus, any increase in the interaction of 1% leads to an increase of 0.006% in public debt. This result indicates the inhibiting action of terrorism on the contribution of the economically active female force. Indeed, as shown in model 2 that the proportion of economically active women contributes to the decrease of the public debt, in model 3 this proportion of economically active women coupled with terrorism contributes to the increase of public debt. The inhibiting action mentioned above is developed by Buvinic, Das Gupta and Casabonne (2013) who show that women are much more exposed to gender-based violence during conflicts. Based on figures they show that during conflict, men are more likely to lose their lives in combat and women are more likely to be trafficked and subjected to gender-based violence and used as a means to subjugate civilian populations. For UN Women (2015), insecurity often limits the movement of girls and women, restricting their access to school and employment. For the World Bank (2017), women are particularly at risk of forced displacement, this finding is supported by ILO (2003) and World Bank (2017).

The results on the interaction between terrorism and women's work are new in literature. The interaction posited between the female employment rate captured by the proportion of women in the labour force and terrorism is new in the literature. Moreover, the existing theoretical literature has mainly focused on the role of the proportion of working women in improving the debt level on the one hand. On the other hand, there is also empirical literature on terrorism effect on debt levels. However, this literature has not sought to determine the cross effects of terrorism and female labour force on debt levels. Also one of the most discussed aspects in both theoretical and empirical literature is the effect of public debt on women's economic participation.

While the impact of terrorism on increasing public debt has been demonstrated on the one hand (Blomberg, Hess and Orphanides, 2004; Abid and Sekrafi, 2020; Jaidane-Mazigh, Khfacha and Chamakh, 2019) and a theoretical formalisation of the contribution of women's

employment rate on reducing public debt (Ostry et al, 2018; IMF, 2019) on the other hand, our added value in this research consisted in creating an interaction variable between the female employment rate captured by the proportion of women in the labour force and terrorism and to analyse the impact of this interaction variable on public debt. The creation of this interaction variable makes it possible to measure the contribution of economically active women to the reduction of the public debt in a context of insecurity caused by terrorism, where women in general react by staying at the bedside of their families.

Previous work has already laid the groundwork for the theoretical formalisation of the contribution of women's employment rate to public debt reduction. This earlier work relates to the findings of Okun (1962) on employment and growth followed by Mendez and Rajhi (2001) who highlight the positive effect of employment on economic growth, wealth that will be released to pay for debt service (Nersisyan and Wray, 2011). However, the female employment rate is essentially handicapped by two factors, namely, the crowding out of women from the labour market and the consequent decline in the female labour force's contribution to national wealth and the impact of terrorism on women. The World Bank (2017) shows that four out of five women of working age are not in the labour force in poor countries, indicating that part of the female labour force is being squeezed out of the labour market. If a part of the working population that constitutes women is crowded out of the labour market, this naturally impacts on the positive effect of employment on economic growth as highlighted by Mendez and Rajhi (2001). Furthermore, Buvinic, Das Gupta and Casabonne (2013), UN Women (2015) and the World Bank (2017) show that in cases of conflict, insecurity or terrorism, there is a restriction on women's employment. In this sense, we proposed to measure the combined effect of terrorism and the proportion of women in the labour force on the level of public debt in order to assess its impact in the ECOWAS zone.

4. Conclusion

Terrorism and armed conflicts have serious consequences on the public finances of the countries affected by these phenomena, such as the ECOWAS countries. These phenomena destroy the capacity of public authorities to fulfill their regalian role, thus increasing their economic and social costs. The objective of this paper was to determine the impact of terrorism on the level of indebtedness of West African countries by highlighting the role and interactions of the proportion of working women in this relationship over the period 2010-2019. After estimation, the results of the two models revealed that the increase in terrorism worsens public debt and the proportion of economically active women lowers the level of debt. However, the interaction between terrorism and the proportion of economically active women contributes to an increase in the level of debt, revealing that although the female labor force (proportion of economically active women) contributes positively to the economy of the ECOWAS zone, terrorism inhibits the positive contribution of the female force. This can be explained by the findings of Buvinic, Das Gupta and Casabonne (2013) which show that, on the one hand, women are much more exposed to gender-based violence during conflicts and, on the other hand, that during a conflict, men are more likely to lose their lives in combat and women are more likely to be trafficked and subjected to gender-based violence and used as a means of subjugating civilian populations.

5. Economic policy implications

Terrorism and its implications on the different compartments of the economy of nations in general and specifically that of the ECOWAS zone constitute a major problem for the pursuit of high and sustained economic growth. The results of this research are important for both policy makers and academics from the point of view of contributing to the economic literature on the one hand; on the other hand, the results we reached have highlighted the necessary

factors that can enable the ECOWAS region to achieve its objectives of controlling public finances and promoting economic growth. Based on the results obtained, it is clear that ECOWAS countries are particularly vulnerable in recent years with terrorism on the rise in West Africa. Therefore, efforts must also be made in the area of security to neutralize or reduce the level of terrorism, which can help promote economic growth and reduce public debt. Also, special emphasis should be placed on the promotion of women in economic activities. It would be important for policy makers in these countries to implement programs towards the empowerment and protection of women.

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Appendices

Appendix 1 : variable definition

Variables	Measurement of variables	Source
Private investment (INVPRI)	<i>Gross capital formation, private sector (% GDP)</i>	AFDB Socio Economic Database (2021)
Domestic product per capita (PIBTET)	<i>GDP per capita (constant 2000 prices, US\$) (in ln)</i>	AFDB Socio Economic Database (2021)
Total debt burden (DETOT)	<i>Total outstanding debt at the end of the year (% of GDP)</i>	AFDB Socio Economic Database (2021)
Proportion of working women (POPACT)	<i>Economically active female population (% of Active Population)</i>	AFDB Socio Economic Database (2021)
Military Expenditures (DEPMIL)	<i>Military expenditure (% of GDP)</i>	World Development Indicators (2021)
Population growth rate (POP)	<i>Population growth (annual %)</i>	AFDB Socio Economic Database (2021)
Inflation (INFLA)	<i>Inflation, consumer prices (annual %)</i>	AFDB Socio Economic Database (2021)

Control of corruption (CONCORR)	<i>Control of corruption</i>	Worldwide Governance Indicators (WGI, 2019)
Terrorism (TERROR)	<i>Overall Terrorism Index Score</i>	Global Terrorism Index (GTI, 2021)
Political Stability (STAPOL)	<i>Political Stability and Absence of Violence</i>	Worldwide Governance Indicators (WGI, 2019)

Source : Author from literature, 2021.

Appendix 2 : Descriptive statistics of variables

Variable	Observations	Means	Stand. Dev.	Minimum	Maximum
DETOT	n = 15	21.79122	22.20989	5.949951	97.10074
PIBTET	n = 15	1152.902	849.5809	473.9977	3539.088
INVPRI	n = 15	14.80777	6.672089	4.482651	28.33459
POPACT	n = 15	45.18461	3.9982	38.51826	50.34344
INDTERROR	n = 15	1.820407	2.458962	0	8.1893
DEPMIL	n = 15	1.181546	.6129568	.4752235	2.17264
INFLA	n = 15	4.810859	4.826956	.7460771	11.82016
POP	n = 15	2.668108	.5777886	1.164073	3.937312
CONCORR	n = 15	-.5845238	.5272326	-1.404029	.8694127
STAPOL	n = 15	-.8228625	.6433065	-2.025557	.7763807

Source : Authors from the base for estimates, 2021.

Appendix 3 : Results of the estimates of the terrorism index and the proportion of women as well as the interaction on public debt in the ECOWAS countries

variables	Coefs.	
	Equation 2	Equation 3
DETOT _{t-1}	.3807006*** (0.001)	.447233*** (0.000)
PIBTET	.0816831** (0.038)	.1603681** (0.000)
INVPRI	.0042204*** (0.001)	.0032074*** (0.008)
POPACT	-.8236109*** (0.000)	
INDTERROR	.0060585** (0.081)	

POPACTxINDTERROR		.0061613***
		(0.000)
DEPMIL	.022294***	.0155608*
	(0.011)	(0.060)
INFLA	.1067606***	.1201182***
	(0.003)	(0.000)
POP	-.1355495***	-.0905757***
	(0.000)	(0.000)
CONCORR	-.0102127***	-.0097908***
	(0.000)	(0.000)
STAPOL	-.0469726**	-.0976454***
	(0.080)	(0.000)
AR(1)	Pr > z = 0.016	Pr > z = 0.009
AR(2)	Pr > z = 0.204	Pr > z = 0.131
Sargan test	Prob > chi2 = 0.401	Prob > chi2 = 0.572
Hansen test	Prob > chi2 = 0.653	Prob > chi2 = 0.881

Source : Authors based on estimation results.

***** : significance at the 1% level; ** : significance at the 5% level; * : significance at the 10% level.**