The Greek-Turkish rivalry: A Bayesian VAR approach

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Abstract

The ongoing Greek-Turkish antagonism has triggered the interest of defense economists to explore whether the two nations are engaged in an arms race. The issues that divide them are complex and rooted in years of conflict and mutual distrust. However, efforts to resolve their disputes have so far been unsuccessful, and rapprochements have invariably been short-lived. Following gas discoveries in the eastern Mediterranean, the states nearly came to blows in 2020 and enacted military expansion plans, further risking escalation. Since empirical studies examining the relationship between their military expenditures do not offer common answers, we use a novel Bayesian technique applied to VAR models to investigate the possible interdependence between four different proxies of the states' physical arms build-up. Based on an annual dataset running from 1960 to 2020, we find that a shock in a country's military expenditure does not have an impact on the opponent's spending. Thus, in distinction to those focusing on the costly maintenance of strategic balance, it is important that these rivals strengthen their cooperation and jointly contribute to the advancement of peace and economic development across the entire area.

Keywords: Interstate rivalry; military expenditures; Greece; Turkey; BVAR models

JEL codes: C11, C53, F52, H56

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1. Introduction

Empirical studies on the topic of arms races have been one of the focal points of political sciences and defense and peace economics, since the seminal work of Richardson (1960), which explains the time series pattern of military expenditures between potential enemies in an action – reaction framework. It is widely admitted that if (at least) two potential adversaries' defense spending is affected by each other, an arms race would be present among them (Seiglie and Liu 2002).

Greece and Turkey, two NATO allies, have been maintaining an antagonistic relationship that can be attributed to historical territorial disputes resulting from their intertwined geography, and despite Western-led diplomatic efforts, the rivalry remains unresolved (You 2016; Ifantis 2018). The ongoing hostility has led many to believe that the countries have been engaged in an arms race, particularly due to the Cyprus conflict in 1974, followed by numerous narrowly avoiding war situations in 1987, 1994, and 1996, during which the respective forces were placed on full alert (Matthews 1999; Athanassiou and Kollias 2000). Apart from the island of Cyprus, the most prominent bone of contention between Greece and Turkey, there are four other primary areas of dispute, namely the extent of territorial waters in the Aegean, the extent of territorial airspace, the continental shelf rights, and the militarization of certain Greek Aegean islands. In August 2020, the tensions escalated to dangerous levels after a sequence of events including a Greek – Egyptian delimitation agreement, ignoring the opponent's territorial claims and Turkish drilling ships entering disputed waters, while shortly before the end of 2022, Greece affirmed its intention to demarcate the country's territorial waters to twelve nautical miles around Crete, and Turkey stepped up its rhetoric, threatening Athens with retaliation, as it could be seen as a casus belli, justifying military action.

At the same time, the two militaries are ramping up their capabilities. Between 1999 and 2020, the ratio of the states' defense expenses to GDP has been above the average for NATO members, and both, are regularly among the top defense spenders globally, with defense budgets sometimes double compared to those of G7 economies. The Turkish military burden has increased by 36.5 percent during the past decade, which depicts the imperative need to assure its national security, as besides the persisting confrontation with Greece, it is surrounded by highly volatile countries, such as Iran, Iraq, Syria, and the newly independent follow-on states of the former Soviet Union in central Asia, but also faces internal security considerations regarding Islamic fundamentalism and its restive population of ethnic Kurds (Chletsos and Kollias 1995; Sezgin 1998). Equally, the volatile situation in the Balkans may well be one of the reasons for the high military expenditures of Greece, although, in 1985 the country officially declared a defense policy by identifying Turkey as a principal threat to its national security[1] (Dunne and Vougas 1999), and thereafter, despite its economic struggles, continued to allocate an average of 3.12 percent of its GDP to the defense sector. In 2020, Athens, aiming to boost its armed forces, announced the purchase of 18 Rafale fighter jets, fully deployed in Athens by the summer of 2023 and four new frigates, while in 2022 signed with France a contract for the acquisition of six additional Rafale aircrafts, delivered to the Hellenic Airforce by 2024[2].

The extant literature does not offer common answers for the questions "Is there an arms race between these neighboring states?" and "Did this arms race end?". As stated by Brauer (2002) the arms race between Turkey and Greece ended during the period 1985-1990, whilst Tütüncü and Şahĭngöz (2020) showed that it continued during the years 2000-2014. The current study makes a fresh empirical investigation using a Bayesian Vector Autoregression (BVAR) model for an annual dataset running from 1960 to 2020, in order to explore the dynamics of Greek – Turkish security relations. Specifically, we investigate the nature of the arms race between the two countries to enhance our understanding of the Eastern Mediterranean region's security dynamics. As endorsed by the findings of the current study, the military expenditures of the rival nations are independent of each other, and may not necessarily be symptomatic of an arms race. In distinction to those focusing on the costly maintenance of strategic balance, it is proved

[1] At the same time, the Greek defense doctrine regarded the Warsaw Pact threat as indirect and possible only in the event of a wider East – West conflict (Platias 1991).

[2] https://www.gdaee.mil.gr/en/fdi-hn-contracts-signing/, contracts 013G/2020 and 018B/2021

important that these opponents strengthen their cooperation and jointly contribute to the advancement of peace and economic development across the entire area.

The remainder of the paper proceeds as follows: Section 2 offers a brief overview of previous research and poses the testable hypothesis, Section 3 sets out the methodological framework upon which our model is structured, Section 4 presents the data, Section 5 provides the empirical analysis of the results, Section 6 offers an evaluation of the performance of our selected model, while Section 7 concludes.

2. Literature Review

The Greek-Turkish relationship is about bitter historical memories, blood spilled, refugee drama, forced population exchanges, conflicting national narratives, and, among certain constituencies, racist representation of each other. But it is equally so about geopolitical competition, security anxieties, and competing sovereignty claims (Choulis et al. 2021). The enduring confrontation between these two neighboring countries has led a number of researchers to test for the existence of an arms race between them, but previous studies have given mixed results. It is possible to divide the Greece and Turkey arms race literature into three categories: works that confirm the arms race hypothesis, those that partially support it and those that reject it.

Majeski and Jones (1981) and Majeski (1985) using statistical causality analysis, test for interdependence in the military expenditures of Greece and Turkey for the period 1949-1975 and find that each nation responds to the current behavior of its rival, which is indicative of the interest the countries attribute to the arms behavior of their opponents. Kollias and Makrydakis (1997) and Kollias and Paleologou (2002) are also among the studies that find bidirectional causality relation between the two states, according to the causality test results. Öcal (2002) considers the hypothesis based on the impact of countries' military spending mutually by using Smooth Transition Regression (STR) and Logistic Smooth Transition Regression (LSTR) models, and shows that the change in Turkey's military expenditures affects the corresponding expenses of Greece. The LSTR model results reveal that Greece does not want to fall behind compared to its opponent. Andreou and Zombanakis (2011) after dividing their research into two sub-periods

- before and after 2000- employing an artificial neural networks method, indicate the leading role of the demographic preponderance of Turkey over Greece. Even after 2000, the former continued to set the arms race rules by determining the defense spending of its enemy.

Among the studies that partially confirm the presence of an arms race, Kollias (1991) applies the classical Richardson model over the periods 1950-1986 and 1974-1986, but the way the model is specified does not seem to work in this case, since it approaches defense expenditures and the arms race from outside, without allowing for the specific strategic environment nor for the way in which decisions are reached by military planners. Only after employing specific indices of military capabilities, Greek military spending is found to depend on the Turkish relative size of the armed forces and defense expenses. Dunne et al. (2005) show some form of cointegration between the military expenditures in both countries, though not of Richardson arms race type, but one in which relative military burdens adjust, with income variables playing an important role. Moreover, the study of Tütüncü and Şahi̇ngöz (2020) elaborated for the years 1960-2016 proves by using asymmetric causality tests that a mutual relationship exists between the nations' defense expenses, whereas the bootstrap causality testing, results in a unidirectional causality relation.

At the other end of the spectrum, Georgiou (1990) finds no evidence of an arms race over the period 1958-1987. Georgiou et al. (1996), based on the work of McGuire (1977) and Desai and Blake (1981), use a vector autoregression specification, and their empirical findings provide little corroboration of the view that there is an arms race. Smith et al. (2000) benefit from game theory and Hamilton's regime-switching model, and their statement that each country plays independently is accepted by the data, whereas in a similar vein, Şahin and Özsoy (2008), employ a Markov switching approach for a dataset running from 1958 to 2004 and detect no interdependence between the defense spending of the two states. Further, Öcal and Yildirim (2009) use Threshold Autoregressive (TAR) and Momentum Threshold Autoregressive (M-TAR) cointegration models to investigate the possibility of an asymmetric error correction for the long-run equilibrium and find that Turkish military expenses harmonize with long-run deviations, whilst Greek ones fail to do so. Paparas et al. (2016) in a study over the period 1957-2013 found that there is no evidence of causality between Greek and Turkish military spending, which means that the countries act independently.

Given this contradictory situation, focusing on the political and strategic environment in the region, and following the theoretical arguments and empirical evidence, it seems appropriate to investigate, using up-to-date data, the Greek – Turkish relationship, anew. The political and military history of the nations and the existing agreements between them may affect the extent of an arms race. The discovery of gas in the eastern Mediterranean has exacerbated Greek – Turkish contestations over maritime borders, and the August 2020 naval stand-off was the latest chapter in a series of high-risk military crises, dating back to 1976. Military posturing that lasted for almost 45 days brought the opponent navies to the brink of clashing violently. Further, Turkish violations of the Greek – claimed airspace that represent a measure of the intensity with which Turkey pursues the conflict (Kollias 2004; Athanassiou et al. 2006), have been on the rise since 2013 with 2020 acknowledged as a record year. In Brauer's (2002) article which constitutes a critical review of the literate on Greek – Turkish relations, it is implied though, that the arms race if any, ended somewhere in the mid-to late-1980s, while according to the time-varying causality testing results in Tütüncü and Şahİngöz (2020), the presence of an arms race can be confirmed for the sub-periods 1975-1990 and 2000-2014. Nevertheless, the hostility between two nations does not necessarily lead to an arms race and may be expressed in diverse ways (Amir-ud-Din et al. 2020). The rivalry can take different forms such as periodic exchanges of bellicose rhetoric; economic, political and diplomatic maneuvering; lobbing within existing alliances; political, historical, and cultural propaganda (Georgiou et al. 1996). Therefore, we form our hypothesis as follows:

H: The hostility between the neighboring countries Greece and Turkey does not feature an arms race.

Next section develops the model and the econometric techniques to formally explore this hypothesis.

3. Methodology

Part of the confusion of the findings in the empirical studies stems from the models used in each case and the specification problems encountered, reflected, among others, in the extensive use of dummy variables. Over the past several decades, the Vector auto-regressive models (VARs) have been extensively used as standard tools in macroeconomic analysis and forecasting (Sims 1980, 1992; Christiano et al. 1999), mainly due to their simple formulation. Moreover, their popularity is attributed to the successful capture of dynamic linear relationships between time series without imposing restrictions on parameters, in contrast to the structural VAR models (Lopreite and Zhu 2020). However, when the frequentist approach is applied to VAR estimation, it presents several deficiencies. First, VARs may suffer from a loss of degrees of freedom, which decrease geometrically with the number of variables and proportionally with the number of lags included, ending up with large standard errors and unstable point estimates. Secondly, a typical VAR model works better with a small number of variables. Given their generous parameterization, as the number of unrestricted parameters that can be estimated is limited, we may result in the over-fitting phenomenon. Lastly, the VAR models are not parsimonious because they contain many parameters, tending to be poor in forecasting and in structural analysis due to omitted variables bias (Giannone and Reichlin 2006).

In recent years, Bayesian techniques applied to VAR models (BVAR models) provide logical and consistent solutions to VAR problems and have been introduced in several fields – especially macroeconomics and finance (Lopreite and Mauro 2017; Brancaccio et al. 2019). The reason why BVAR models are more effective than VAR models in forecasting and macro dynamic analysis is that they impose restrictions (priors) on the model coefficients, assuming that they are more likely to be close to zero with respect to the coefficients of the shorter lags (Litterman 1981; 1986; Doan et al. 1984). Specifically, in this case, it is possible to reduce the estimation error and generate only a relatively small bias on the estimated parameters. The problems associated with overfitting and the poor forecasting performance introduced by the VAR methodology when the number of parameters is large, the dataset is short. or the sample information is weak, can be mitigated with the BVAR approach (Sims et al. 1982; Stock and Watson 2001; Canova 2007; Kanngiesser et al. 2020). A number of studies have confirmed that the BVAR methodology can be successfully used for large datasets as well as datasets with a moderate level of cointegration (Bańbura et al. 2010; Auer 2014). Since in a classical estimation framework based on a frequentist VAR approach it is difficult to incorporate non-sample information into the estimation, the use of Bayes' theorem promotes the incorporation of our knowledge about the parameters observed from the data, into the Bayesian framework. The Bayesian approach combines the sample information with the researcher's prior information on the coefficients to derive a posterior distribution.

The choice of a prior distribution summarizing the researcher's uncertainty over the model parameters is a crucial step in specifying a BVAR (Ciccarelli and Rebucci 2003); if the prior is too loose the risk of overfitting is hard to reduce, whereas if it is too tight the data are not allowed to speak. As pointed out by Learner (1978) prior information matters in the sense that two researchers can legitimately make different inferences from the same dataset. The usage of the priors could balance the trade – off between less overfitting data and more signal extraction capabilities. In other words, their specification provides a solution to the problem that equations with too many free parameters tend to contain excess noise, while equations with too few parameters fail to pick up the signal.

We start our analysis from a typical VAR(p) model:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + C x_t + u_t, \quad t = 1, \dots, T \tag{1}$$

where y_t is a $K \times 1$ vector of endogenous (dependent) variables, x_t is a m x 1 vector of exogenous variables, $A_l = (a_{ij}^l)$ are K x K matrices of unknown endogenous-variables lag coefficients $(l = 1, \dots p)$, $C = (c_{is})$ is a K x m matrix of exogenous-variables coefficients, and u_t is a K x 1 vector of error terms with a K x K covariance matrix Σ.

Equation (1) can be written in a compact form as follows:

$$Y = X^*B + U \tag{2}$$

where,

$$Y = \begin{pmatrix} y_1^{'} \\ \vdots \\ y_T^{'} \end{pmatrix}, X = \begin{pmatrix} y_0^{'}y_{-1}^{'} & \cdots & y_{1-p}^{'}x_1^{'} \\ \vdots & \ddots & \vdots \\ y_{T-1}^{'}y_{T-2}^{'} & \cdots & y_{T-p}^{'}x_T^{'} \end{pmatrix}, B = \begin{pmatrix} A_1^{'} \\ \vdots \\ A_p^{'} \\ C^{'} \end{pmatrix}, U = \begin{pmatrix} u_1^{'} \\ \vdots \\ u_T^{'} \end{pmatrix} \tag{3}$$

Y is a T x k matrix, X is a T x (Kp+m) matrix, B is a (Kp + m) x K matrix of the coefficients, and U is a T x K matrix.

The vectorized form of equation (2) is

$$Y = X^*\beta + u \tag{4}$$

where, y = vec(Y) is a $KT \times 1$ vector, $X^* = I_K \otimes X$ *is* a $KT \times K(Kp + m)$ matrix (I_K is a $K \times K$ identity matrix and $\otimes$ is the Kronecker product), β = vec(B) is a K(Kp +m) x 1 vector of all the coefficients, and u = vec(U) is a KT x 1 error vector with $\Sigma^* = \Sigma \otimes I_T$ a KT x KT covariance matrix.

Estimating equation (4) in a Bayesian way works as follows. Given the probability density function (pdf) of the data conditional on the model's parameters, that is the information contained in the data, in the form of a likelihood function,

$$L(Y|\,\beta, \Sigma) \propto |\Sigma|^{-T/2} exp\left\{-\frac{1}{2}\sum_t (Y_t - X_t\beta)^{'}\Sigma^{-1}(Y_t - X_t\beta)\right\}, \tag{5}$$

and a joint prior distribution on the parameters, $p(\beta, \Sigma)$, then the joint posterior distribution of the parameters conditional on the data is obtained by using the rule of Bayes,

$$p(\beta, \Sigma \mid Y) = \frac{p(\beta,\Sigma\,)L(Y|\,\beta,\Sigma)}{p(Y)} \tag{6}$$

$$\propto p(\beta, \Sigma\,)L(Y|\beta, \Sigma),$$

where, the joint pdf of the data and the parameters p(β, Σ, Y), by definition of conditional probability, can be written as:

$$p(\beta, \Sigma\,, Y) = L(Y\,|\beta, \Sigma)p(\beta, \Sigma)$$

$$= p(\beta, \Sigma|Y)p(Y) \tag{7}$$

The marginal posterior distributions conditional on the data, $p(\beta | Y)$ and $p(\Sigma | Y)$, can be obtained by integrating out Σ and β from $p(\beta, \Sigma \mid Y)$, respectively.

Next, we describe the Minnesota[3] (M) (Litterman 1980, 1986) and the Inverse Wishart (IW) priors employed in our modeling approach, a set of priors commonly used in VAR modeling.

The original M prior assumes that the variance-covariance matrix of the error vector u is fixed and known based on an approximation that involves substituting Σ with an estimate Σ_e, ignoring any uncertainty in this parameter. Specifically:

$u \sim N(0, \Sigma_e \otimes I_T)$.

This approximation sets the Σ matrix to be diagonal ($\Sigma_e = diag(\sigma_1^2, \dots \dots \dots \dots \sigma_n^2)$), simplifying the computation of the model, as the errors are assumed to be independent for each equation. This matrix is usually set by fitting a univariate autoregression for each series or the OLS residual variance from a classical VAR.

Given a diagonal variance-covariance matrix, we need to specify the prior covariance for β, taking into account a set of hyperparameters. The Minnesota prior for the vector coefficient β is a Multivariate Normal prior, where following Karlsson (2013):

$\beta \sim N(\beta_0, \Sigma \otimes \Phi_0)$.

The prior mean vector β_0 is a vector of 1s and 0s, with 1s corresponding to the self-variables first-lag coefficients, and Φ_0 is a fixed diagonal covariance matrix whose elements are defined for $l = 1, \dots p,\ j = 1, \dots K,$ and $s = 1, \dots, m$ as below:

For endogenous-variables lag coefficients:

$$\sigma^2_{\alpha_j^l} = \left(\frac{1}{\hat{\sigma}_j^2}\right)\left(\frac{\lambda_1}{l^{\lambda 2}}\right)^2 \tag{8}$$

For exogenous-variables coefficients:

[3] According to Giannone et al. (2015) this prior is centered on the premise that each variable follows a random walk process, maybe with drift, which is a "reasonable approximation of the behavior of an economic variable".

$$\sigma_{c_s}^2 = (\lambda_1 \lambda_3)^2 \tag{9}$$

The above formulas are controlled by the following scalars: (a) λ_1 controls the tightness of the prior variance for endogenous-variables lag coefficients. Small values imply that the prior information dominates the sample information. Contrariwise, large λ_1 values make the prior become non-informative and the posterior estimates converge to the unrestricted VAR coefficients. (b) λ_2 controls the lag attenuation (the higher the lag, the tighter the prior variances). Setting $\lambda_2 = 1$ implies a linear decay, and (c) λ_3 controls the prior variance of the exogenous-variables coefficients. Following similar literature (see *inter alia:* Bańbura et al. 2010; Koop 2010; Koop and Korobilis 2010; Brancaccio et al. 2019; Lopreite and Zhu 2020; Cafiso 2022) we give to our main hyperparameter of interest λ_1 (prior information) a small value (an evaluation of different values is provided in Section 6), λ_2 is set to represent a linear decay of lag attenuation, and λ_3 takes a value greater than zero as the information of exogenous variables is important in our analysis.

Although the above case is quite common in BVAR modeling, it ignores any uncertainty associated with the variance-covariance matrix Σ. The IW prior, alternatively, has the twofold advantage of relaxing the strong assumption of a fixed and diagonal variance-covariance matrix of the error terms, and also, being simple to interpret with convenient calculations, since the posterior distribution follows the same parametric form as the prior distribution.

So, in this case we have:

$u \sim N(0, \Sigma \otimes I_T)$ where, $\Sigma \sim IW(\alpha_0, S_0)$.

In our analysis, we select a typically used specification for the IW prior (Schuurman et al. 2016), where the hyperparameter α_0 (degrees of freedom) is set to the minimum possible[4] K+2 and S_0 refers to the identity matrix.

[4] Kadiyala and Karlsson (1997) and Giannone et al. (2015) follow a similar specification as this setting is the minimum value that guarantees the existence of the prior mean of Σ.

4. Data

In this section, we introduce the endogenous and exogenous variables of our modeling approach. To test our hypothesis, we examine as endogenous variables four different proxies for physical arms build - up, according to the notion that increases in the arsenal of the two rivals should be echoed by upward changes in their military spending (Kollias and Makrydakis 1997). Following the classical Richardon model (Dunne et al. 2001; Dunne et al. 2005) a bivariate BVAR approach is applied. In this context, each proxy is introduced into the model as two different series (one for Greece and one for Turkey), while we focus our interest on the interrelationship between them. Specifically, we use a) Military spending levels (in constant 2015 USA dollars), b) Military stock levels (in constant 2015 USA dollars), c) Military spending per capita of armed forces (in constant 2015 USA dollars), and d) Military burden (military spending as % GDP). Data on countries' military expenditures, is obtained from the World Bank, World Development Indicators database-WDI (2021). This is in line with much of the literature on the Greek – Turkish relations (Kollias 1996; Avramides 1997). In Brauer's (2002) study, it is stated that when analyzing an imminent military threat and testing for the presence or absence of an arms race, it is proper to use level or stock data, since levels and stocks indicate the actual or expected fighting capabilities of oneself vis-à-vis the putative adversary. Thus, countries' military stocks are captured by a second proxy, evaluated by using the perpetual inventory method[5]. Furthermore, since the existing literature points out that military capability is not appropriately measured by levels of military expenditures per se but rather in labor and capital, we obtain data on the Greek and Turkish armed forces for the period 1962-1992 from Kollias (1996) and extend this time series to also include the years 1993-2020 using data stemming from the World Bank (2021), in order to capture the military capability that such expenditures finance. Finally, we also use the countries' military burden, a common measure in the conventional defense literature, despite the

[5] The main idea of the method is the construction of yearly military stocks by adding each year's military expenditures and subtracting each year's depreciation of the existing stock by a specific rate. We construct the military stocks by using a 15% depreciation rate. Following the extant literature, we have tried different depreciation rates, e.g., 10%, and 20%, with overall similar results.

admission that share data may be more appropriate when the substantive concern is about the economic impact of military spending on variables of economic performance, such as economic growth (Sandler and Hartley 1995; Gold 1997)[6]. Except for the fourth proxy, which appears in the models in first differences, all the other variables are introduced as ln-transformed differences.

Our basic modeling approach further includes an exogenous variable, proxied by world GDP growth, in order to account for global factors (Berument et al. 2010; Comunale 2017).

Table 1, presents the descriptive statistics for all the variables detailed above, while Figure 1, illustrates a first view of the over-time levels of Greek and Turkish physical arms build-up.

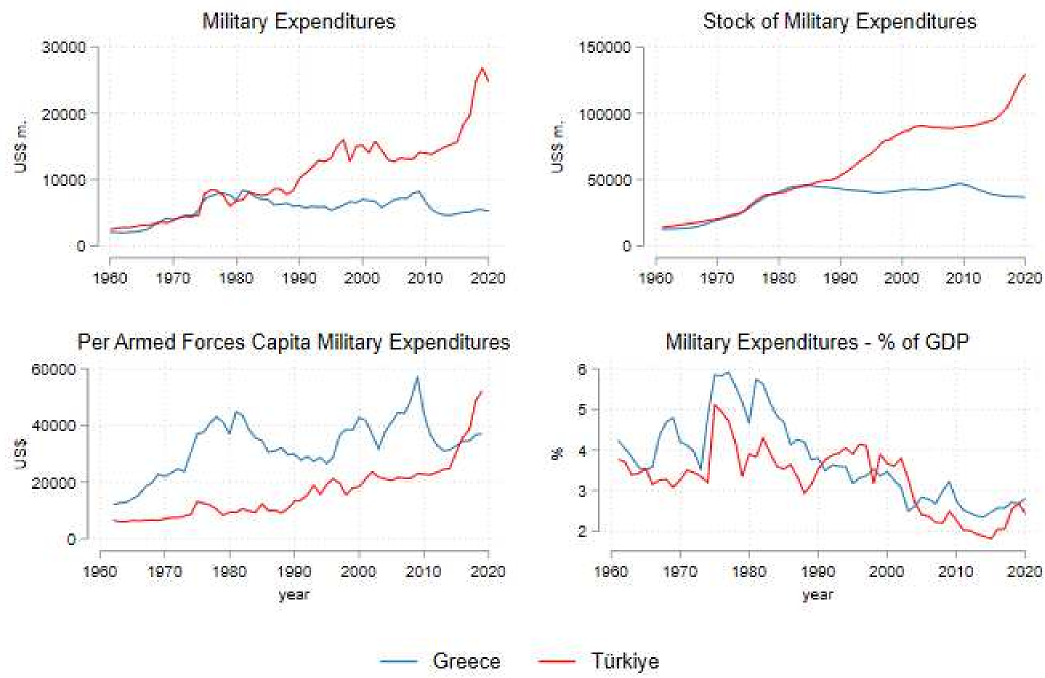
Table 1: Variable Definitions and Descriptive Statistics

Variable Description	Variable code	Mean	Std.dev.	Min	Max
Greece					
Military Expenditures (millions US$ constant 2015) – **Proxy 1**	gr_mil_con	5610.78	1733.49	1927.95	8348.37
Stock of Military Expenditures (millions US$ constant 2015) – **Proxy 2**	gr_mil_stock	35118.63	11410.85	12194.11	46751.88
Military Expenditures per armed forces capita (US$ constant 2015) – **Proxy 3**	gr_mil_parm	32765.06	9542.76	12049.7	57247.59
Military expenditures as % GDP – **Proxy 4**	gr_mil_gdp	3.77	1.01	2.35	5.91
Turkey					
Military Expenditures (millions US$ constant 2015) – **Proxy 1**	tr_mil_con	10484.43	5808.22	2434.85	26801.61
Stock of Military Expenditures (millions US$ constant 2015) – **Proxy 2**	tr_mil_stock	59022.48	32453.16	13004.76	129487.4
Military Expenditures per armed forces capita (US$ constant 2015) – **Proxy 3**	tr_mil_parm	16450.73	10038.55	6038.3	52346.9
Military Expenditures as % GDP – **Proxy 4**	tr_mil_gdp	3.28	0.78	1.81	5.12
Global					
World GDP growth	world_gdp_gr	3.44	1.72	-3.12	6.56

Notes: We account for four different proxies of the physical arms build-up. Prefixes used throughout the text are d_ for first difference, ln_ for natural logarithm, and L_ for lagged values.

[6] While the use of share data confers certain statistical advantages, such as comparability across countries, no need to deal with inflation and deflators or exchange rate conversions into a common currency, one cannot ignore Smith's (1998) sentiment that statistical convenience may not supplant substantive considerations.

Figure 1: The four proxies of physical arms build – up through time



At first, focusing on the two opponent states' military expenditures in constant prices, one can observe that from 1960 to 1966, both increase in line with each other, but Turkey's ones are at a higher level than Greece's. The first structural break occurs in 1967 and from then on, until around the mid - 1980's the two variables are tracing each other fairly closely. The Greece's spending upward trend documented from the early 1970's, could be attributed to weapon embargoes during the seven year dictatorship which forced government-controlled defense industries to be established, as well as to the increasing tensions with Turkey (Avramides 1997), which urged the country to assert its independence in weapon procurement. A huge increase in both states' military spending is evident in 1974, due to the Turkish invasion of Cyprus, which was accompanied by and created a domino effect, causing the Greek military junta to collapse[7]. From 1984 onwards, the level of Greek defense spending appears to be falling short of its Turkish counterpart. In fact, the year 1983 marks the second visually clear structural break, and whereas Greece's military expenses stay almost perfectly flat, Turkey's continue to rise, so that

[7] The decline in Turkish GDP growth and an economic crisis in the late 1970's were followed by a political crisis and the imposition of a military coup in 1980, which adopted a more outward looking economic strategy causing dramatic improvements for the Turkish economy.

the divergence grows in Turkey's favor. Two reasons can be put forward in explaining the visual disparity of the two series until 1995. First, the implemented stabilization programs in Greece in the late 80's have seriously curtailed the availability of the funds needed for the country to modernize its arsenal at the same rate as in the past, and be able to keep pace with the considerable arms purchases its adversary has been indulging into, during the same period[8]. Second, the intensification of Turkish internal security problems regarding the Kurdish movement for autonomy may partly justify the sustained upward development in its military expenses[9]. Another interesting pattern that also emerges according to the upper left figure, is the severe impact of the 2009 financial crisis on the Greek defense budget (Kollias et al. 2016), which limited the ability of the Greek government to direct resources to national defense[10]. In recent years, as Turkey increases the government spending for military purposes, Greece tries not to fall behind but has been unable to keep up with its rival. It is meaningful though, to note that both states have been yearly allocating an appreciable share of their national income to defense, a conclusion drawn both from the average values and the plot of the variables which capture the relevant military spending %GDP. Their defense burden has invariably been above the 2% guideline agreed among the NATO allies in 2006[11]. Specifically, Turkey allocates on average

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[8] Meanwhile, the events in the Balkans did not associate with amendments to the Greek military planning. Yugoslavia began to break up, and Greece was particularly upset about the creation of a state called Macedonia, and the treatment of Greek minority in Albania. Although the trends seemed primarily to require additional security concerns, none of these countries possessed large military establishments, and the Greek defense policy remained almost unaltered (Dunne et al. 2001).

[9] The Turkish security forces had been fighting for almost a decade in a costly and bloody – war with Kurdish separatists in the south – eastern provinces of the country (Günlük-Şeneser 1995; Kollias 1997).

[10] While Turkish military spending was driven solely by security concerns, Greece's decision – making on military expenses was more restricted due to its European Monetary Union membership (Waszkiewicz 2016).

[11] NATO Defense Ministers agreed to commit a minimum of 2% of their GDP to defense spending to continue to ensure the Alliance's military readiness. This guideline also serves as an indicator of a country's

3.28% of GDP on its military sector, while Greece 3.77%, a proportion higher than the NATO average (Choulis et al. 2021). The bottom left graph is, lastly, indicative of Greece's effort to respond to the military capabilities of its adversary by enhancing the capital intensity of its armed forces, which in principle, offsets its quantitative disadvantage resulting from its size and population constraints. Military expenditure per soldier can be treated as a proxy indicating the degree of weapon sophistication and the level of personnel training. Assuming that quality is provided at a higher cost, a well-trained army using modern weapons systems is more expensive to maintain than a poorly trained one using outdated armaments (Kollias 1996). Greece's higher values observed until 2015, prove that Greek defense planners attempt to counterbalance the country's disadvantage in numbers, by deploying more capital-intensive mechanized armed forces.

5. Results

5.1 BVAR analysis: impulse response functions and forecast error variance decomposition

In this section, we present the BVAR results, focusing our interest on the Impulse Response Functions (IRFs), which are commonly used to summarize VAR models. IRFs measure the effect of one variable's shock, called an impulse variable, on a given response variable. The impact of the shock on the response variable is identified over a predefined future period. We draw the posterior mean estimates of IRF coefficients along with the 95% CrIs[12].

First, for every variation of our endogenous variables, we have to select the number of lags, a process that constitutes an important consideration in the VAR models. In the Bayesian

political will to contribute to NATO's common defense efforts, since the defense capacity of each member has an impact on the overall perception of the Alliance's credibility as a politico-military organization.

[12] Bayesian credible intervals (CrIs) are actual probability distributions, and their interpretation is that there is a 95% probability that the true (unknown) estimate would lie within the interval, given the evidence provided by the observed data. On the other hand, the interpretation of the frequentist 95% confidence interval is the following: we can be 95% confident that the true (unknown) estimate would lie within the lower and upper limits of the interval, based on hypothesized repeats of the experiment.

framework, we compute the model posterior probability, conditional on the observed data, assuming that each model is equally likely a priori, considering a maximum number of five lags (max p=5). Results are reported in Panel A of Table 2. For all endogenous variables' variations, the highest posterior probability appears for one lag, except for Proxy 4 - Mil.Exp. as % GDP, where the highest posterior probability emerges for four lags.

Table 2: Model's posterior probabilities and probabilities of eigenvalues lie inside the unit circle

	Proxy 1 Mil. Exp. (m. US$ constant 2015)	**Proxy 2** Stock of Mil. Exp. (m. US$ constant 2015)	**Proxy 3** Mil. Exp. per Armed Forces Capita (US$ constant 2015)	**Proxy 4** Mil. Exp. (% GDP)
Panel A	P(M|y)	P(M|y)	P(M|y)	P(M|y)
1 lag	**0.8625**	**0.8961**	**0.7462**	0.0749
2 lags	0.1010	0.0992	0.1824	0.2319
3 lags	0.0351	0.0046	0.0600	0.1752
4 lags	0.0012	0.0001	0.0108	**0.3104**
5 lags	0.0001	0.0000	0.0006	0.2075
Panel B				
Pr(eigenvalues lie inside the unit circle)	0.9974	0.8715	0.9965	0.9932

Notes: We account for four different proxies of the physical arms build-up. The model posterior probability P(M|y) is defined as the probability of a model M computed given the observed data y, P(M|y) = P(M)P(y|M) = P(M)m(y) where P(M) is the prior probability of a model M and m(y) is the marginal likelihood under model M. In our case we assume P(M)=0.2.

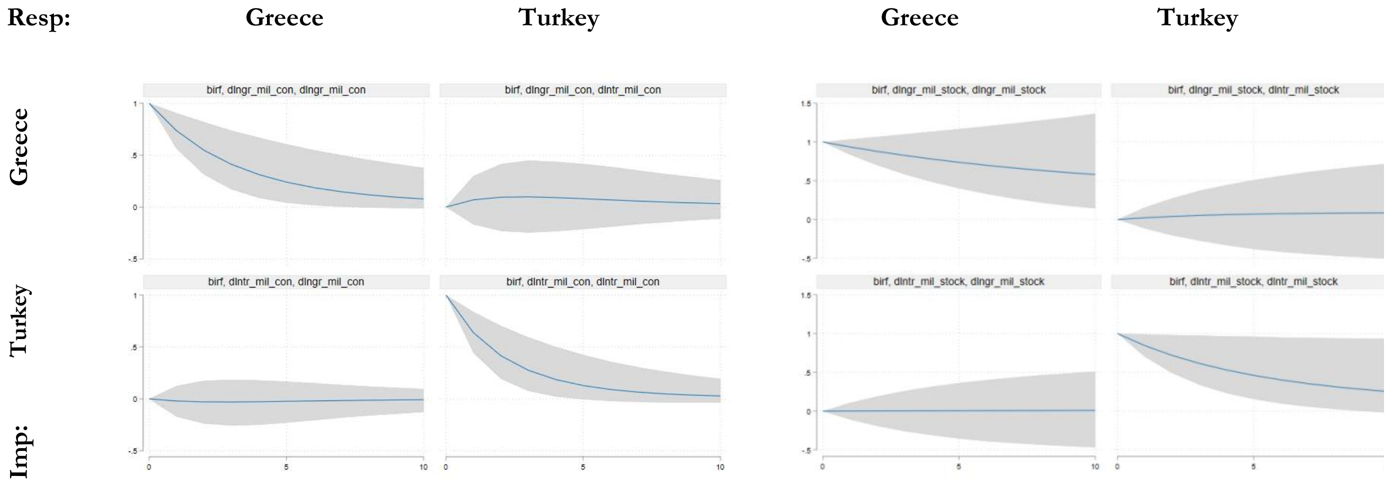
Next, having selected the number of lags for each one of our four different proxies, we proceed with the stability and graphical diagnostics checks, while we explore whether the Markov Chain Monte Carlo (MCMC) algorithm has converged. In Panel B of Table A.1, it is shown that in every case, the posterior probability that all eigenvalues lie in the unit circle is close to one, having no reason to suspect a violation of the stability assumption. Then, for the case of the proxy constant-value military expenditures (Proxy 1), Figure A.1 in the Appendix, shows that the trace plot does not exhibit any trend, and the autocorrelation is low, indicating that the MCMC has converged. Results are similar for the rest three of our endogenous proxies' variations[13].

Figure 2, depicts the IRFs for the BVAR models for the four different endogenous variables that we use as proxies (Proxies 1 to 4) of the physical arms build – up for Greece and Turkey. As an exogenous variable, the world GDP growth is included in all specifications in order to account

[13] Results are not reported for sake of brevity but are available upon request.

for global factors. The shaded regions are the 95% CrIs obtained through Gibbs Sampling, using a total number of 12,500 iterations, including 2,500 burn-in iterations. We present the responses of each country's variable (Proxy) to a shock (1% increase) from itself and the other country's same variable in the bivariate BVAR model for a ten-year period.

Figure 2: Bayesian IRFs and 95% credible intervals for the four different proxies of the physical arms build – up for the bivariate BVAR models between Greece and Turkey (10 - year horizon)

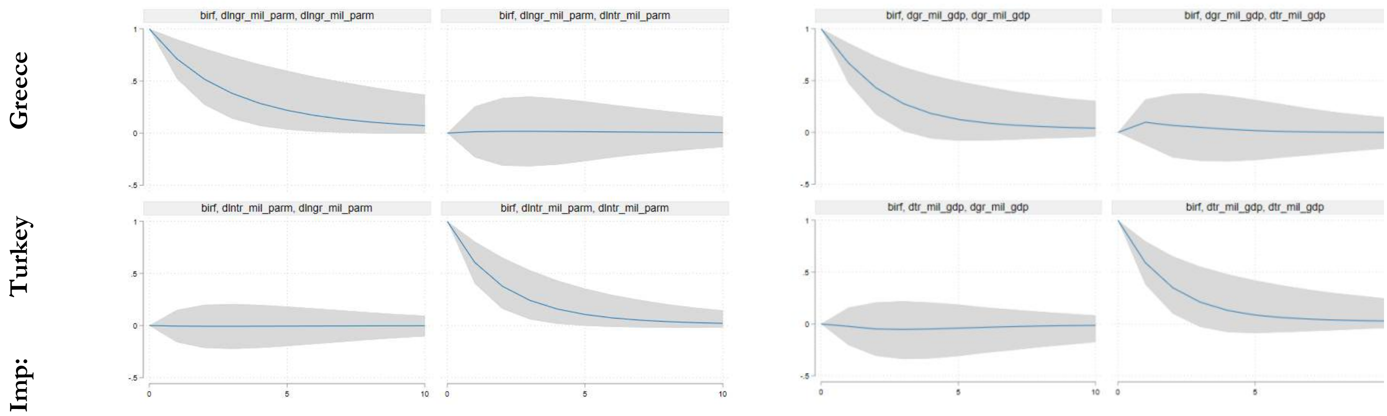


Proxy 1 - Mil. Exp. (m. US$ constant 2015)

(a)

Proxy 2 - Stock of Mil. Exp. (m. US$ constant 2015)

(b)



Proxy 3 - Mil. Exp. per Armed Forces Capita (US$ constant 2015)

(c)

Proxy 4 - Mil. Exp. (% GDP)

(d)

As it can clearly be seen, the IRFs indicate that for every Proxy the results are significant only for the own country's shocks (impulses). Specifically, for Proxy 1, Greece's own shock has a positive effect that remains significant till year 5 (row one, column one, Figure 2a), while Turkey's self shock is significant for a four - year period (row two, column two, Figure 2a). For Proxy 2, the significance of a country's own shocks is detected for longer periods, capturing the long run nature of building a nation's defense armaments, through military equipment programs (row one, column one, and row two, column two, Figure 2b). For Proxy 3, the results are similar to those concerning Proxy 1 (Figure 2c). Finally, for Proxy 4, for both countries, the state's own impulses have significant positive effects for a three - year period (row one, column one, and row two, column two, Figure 2d). As for the other county's shocks, results indicate a negligible/ insignificant positive effect from Greece to Turkey for Proxy 1 (row one, column two, Figure 2a) and for Proxy 4 (row one, column two, Figure 2d).

To gain a deeper understanding of the potential interdependencies and the relative importance of the variables, we further, conduct an analysis of forecast error variance decomposition (FEVD), using a predicting period of ten years following the initial shock. The FEVD measures the proportion of forecast error variance explained by the variables themselves and the other model variables. In Table 3, we present the results for each one of our Proxies of interest. In every case, the contribution to the variance of the other country's variable is minor, less than 10% in the ten-year horizon. The only exception is the case of Proxy 2, where Greece's Military Stock shows a contribution of 16% on Turkey's Military Stock total variance in the 10th year after the initial shock. On average, the other country's shocks do not have a notable power to explain the own country's forecast error variance, confirming the results of the impulse response function analysis, and validating our hypothesis that the hostility between the two neighboring countries does not feature an arms race.

Table 3: BVAR forecast-error variance decomposition (10 - year horizon)

Endogenous Variable:	**Proxy 1** - Mil. Exp. (m. US$ constant 2015)				**Proxy 2** - Stock of Mil. Exp. (m. US$ constant 2015)			
Impulse:	Greece		Turkey		Greece		Turkey	
Response:	Greece	Turkey	Greece	Turkey	Greece	Turkey	Greece	Turkey
Steps								
1	100.00(0.00)	1.83(2.48)	0.00(0.00)	98.17(2.48)	100.00(0.00)	9.59(6.62)	0.00(0.00)	90.41(6.62)
2	99.31(1.02)	2.82(3.23)	0.69(1.02)	97.18(3.23)	99.74(0.39)	10.16(6.90)	0.26(0.39)	89.84(6.90)
3	98.38(2.34)	4.06(4.41)	1.62(2.34)	95.94(4.41)	99.24(1.12)	10.83(7.40)	0.76(1.12)	89.17(7.40)
4	97.52(3.53)	5.19(5.57)	2.48(3.53)	94.81(5.57)	98.60(2.04)	11.57(8.05)	1.40(2.04)	88.43(8.05)
5	96.84(4.48)	6.10(6.52)	3.16(4.48)	93.90(6.52)	97.87(3.05)	12.35(8.78)	2.13(3.05)	87.65(8.78)
6	96.33(5.19)	6.77(7.25)	3.67(5.19)	93.23(7.25)	97.12(4.08)	13.15(9.55)	2.88(4.08)	86.85(9.55)
7	95.96(5.72)	7.26(7.80)	4.04(5.72)	92.74(7.80)	96.37(5.09)	13.95(10.31)	3.63(5.09)	86.05(10.31)
8	95.70(6.10)	7.60(8.22)	4.30(6.10)	92.40(8.22)	95.64(6.06)	14.73(11.06)	4.36(6.06)	85.27(11.06)
9	95.52(6.39)	7.85(8.53)	4.48(6.39)	92.15(8.53)	94.95(6.96)	15.48(11.77)	5.05(6.96)	84.52(11.77)
10	95.39(6.61)	8.03(8.76)	4.61(6.61)	91.97(8.76)	94.30(7.81)	16.20(12.44)	5.70(7.81)	83.80(12.44)

Endogenous Variable:	**Proxy 3** - Mil. Exp. per Armed Forces Capita (US$ constant 2015)				**Proxy 4** - Mil. Exp. (% GDP)			
Impulse:	Greece		Turkey		Greece		Turkey	
Response:	Greece	Turkey	Greece	Turkey	Greece	Turkey	Greece	Turkey
Steps								
1	100.00(0.00)	1.72(2.37)	0.00(0.00)	98.28(2.37)	100.00(0.00)	1.80(2.48)	0.00(0.00)	98.20(2.48)
2	99.29(1.05)	2.38(2.70)	0.71(1.05)	97.62(2.70)	99.21(1.17)	2.82(2.97)	0.79(1.17)	97.18(2.97)
3	98.39(2.32)	3.28(3.53)	1.61(2.32)	96.72(3.53)	97.89(2.86)	3.99(4.10)	2.11(2.86)	96.01(4.10)
4	97.61(3.40)	4.12(4.43)	2.39(3.40)	95.88(4.43)	96.61(4.42)	5.13(5.22)	3.39(4.42)	94.87(5.22)
5	97.03(4.21)	4.78(5.18)	2.97(4.21)	95.22(5.18)	95.60(5.59)	6.04(6.08)	4.40(5.59)	93.96(6.08)
6	96.61(4.80)	5.26(5.77)	3.39(4.80)	94.74(5.77)	94.89(6.39)	6.69(6.69)	5.11(6.39)	93.31(6.69)
7	96.31(5.23)	5.61(6.23)	3.69(5.23)	94.39(6.23)	94.43(6.95)	7.13(7.13)	5.57(6.95)	92.87(7.13)
8	96.11(5.53)	5.85(6.58)	3.89(5.53)	94.15(6.58)	94.14(7.34)	7.41(7.45)	5.86(7.34)	92.59(7.45)
9	95.97(5.76)	6.03(6.85)	4.03(5.76)	93.97(6.85)	93.94(7.62)	7.60(7.68)	6.06(7.62)	92.40(7.68)
10	95.88(5.92)	6.16(7.07)	4.12(5.92)	93.84(7.07)	93.81(7.84)	7.73(7.87)	6.19(7.84)	92.27(7.87)

Note: We account for four different proxies of the physical arms build-up. Numbers in parentheses denote standard errors.

5.2 Robustness Analysis

Several additional analyses are performed to assess the robustness of our results, as we are particularly interested in further exploring contingent interrelationships between the two countries.

First, we split our sample into two sub-periods, 1960-1974 and 1975-2020, because it was the summer of 1974, when the threshold of military engagement was crossed, with the Turkish Armed Forces invading and violating the sovereignty of Cyprus. Moreover, 1975, was the year during which Turkey called on Greece to limit its national airspace from 10 to 6 nautical miles, in line with the delimitation of its continental shelf[14]. Results presented in Figures A.2 and A.3 in the Appendix do not reveal any interdependent impacts. Then, we test the sub-periods 1960-1993 and 1994-2020 - before and after - the establishment of the Common Foreign and Security Policy (CFSP) under the Treaty of Maastricht in Europe, as a probable time benchmark for a structural change in the policy concerning the defense sector. Results do not alter significantly. The same findings apply for the period 1975-1993, in contradiction to those reported in the work of Tütüncü and Şahïngöz (2020), which confirm the presence of an arms race for the sub-period 1975-1990.

Subsequently, we insert a number of additional variables in our models to uncover any potential correlation between the rivals' military expenses. At first, since defense spending is used as an explicitly electoral tool, with spending levels rising just before elections to stimulate the economy and improve the incumbent party's prospects (Mayer 2002), we account for this process, by constructing two exogenous dummy variables, each of which takes the value of 1, if elections took place in the year under observation in Greece and Turkey, respectively, and zero otherwise. In addition, we use an exogenous dummy indicating whether Recep Tayyip Erdoğan was the country's leader in a given year, because it is possible that he is "structurally different" than his predecessors, as he has now ruled for twenty years, since taking prime ministerial office in 2003, whilst that position was held by eight different individuals in the previous

[14] The root of the problem lies in a reform enacted by Greece in the 1930s to delimit airspace of 6-10 nautical miles above international waters. The 1944 Chicago Convention on International Civil Aviation, however, stipulated that airspace can only exist over land areas and territorial waters, yet no one addressed the issue of Greece's expansion of its airspace over international waters.

twenty-year-long period. Moreover, we use a dummy in order to allow for the substantial shift in foreign and defense policy that occurred in 1981, when the socialist party came into office in Greece, and a second one to capture if an observation occurred in or after the 2016 coup attempt, which resulted in an important change in Turkish civil military relations, thus potentially affecting both Turkish military spending and Greek perceptions of the danger posed by its rival. We also, insert into our models a Political Regime proxy using data from the Polity IV Project. The results emerging from IRFs remain unchanged throughout. As for economic factors, following previous studies, we include in an augmented BVAR modeling approach, variables to capture investments as %GDP and GDP growth (Kollias and Paleologou 2010, 2016, 2019), but also urban population (% of total population), and age dependency ratio (% of working-age population) (Amir-ud-Din et al. 2020), deriving data from WDI. The results of the dynamic IRFs analysis between the rivals are barely modified. Lastly, we account for the serious Greek – Turkish disputes and include a variable, taking a value of 1 for the years 1963, 1974, 1977, 1987, 1994, 1996, 1999 and 2018-2020 (Clogg 1991; Brauer 2002; Tütüncü and Şahi̇ngöz 2020; Choulis et al. 2021), but additionally, we take into consideration the significance of each state's internal security environment. Given the dramatic changes in the Balkan region and the tensions that had developed between Greece and two of its northern neighbors, Albania and North Macedonia (Klok 2003), a dummy is inserted in the models taking the value of 1 for the years 1991-1995, allowing for the Balkan area developments. Similarly, since Turkey is also facing a relevant domestic security challenge from the PKK and more severe internal conflict may be correlated with increased military spending, we construct a dummy that takes the value of 1 for each of the years the Turkish security forces were involved in a struggle with the PKK militants (Thomas and Zanotti 2019). Results concerning our main proxies of interest remain almost unaltered. Overall, the results do not vary in any substantial way across alternative variables, subsets, and specifications.

6. Forecast evaluation

To validate our choice of a Bayesian framework and evaluate the performance of our selected model, in this section, we compare the forecast accuracy resulting from four different models: the unrestricted VAR and three BVAR models for the four different endogenous variables with the same specification (lags and an exogenous variable). We evaluate three different BVAR models for each of our proxies, where in the first model the main hyperparameter λ_1 (which controls the prior variance for endogenous variables lag coefficients) is set to the value 0.1 indicating an informative prior, in the second model, it is set to the value 0.5, and in the third, to 1 indicating a quite non-informative prior. To perform the evaluation, we do not use the entire available time span, but, taking into account the low number of observations, we drop the last six (10% of our sample) and use them for comparison reasons. These observations are computed from the fitted models in order to evaluate which model has the highest forecast accuracy. Two relevant metrics are used, the Root Mean Square Error (RMSE) and the Mean Absolute Error (MAE) defined as:

$$RMSE = \sqrt{\frac{\sum_i^n (y_i - \bar{y}_i)^2}{n}} \text{ and } MAE = \frac{\sum_i^n |y_i - \bar{y}_i|}{n} \qquad (10)$$

where, y_i are the observed data and $\bar{y}_i$ the corresponding forecast values. Both metrics are reported, as the first is more sensitive to larger deviations, and the second is more sensitive to smaller deviations from the true values. A better forecast performance corresponds to lower values for both metrics.

The evaluation presented in Table 4, illustrates the important benefits of applying Bayesian techniques and confirms our choice for the prior specification: on average, the poor performance of the frequentist VAR model in comparison to the BVAR models, and especially the one where the hyperparameter λ_1 is set to 0.1, suggests that the informative priors considerably enhanced the forecast of our modeling approach.

Table 4: Forecasting comparison of different VAR and BVAR models

Variable	RMSE VAR	RMSE BVAR λ_1=1	RMSE BVAR λ_1=0.5	RMSE BVAR λ_1=0.1	MAE VAR	MAE BVAR λ_1=1	MAE BVAR λ_1=0.5	MAE BVAR λ_1=0.1
Proxy 1 - Mil. Exp. (m. US$ constant 2015)								
Greece	0.0673	0.0638	0.0599	**0.0592**	0.0487	0.0459	0.0494	**0.0435**
Turkey	0.0433	0.0429	0.0422	**0.0365**	0.0289	0.0283	0.0279	**0.0226**
Proxy 2 - Stock of Mil. Exp. (m. US$ constant 2015)								
Greece	0.0292	0.0284	0.0283	**0.0268**	0.0265	0.0256	0.0256	**0.0240**
Turkey	0.0106	0.0109	0.0108	**0.0098**	0.0096	0.0097	0.0096	**0.0081**
Proxy 3 – Mil. Exp. per Armed Forces Capita (US$ constant 2015)								
Greece	0.0750	0.0718	0.0667	**0.0648**	0.0541	0.0522	**0.0492**	0.0526
Turkey	0.0734	0.0737	0.0734	**0.0672**	0.0469	0.0469	0.0466	**0.0416**
Proxy 4 – Mil. Exp. (% GDP)								
Greece	0.0812	0.0800	**0.0790**	0.1001	0.0726	0.0829	0.0705	**0.0678**
Turkey	0.1152	0.1074	0.1024	**0.1013**	0.0887	0.0854	0.0853	**0.0820**

Notes: We account for four different proxies of the physical arms build-up.

7. Conclusion

For more than thirty years, Greece and Turkey have been at odds over the occupation of the northern portion of Cyprus, and conflicting claims of sovereignty over the continental shelf, sea, and air regions of the Aegean Sea. Based on their intense disagreement, there is a strong belief that the two nations have been engaged in an arms race, which appears to have escalated over the past decade due to the gas discoveries in the eastern Mediterranean, the Libyan-Turkish maritime agreement, and the territorial demarcations between Greece and Egypt. This study constitutes another attempt to shed new light on the issue, where the previous literature has produced poor and mixed results. Using a Bayesian Vector Autoregression (BVAR) model for an annual dataset running from 1960 to 2020, we make an empirical investigation of Greek-Turkish relations, focusing on four different proxies of the states' physical arms build – up. The findings indicate that a shock in a country's military expenditure does not have an impact on the opponent's spending, confirming our hypothesis that the rivalry between the neighbors does not feature an arms race. The policy implications are straightforward and demand the attention of the academic community and policy experts. The proliferation of these disputes in a volatile strategic environment could threaten the development and stability of the wider region of Southeast Europe and the Eastern Mediterranean. A reduction in the tension could be achieved through a gradual, step-by-step approach to the bilateral differences, involving an arms control agreement aiming at stabilizing or even limiting the current levels of weapon stocks. Instead of weaving a canvass of ever-increasing hostility and claims that bring the two countries to the brink of an armed conflict, a just and stable solution to the problems could impose a balance of power at lower armament levels and hence, the reduction of the cost of arming would allow the reallocation of resources to more productive uses in the economy, yielding a piece dividend for both nations.

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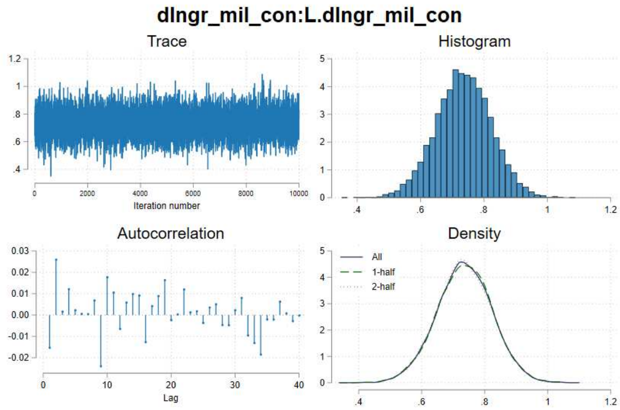
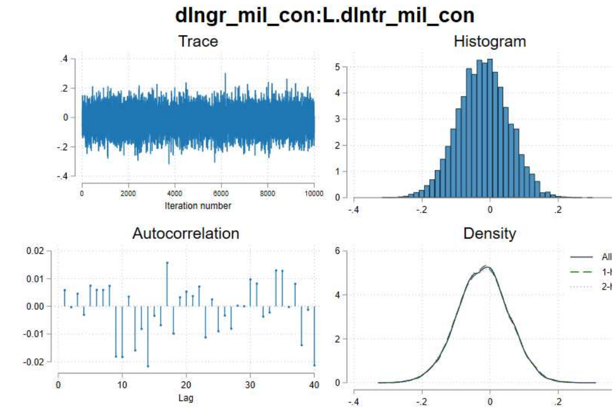
Appendix

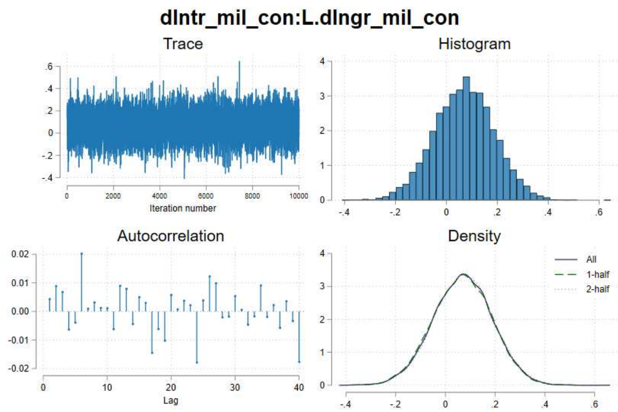
Figure A.1: Diagnostics' checks for BVAR(1) model with the endogenous variable Proxy 1 - Military Expenditures (m. constant 2015 US$)



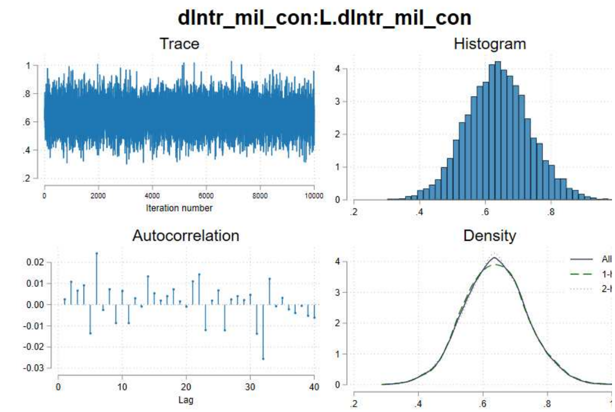
(a)



(b)



(c)



(d)

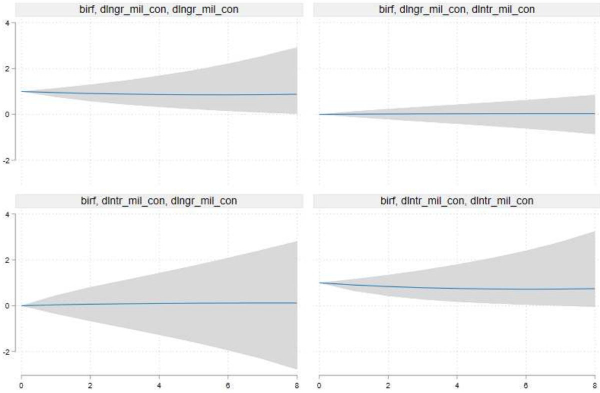
Figure A.2: Bayesian IRFs and 95% credible intervals for the four different proxies of the physical arms build – up for years 1960-1974

Resp: **Greece** **Turkey** **Greece** **Turkey**

Greece

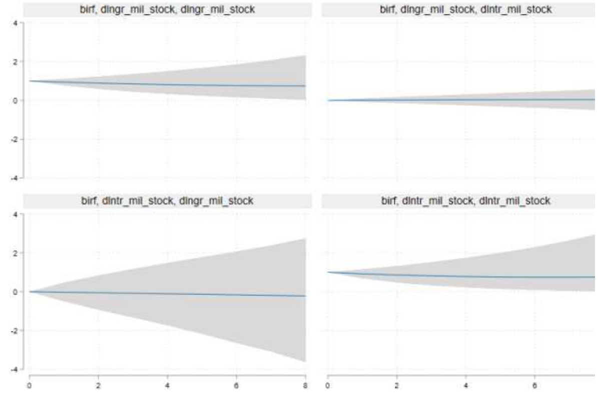
Turkey

Imp:



Proxy 1 - Mil. Exp. (m. US$ constant 2015)

(a)



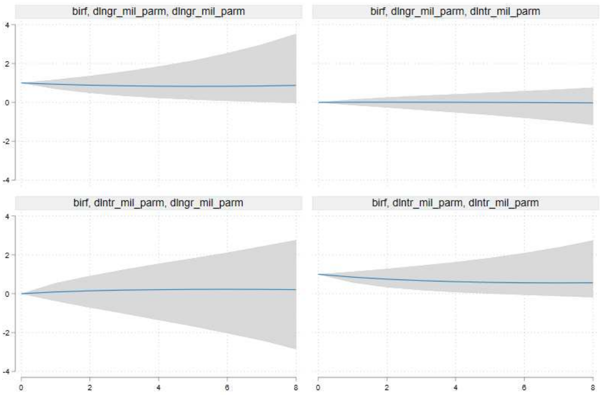
Proxy 2 - Stock of Mil. Exp. (m. US$ constant 2015)

(b)

Greece

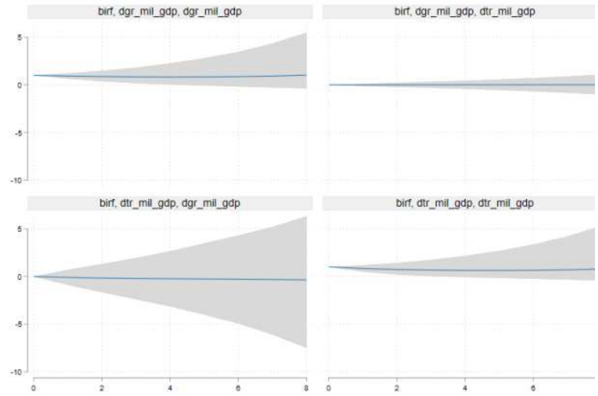
Turkey

Imp:



Proxy 3 - Mil. Exp. per Armed Forces Capita (US$ constant 2015)

(c)



Proxy 4 - Mil. Exp. (% GDP)

(d)

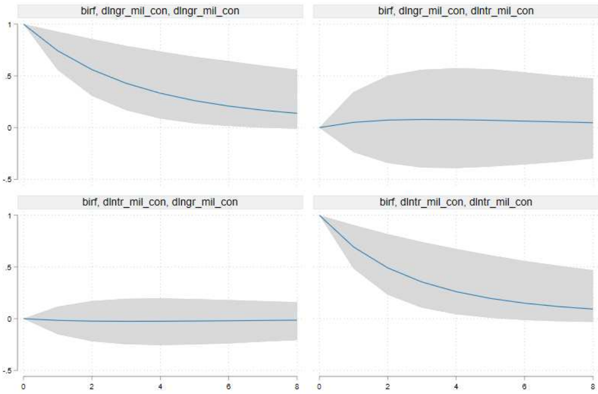
Figure A.3: Bayesian IRFs and 95% credible intervals for the four different proxies of the physical arms build – up for years 1975-2020

Resp: **Greece** **Turkey** **Greece** **Turkey**

Greece

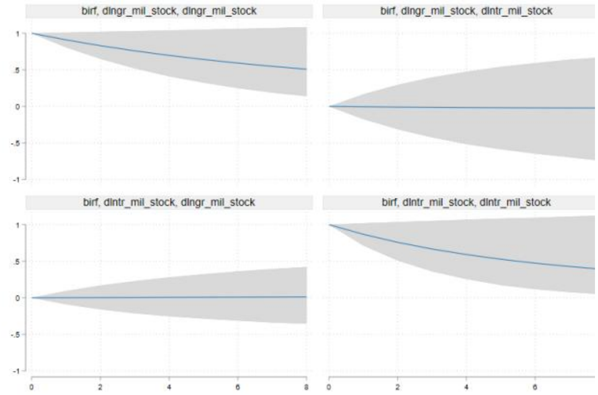
Turkey

Imp:



Proxy 1 - Mil. Exp. (m. US$ constant 2015)

(a)



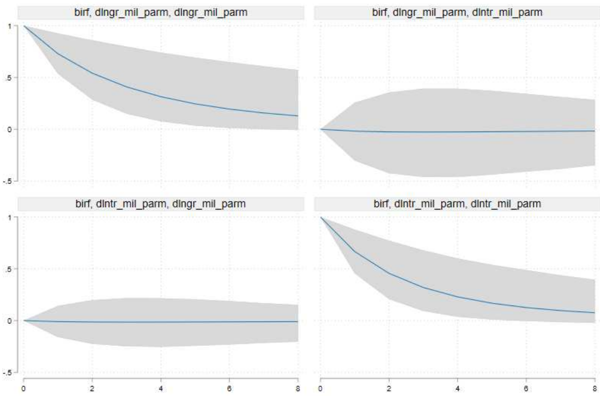
Proxy 2 - Stock of Mil. Exp. (m. US$ constant 2015)

(b)

Greece

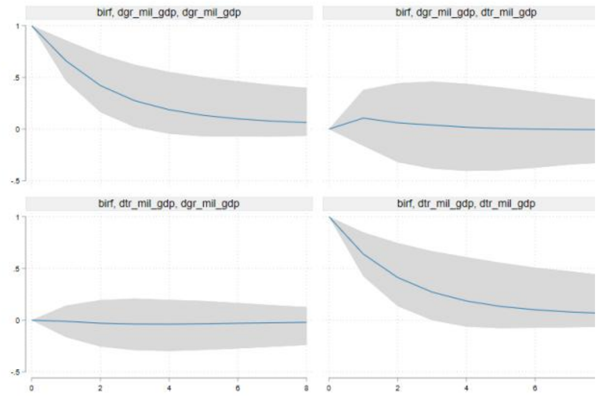
Turkey

Imp:



Proxy 3 - Mil. Exp. per Armed Forces Capita (US$ constant 2015)

(c)



Proxy 4 - Mil. Exp. (% GDP)

(d)