International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 12, December-2016

Survey of the Causality between Military Training Quality and Security: the case of Malagasy Military

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***Abstract*- The impact of military training on security is not clear and deserves detailed empirical analysis in order to discern which one (if any) of the effects prevails This paper has focused on the relationship between military training quality and security. A Granger-causality analysis has been carried out in order to assess whether there is any potential predictability power of one indicator for the other. The conclusion that can be drawn is that military training quality can be used in order to predict security, but the opposite it is not true.**

Key words: Granger causality Test, military training quality, security

I. INTRODUCTION

The relationship between military spending and economic growth has attracted the interest of many economists and researchers since Benoit's study [1]. Since then, scholars have carried on several studies which, among others, are to investigate the presence and direction of the relationship between these two variables, either at the individual country level or through the examination of large samples of countries. The present study is about military training quality and security. The first variable is under military spending and the second variable is determinant for economic growth. So the research question is "what is the relation between military training quality and security?".

II. METHODOLOGY

Data

Data used in this study are annual basis which cover the period of 2009-2015 and the variables are Malagasy military training quality (mtq) [3] and security (sec):

- Data related to (mtq) were collected from the Centre de Perfectionnement des Officiers (or Improvement Center for Officers) and Ecole d'Etat-Major (or Army Staff School). Quality of each training syllabus was evaluated on 1-5 Likert scale.
- And we have carried out a survey among population to collect data corresponding to security. For that survey, we were based on indicators formulated in the Plan National de Développement (PND) (or National Plan Development). In that national document, security is framed by three indicators: homicidal ratio, ratio of military frequency per population, and percentage of people feeling in security.

Thus, the fundamental equation for the present study can be shown as follows:

$$(sec) = f(mtq) \qquad (1)$$

Where security (sec) is function of military training quality (mtq).

Granger causality tests

Granger (1969) proposed a time-series data based approach in order to determine causality. In the Granger-sense (mtq) is a cause of (sec) if it is useful in forecasting (sec). In this framework "useful" means that (mtq) is able to increase the accuracy of the prediction of (sec) with respect to a forecast, considering only past values of (sec).

There are three different types of situation in which a Granger-causality test [2] can be applied:

- In a simple Granger-causality test there are two variables and their lags.
- In a multivariate Granger-causality test more than two variables are included, because it is supposed that more than one variable can influence the results.
- Finally Granger-causality can also be tested in a VAR framework; in this case the multivariate model is extended in order to test for the simultaneity of all included variables.

The empirical results presented in this paper are calculated within the first type that is a simple Granger-causality test in order to test whether military training quality "Granger cause" security and vice versa. This test is performed in order to identify the direction of the causal relationship between (sec) and (mtq). The casual relationships can be either unidirectional or bi-directional. This test estimates the following equations assuming there is no correlation between u_{1t} and u_{2t}

$$(sec)_t = \sum_{i=1}^{n} \alpha_i \,(mtq)_{t-i} + \sum_{j=1}^{n} \beta_j \,(sec)_{t-j} + u_{1t} \qquad (2)$$

$$(mtq)_t = \sum_{n=1}^{n} \lambda_i \,(mtq)_{t-i} + \sum_{j=1}^{n} \delta_j \,(sec)_{t-j} + u_{2t} \qquad (3)$$

Based on the coefficients for the equations (2) and (3) four different hypotheses about relationship between (sec) and (mtq) can be formulated:

- Unidirectional Granger-causality from (mtq) to (sec). In this case (mtq) increases the prediction of the (sec) but not vice versa. Thus $\sum_{j=1}^{n} \beta_j \neq 0$ and $\sum_{j=1}^{n} \delta_j = 0$
- Unidirectional Granger-causality from (sec) to (mtq). In this case the (sec) increases the prediction of (mtq) but not vice versa.. Thus $\sum_{j=1}^{n} \beta_j = 0$ and $\sum_{j=1}^{n} \delta_j \neq 0$
- Bidirectional (or feedback) causality. In this case $\sum_{j=1}^{n} \beta_j \neq 0$ and $\sum_{j=1}^{n} \delta_j \neq 0$, so in this case the (sec) increases the prediction of (mtq) and vice versa
- Independence between (sec) and (mtq). In this case there is no Granger causality in any direction, thus $\sum_{j=1}^{n} \beta_j = 0$ and $\sum_{j=1}^{n} \delta_j = 0$

Hence by obtaining one of these results it seems possible to detect the causality relationship between military training quality and the security in Madagascar as far as assessment of strategic management is concerned [4].

III. RESULTS AND DISCUSSION

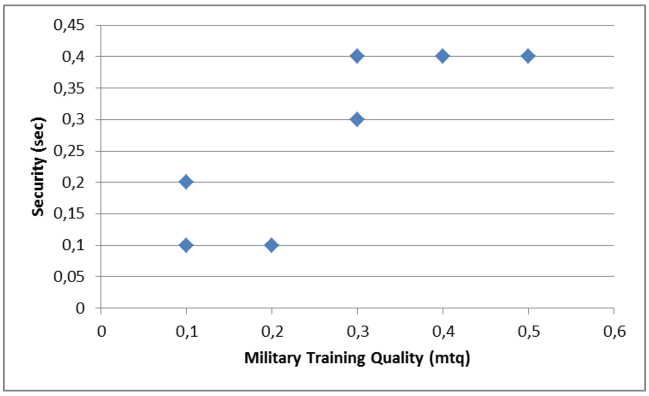

Figure 1: Scatter plots for (sec) and (mtq)

Figure 1 shows how just a quick view on the data can support a positive relation between the two variables (in percentages). The analysis in this paper will show in formal terms what kind of relation can be hypothesized on these two variables.
The first step in this analysis concerns the stationarity of the (sec) and (mtq) series. Granger causality requires that the series have to be covariance stationary, so an Augmented Dickey-Fuller or ADF test has been calculated. For all of the series the null hypothesis H_0 of non stationarity can be rejected at a 5% confidence level.

Then, since the Granger-causality test is very sensitive to the number of lags included in the regression, both the Akaike (AIC) and Schwarz Information Criteria have been used in order to find an appropriate number of lags.

After that these requirements have been satisfied, Granger-causality tests are computed. Taking equation (2) as an example, the two steps procedure in testing whether (mtq) causes (sec) is as follows.

1- (sec) is regressed on its past values excluding (mtq) in the regressors. This is called the restricted regression, from which we obtain the restricted sum of squared residuals.
2- Thus, a second regression is computed including the lagged SP. This is called the unrestricted regression from which the unrestricted sum of squared residuals is obtained.

The statistics is defined as:

$$F = \frac{\frac{SSR_r - SSR_u}{n}}{\frac{SSR_u}{T-(m+n+1)}}$$

where SSR_r and SSR_u are the two sums of squared residuals related to the restricted and unrestricted form of the equation; the elements that form the degrees of freedom are T , that is the number of observations while n and m are the number of lags as it can be seen from (2). The same procedure is used in order to test for the inverse Granger-causality relation in (3).

It is important that the data are covariance stationary in order to perform any kind of such regression, given the key of interpretation that we are looking for. For this the ADF test has been performed. This is a classic choice in literature and very strong test against unit roots. It is worth emphasizing that the two series that we are working with are already growth patterns, therefore we expect them to be I(0).The result reflects the I(0) state of the variables. It is also possible to see this result from the graphs above that show the rates of growth of the two series.

Since the series are covariance stationary we can proceed to checking f or the number of lags to input in the model. The Granger causality test is sensitive to this kind of formatting of the model, and it is therefore important to choose and information criterion to base the decision on the number of lags to apply to the two series in the regressions to follow. For this purpose we have analyzed a large range of lags both for the β referring to the (sec). Many previous works use the criterions of Akaike and Schwarz to formulate these choices. The optimal values are m = 2 and n = 7 form defined as the lag of the (sec) series and n the lag applied for the mtq series.

Thus, the results of Granger Causality for equations (2) and (3) are represented in table 1 and 2. The tables report the results corresponding to diff erent regressions, in order to have a comparison of the diff erent regressions outputs. The values of F statistic suggest that (mtq) Granger-causes $(sec)^2$, and (sec) does not cause (mtq). Thus, it can be argued that past values of (mtq) contribute to the prediction of the present value of (sec) even with past values of (sec). Moreover by the single regressions it can be showed that also with 5 lags much of the coefficients have positive sign and with an acceptable significance level. However it has to be taken in account that the level of R^2 is low, reminding that past rates of (mtq) could have a limited ability for the prediction of (sec).

For the equation (2) the associated F tests give the opposite result, in fact there seems to be no Granger-Causality from past values of (sec) for future values of (mtq). It has to be noted that this holds for all the specifications tried, and so in this case the null hypothesis of no causality from (sec) to (mtq) . Moreover all the R is close to zero, and the F-ratios (that test for all the right-hand coefficients significance) are statistically insignificant.

Concluding our tests for Granger causality reflects what showed and as-assessed in the theory. There seems not to be any causality from (sec) to (mtq). But an inverse Granger-causality seems to be possible even if the relationship does not seem to be so strong. Indeed this can be found in the current and past events, which showed more than once how the (mtq) is not always in tune with the (sec). However, to the extent that the variation in the (mtq) can be seen as a leading indicator for the fluctuations of the aggregate output of security, there is a better chance for countercyclical policies to be adopted in advance.

TABLE I: RESULTS OF GRANGER-CAUSALITY TESTS EQUATION 2

m	n	DW-Stat	F-Stat	R^2	F-Ratio
2	1	2.1182	5.573(1,120)	0.119	6.215(3,120)
2	2	2.0372	11.015(2,120)	0.210	9.127(4,120)
2	3	1.9583	7.983(3,120)	0.223	7.733(5,120)
2	4	1.8840	5.555(4,120)	0.216	6.119(6,120)
2	5	1.9582	3.885(5,120)	0.224	5.398(7,120)
2	6	2.0071	3.272(6,120)	0.230	4.801(8,120)
2	7	2.0042	3.043(7,120)	0.240	4.458(9,120)

TABLE II: RESULTS OF GRANGER-CAUSALITY TESTS EQUATION 3

m	n	DW-Stat	F-Stat	R^2	F-Ratio
2	1	1.9122	0.007(1,120)	0.003	0.161(3,120)
2	2	1.9281	0.647(2,120)	0.012	0.444(4,120)
2	3	2.0166	0.461(3,120)	0.017	0.471(5,120)
2	4	2.0020	0.307(4,120)	0.014	0.319(6,120)
2	5	1.9841	0.462(5,120)	0.022	0.425(7,120)
2	6	2.0011	0.484(6,120)	0.270	0.448(8,120)
2	7	2.0028	0.408(7,120)	0.268	0.389(9,120)

I. CONCLUSION

There is a causality relation between military training quality and security in Madagascar base of military learning and quality [5]. The Granger test has permitted to undertake the survey. The Malagasy case reveals that is that military training quality can be used in order to predict security, but the opposite it is not true.

II. REFERENCES

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