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Centrality in Trade Networks and Investment in Security

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Abstract: The contemporary empirical literature on military spending has focused on institutional and conflict factors, and although has acknowledged the role of trade openness, it has not taken into account the position of a state in the trade network. Building on the concept of network centrality, we claim that the structure of trade networks affects the optimal investment in security, and that a country's level of military spending is a function of its strategic position in the global network of a critical commodity, such as oil. Our empirical results show that network centrality constrains military spending.

Keywords: military spending, trade, network

JEL Classification: D85, F51, F52

1 Introduction

Military spending, or the amount of resources that a country allocates to its armed forces, it is the first element in the value chain producing security (Smith 2009), but it is also a sizable component of public spending, and. As such, military spending has also a number of implications which extend beyond issues of security, related to its economic rather than its strategic functions, and many studies revolve around the issue of what effect defense spending has on economic growth (e.g. Alptekin and Levine 2012; Dunne and Smith 2010; Dunne, Smith, and Willenbockel 2005; Kollias and Paleologou 2013; Pieroni 2009). Another large strand of the economic literature explores which factors are more likely to drive the

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[a]The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the European Commission.

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defense burden, such as the presence of regional instabilities or arms race at the international level or the regime type and the level of military involvement in politics at the domestic level (see Bove and Nisticò 2014a,b; Dunne and Perlo-Freeman 2003; Dunne, Perlo-Freeman, and Smith 2008; Nordhaus, Oneal, and Russett 2012).

What determines military spending has been an active area of academic debate in recent years and in this article we investigate how the structure of a country's relationships with other states in the system, in particular its centrality in trade networks, affects its investment in defense. We revisit the old theory of free-riding and military spending by looking at whether the relative position of a country in a trade network affects its optimal investment in security: to what extent does an increase in a country's exposure to a strategic trade, e.g. oil trade, affect its safety level and in turn decreases its defense burden? We address this question by means of a panel analysis of the effects of oil trade networks on countries' military spending. We show how a country's degree of centrality – i.e. the diversification of trading partners, the importance of a country to overall trading network and the importance of country's trading partners to overall network – have important implications for the level of military spending.

We begin Section 2 with a short review of the literature and a discussion on how the structure of trade networks can affect the optimal investment in security. Section 3 discusses the data and the methodology, while Section 4 presents our empirical results. Section 5 provides concluding remarks.

2 Network centrality, security and the defense burden

This paper contributes to a well-established literature on public good provision, in particular the provision of security. Olson and Zeckhauser (1966) firstly applied the theory of private provision of public goods to national defense with military spending considered as a "public good" i.e. the consumption of security is non-excludable and non-rival in consumption among allies. One of the main implications of the model is that larger members bear a disproportionately large share of the security costs. Only 1 year after Olson and Zeckhauser (1966)'s major contribution, van Ypersele de Strihou (1967) presented an alternative model where military expenditure yields some ally-specific benefits which are excludable. Defense spending is in fact best represented as being an impure public good (see Murdoch and Sandler 1984; Sandler and Murdoch 1990). The implications of the two theories are quite distinct about the extent of free riding we should expect. Yet, they disregard the many possible connections between states and the relative importance of each state in the system.

A recent work by Jackson and Nei (2014) models networks of military alliances and their interaction with international trade. It shows that by increasing the density of alliances, international trade makes countries less vulnerable to attack and reduces their incentives to attack an ally. In the same spirit, a number of recent quantitative studies on the impact of trade on conflict have started to emphasize a more integrative concept of interdependence which goes beyond dyadic interactions (see Maoz 2009). Dorussen and Ward (2010), for example, show how extradyadic ties can be regarded as channels of communication and social capital. They find that when measured as trade flows, extradyadic trade discourages conflict. Similarly, using aggregated data on bilateral trade, Kinne (2012) finds that more central states initiate fewer conflicts and that network centrality constrains aggression. Finally, Caruso and Di Domizio (2015) show a positive interdependence between US and European military spending, thus confirming the existence of a leader/follower relationship. There is therefore convincing empirical ground to believe that complex channels of influence among states exist and that they have important strategic implications; in this respect network analysis offers promising new avenues of investigation.

We claim that the credibility of an ally helping a threatened member depends on the location of the threatened member within the alliance and its strategic relevance. For a given country, every state in the system has, *ceteris paribus*, a particular importance, which depends on a number of factors, including its location in the network; consequently, an adequate definition of free-riding or optimal investment in defense must take into account a country's ties to every other state in the system and its strategic relevance. In a similar vein, Kim (2009) introduces a new power concept, the so-called "structural network power," which captures the power of an individual state as a function of its location within the networks of international relations. Here we push this argument further and posit that countries connected in a trade network, which can be considered as a form of transnational collective without the formal security arrangements usually found in military alliances, enjoy a level of security from the other members which increases with its strategic position. Suppose a finite set of homogeneous countries, trading a strategic good (e.g. oil) according to a network structure. If a country is *isolated*, or alternatively said, if it does not own any trade connection with the rest of the countries, it would optimally choose a strictly positive defense level. On the other hand, if a country belongs to a trade community, it can enjoy the defense contributions of the other members, in proportion to its structural importance or *centrality*. This centrality describes a country's relative position within the context of its network and highlights key nodes in the network. Generally speaking, the importance of a node is measured in a variety of ways depending on the application. In this paper, we consider important nodes as those nodes that have a major role in the oil trade, the type of economic interdependence which best implicates geo-strategic considerations, including the investments in security.

While most economies in the world rely on oil imports, there are only a limited number of oil producing countries, which have market power on their own. This means that "oil is a commodity on which actors place significant strategic weight, which is not necessarily true of bananas or coffee" (Colgan 2014, p. 627). As oil-importing states have only a limited number of oil-exporting states to choose from, breaking oil trade ties can cause significant replacement costs. This means that the political stability of oil-exporting states is crucial in a oil trade market, a claim echoed in recent empirical studies on oil dependence and conflict behavior. Bove, Gleditsch, and Sekeris, (2015), for example, find that the odds of an external military intervention in civil war increases when the country at war has large reserves of oil and such interventions are more likely to be carried out by oil-dependent economies. If subscribing to this claim, we should expect that countries with a pivotal position in the oil trade market to be able to gain external military assistance when threatened by other countries.

One possibility for measuring the importance of a node in the oil trade is to calculate how many links a node has with the rest of the network's nodes, this is called degree centrality. Nodes with high degree centrality have higher probability of importing and exporting oil in the network. This measure is also defined as a "radial" measure since it counts the flows starting/ending from a given node. Another centrality measure, called betweenness, evaluates the degree with which a country controls the flow of oil in the network. World oil flows frequently pass through these countries, which function as a sort of brokers. This measure belongs to the family of "medial" measures since it counts walks passing through a given node.

Consider a directed graph or network $G(N, L)$ defined by a finite set of players $N=\{1, \ldots, n\}$ and a finite set of (directed) links L. We say that the pair of nodes i, $j \in N$ is connected if and only if $ij \vee ji \in L$. We indicate with δ_i^+ the number of linkages departing from a node $i \in N$, or $\delta_i^+ = \#j : ij \in L$. Since the greatest number of linkages departing from a node when $|N|=n$ is $(n-1)$, the normalized out-degree centrality of a node i is defined as

$$c_i^d = \frac{\delta_i^+}{(n-1)}$$

where the lowest value 0 is scored by nodes i such that $ij \notin L$ for all $j \neq i$, and the highest value 1 is scored when a node i is such that $ij \in L$ for all $j \neq i$.

As mentioned earlier, an alternative measure of network centrality is the betweenness centrality.[1] This measure captures the idea that a player is central if it lies between other players on their shortest path. Consider any triplet of distinct nodes $i, j, k \in N$. Define a path of length q from j to k as an ordered sequence of q directly connected nodes starting from j and terminating at k. A geodesic distance is the shortest path between two nodes. Define with $\sigma_{jk}(i)$ the number of geodesic paths from node j to node k passing through i, and σ_{jk} the total number of such paths. The normalized betweenness centrality of a node i is

$$c_i^b = \frac{\sum_{j \neq i \neq k} \frac{\sigma_{jk}(i)}{\sigma_{jk}}}{(n-1)(n-2)}$$

This measure is particularly powerful to highlight the "exclusivity" of the location of a node in the network or its power to control the flow from any other pair of nodes.[2]

We make use of a large panel of 152 countries for the period 1962–2000 and investigate how both measures are related to a country's level of military spending, the issue considered next.

3 Econometric strategy

We take information on military spending in current USD from the Correlates of War (COW) National Material Capabilities.[3] We transform it into percentage of GDP using GDP figures (in current USD) from the World Development Indicators to get a measure of military burden. Data on *oil imports* and *oil exports* are taken from Feenstra et al. (2005) and are available for the period 1962–2000. From those dataset we generate two measures of centrality: 1) *the betweenness* and the *degree centrality*. Table 1 contains the summary statistics. Our data suggests that over the period under consideration, countries with top centrality scores are unsurprisingly developed and industrialized countries, highly exposed to international trade and with very large international ports such as Belgium, Canada, Germany,

1 See Freeman (1979).

2 The two measures presented are correlated. Intuitively, increasing the degree of a node i the betweenness centrality of i weakly increases too.

3 http://www.correlatesofwar.org

Table 1: Summary statistics of the variables.

	Mean	SD	n
Betweenness	0.0271465	0.0452748	3663
Degree centrality	436.3245	1482.652	3663
Military spending/GDP	0.0055715	0.0097574	3663
Per capita GDP	5906.001	8803.751	3663
Log(population)	9.129271	1.693908	3663
War	0.1670762	0.3730948	3663
Polity2	0.9459069	7.644308	3457
Trade/GDP	65.21262	43.9441	3523
Defense	0.8213009	0.3831686	2798
Emulation	0.0000695	0.0000677	3663

Italy, Japan, Netherlands, Singapore and the UK. Note that centrality is not a measure of export, but it rather captures the salience of a country in the international oil network where countries with e.g. higher betweenness centrality have a larger influence on the transfer of oil through the network. Note also that we assume that oil is transferred following the shortest paths.

We run a number of panel data regressions with fixed effects, to account for the likely omission of important explanatory variables correlated with the error terms. We estimate the following two-way fixed effects model:

$$y_{it} = \alpha Centrality_{it} + \beta' x_{it} + f_i + f_t + \varepsilon_{it} \qquad (1)$$

with i=1, …, 152; t=1962, …, 2000, where y_{it} is the military burden (as a share of GDP); *Centrality* is our variable of interest: we use both the betweenness and the degree centrality. x is a vector of explanatory variables and β is the associated coefficient vector; f_i and f_t are the country and time fixed effects and ε_{it} is the error term.

The vector of covariates x includes information on GDP per capita, population, defense alliances, openness, the polity2 index, emulation (the average military spending of neighboring states) and a war dummy.

The dummy of alliances takes on the value 1 if a country i belongs to a formal defense pact, the highest level of military alliance, as it requires alliance members to provide military support if a member is attacked by a third party (see the Correlates of War project). The war dummy takes on the value 1 if i is involved in at least one interstate or intrastate war in year t and the information is taken from the UCDP/PRIO Armed Conflict Dataset.[4] The variable emulation is based

4 http:// www.prio.no/Data/Armed-Conflict/UCDP-PRIO/

on average regional defense spending in percentage of GDP; we group countries into 7 geographical regions, according the World Bank's classification. Data on the GDP per capita are in constant 2000 US$ while, openness, the sum of imports and exports, is expressed in percentage of GDP. Both stem from the World Development Indicators. The polity2 score measures a regime authority spectrum on a 21-point scale ranging from –10 to +10 and the data are taken from the Polity IV Project.[5] Finally, the size of the population comes from the COW dataset and we transform the variable into logs to scale down the variance and reduce the effect of outliers. Moreover, we control for group-wise heteroscedasticity and serial correlation by reporting robust standard errors clustered on countries.

4 Results

The main results are presented in Tables 2 and 3. Table 2 provides estimates for alternative versions of the fixed-effect models where the centrality is captured by the level of betweenness, while Table 3 makes use of the degree centrality. We run six models for each table, whose results are meant to provide robustness checks.

The model in Table 2 assesses the importance of the betweenness in affecting the level of defense spending. Before discussing our main explanatory variables, we briefly look at the control variables. Note that our model is quite conservative and our empirical strategy likely soaks up much of the effects of the "slow-moving" control variables in either the country or the year fixed effects. In columns i–vi, the coefficient of GDP per capita is positive, even if is not always significant, and suggests that richer countries invest relatively more on their security. Perhaps because of the divergent views on whether and how the size of the population influence military spending, the log of population is only significant in the first specification. The positive sign suggests that larger countries such as China, India, or Brazil tend to assume the role of regional powers and require a large armed force. The presence of ongoing intrastate and interstate wars has a predictable positive effect on military expenditures. Column ii adds the polity score, a country's level of democracy, which does not hold predictive power significant at conventional level; column iii includes trade in percentage of the GDP which is negative and significant, thus suggesting that the openness to international markets decreases the investment in defense. Importantly, trade openness is highly aggregated and do not capture more complex levels of relations and interactions between states, which in turn affect strategic behavior.

5 http://www. systemicpeace.org

Table 2: Panel data fixed effects – betweenness measure.

	i	ii	iii	iv	v	vi
Per capita GDP	0.004*	0.004	0.003	0.003	0.005**	0.004
	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Log(population)	0.007*	0.007	0.004	0.004	0.002	0.000
	(0.004)	(0.005)	(0.004)	(0.005)	(0.005)	(0.008)
War	0.002**	0.002***	0.001***	0.001**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Polity2		0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade/GDP			−0.339**	−0.474**	−0.575***	−0.738***
			(0.170)	(0.213)	(0.202)	(0.267)
Defense				0.002	0.002	0.003
				(0.002)	(0.002)	(0.002)
Emulation					34.902**	33.022**
					(13.876)	(15.330)
Betweenness_t	−0.012*	−0.012*	−0.008**	−0.009*	−0.010**	−0.009**
	(0.006)	(0.006)	(0.004)	(0.005)	(0.004)	(0.004)
Betweenness_{t-1}						−0.004*
						(0.002)
Betweenness_{t-2}						−0.006*
						(0.003)
Betweenness_{t-3}						−0.003
						(0.002)
Betweenness_{t-4}						−0.006**
						(0.002)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
n	3663	3457	3355	2575	2575	2053

Dependent variable is the share of military expenditure over GDP. A constant is estimated for all models but not shown. The coefficients and standard errors of GDP per capita and the share of trade over GDP are divided by 10,000. Ordinary least squares estimates given. Robust standard errors (in parentheses) allow for arbitrary correlation of residuals within each country.

Conceptually, a country may exhibit high trade openness while being exposed only to a limited number of other states (see e.g. Kinne 2012). Our centrality measures will therefore provide a more nuanced measure of the relations of a country with other partners in the global network of oil trade. Columns iv and v pick up the presence of defense alliances and the spending of neighboring countries i.e. the variables alliances and emulation. While the former is insignificant, the latter is positive and significant at conventional level. This result may be taken as evidence of increased threat that requires more commitment of resources to the military.

Table 3: Panel data fixed effects – degree centrality measure.

	i	ii	iii	iv	v	vi
Per capita GDP	0.004*	0.004	0.004*	0.004	0.006**	0.006
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)
Log(population)	0.007*	0.007	0.004	0.004	0.002	0.002
	(0.004)	(0.006)	(0.004)	(0.005)	(0.005)	(0.008)
War	0.002**	0.002**	0.001***	0.001**	0.002**	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Polity2		0.000	0.000	0.000	0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Trade/GDP			−0.346**	−0.481**	−0.579***	−0.746***
			(0.171)	(0.215)	(0.204)	(0.273)
Defense				0.003	0.003	0.003
				(0.002)	(0.002)	(0.002)
Emulation					33.269**	30.599*
					(14.058)	(15.660)
$Degree_t$	−0.057***	−0.058***	−0.062***	−0.066***	−0.058***	−0.067**
	(0.016)	(0.018)	(0.017)	(0.020)	(0.020)	(0.032)
$Degree_{t-1}$						0.013
						(0.016)
$Degree_{t-2}$						−0.015*
						(0.008)
$Degree_{t-3}$						0.007
						(0.011)
$Degree_{t-4}$						0.017
						(0.022)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
n	3663	3457	3355	2575	2575	2053

Dependent variable is the share of military expenditure over GDP. A constant is estimated for all models but not shown. The coefficients and standard errors of GDP per capita and the share of trade over GDP are divided by 10,000, while those ones of the degree centrality measure by 100,000. Ordinary least squares estimates given. Robust standard errors (in parentheses) allow for arbitrary correlation of residuals within each country.

In line with our expectations, we find a negative and significant effect of betweenness in all our model specifications. Furthermore, the level of centrality has an important effect, significant at conventional levels, even if we are controlling for lagged values of betweenness (column vi). The value of α, the coefficient of betweenness, is on average 0.01 across the specifications. Given the linearity of the model, the interpretation of α is that of a proportional change in the military burden given a unit change in betweenness, holding all else constant. Therefore, an increase of one unit in betweenness is estimated to augment the military burden by 0.01. For instance, if Rwanda's average betweenness (0.027, which is also the average value in the sample) increased to the level of Japan (0.167) it would reduce its military spending over GDP by 0.14 percentage points.

This measure of integration is suitable to investigate forms of strategic interdependence across countries and with respect to a pivotal natural resource such as oil. In fact, by quantifying the number of times a country acts as a bridge along the shortest path between two other countries, the betweenness indicator expresses strategic interdependence even among countries that lack direct trade relations. Accordingly, the above measure of integration allows for the possibility that a country may reduce defense spending even in the absence of direct ties with other suppliers of security. Table 3 reports the effects of degree centrality on military spending using the same panel regression model with fixed effects. Results are consistent with the previous table, even though the effect of direct ties as measured by the degree centrality is negligible (notice that the indicator is divided by 100,000 for sake of readability).[6] Recall however, that the degree centrality captures only the total number of trade partners, and therefore can be interpreted in terms of the importance of a node for its immediate neighborhood rather than the global network at large. Although oil supplies are concentrated in a handful of countries, the substantially higher impact of betweenness indicates that the relevance of oil goes beyond direct links.

Finally, a fair additional robustness check would involve exploring the existence of structural breaks in the relationship between centrality and military spending. The end of the Cold War, in 1989, is an ideal candidate, as it reduced the level of political and military tension between the Western Bloc and the Soviet Union, and inaugurated a new era of economic and politica relations worldwide, thus reshaping both the patterns of oil trade as well as countries' optimal investment in security. We therefore select two time windows, one before 1989 and another after 1989, and run separate regressions. Results of this exercise are shown in Table A1 in the Appendix. We still detect a negative and statistically significant effect for degree centrality in both periods (columns 3 and 4), whereas our estimates are less precise when we use betweenness (columns 1 and 2).

A well-established literature has successfully demonstrated that trade reduces the odds of conflict, in particular between commercial partners (Caruso 2006; Dorussen 2006); as of yet, however, there are no systematic empirical

6 For example, if Turkey' degree centrality which is on average equal to 0.00224 creeped up to the value of Japan (0.03061) it would produce 0.0003 percentage points reduction in military burden.

studies on how patterns of trade influences military spending. Taken together, our results suggest that this is indeed the case, and trade ties can constrain military spending, in particular when they can be used as a strategic tool to ensure external assistance. Direct or indirect oil trade ties can guarantee, under certain conditions, that other countries will invest in the security of a central node, in order to avoid disruptions in the trade of a vital commodity and energy source, such as oil.

5 Conclusions

We claim that a country's level of military spending is a function of its strategic position in the global oil network. We provide empirical evidence of this relation using a panel data analysis and a dataset of 152 countries over the period 1962–2000. Our results are very much in line with anecdotal evidence such as the one on US-allies relationship. Being in a pivotal node in the global network of oil trade increases the dependence of world countries on strategic nodes; this mechanism encourages dependent states such as the US to provide central nodes with external military assistance. This can take the form of direct military transfers of major conventional weapons, or training to the military personnel of the recipient country or through the deployment of troops (Bove, Elia, and Sekeris 2014).

This assistance in turn can decrease recipient countries' reliance on domestic spending on security. Other foreign powers have provided military assistance or have deployed troops to pivotal areas. Britain played a key role in shaping the political landscape of many countries in the Middle East; she participated in the overthrow of the Mosaddeq regime in Iran (1953) and, with France and Israel, opposed Egypt in the Suez crisis (1956), an important choke point for the oil trade. Similarly, many oil-rich countries in Africa have been the scene of covert or open foreign power interventions since 1945.

The oil market has a monopolistic nature, it is characterized by a small number of oil suppliers and by world prices sensitive to the amount of oil produced by each of these countries. This means that countries are vulnerable to disruptions and breaks of their oil trade ties and are concerned with the stability of countries with high levels of centrality. This in turn can have implications for the optimal level of military spending chosen by pivotal economies, which can more easily attract external support given their importance to the global trading network. Our empirical analysis shed new light on some of the economic and strategic conditions explaining countries' investment in defense, according to its salience to other nodes in the network.

Appendix A

Table A1: Panel data fixed effects – before and after the end of cold war.

	Before	After	Before	After
Per capita GDP	0.006**	0.002	0.007***	0.002
	(0.003)	(0.002)	(0.002)	(0.002)
Log(population)	0.010*	−0.003	0.011*	−0.002
	(0.005)	(0.005)	(0.005)	(0.005)
War	−0.000	0.001**	−0.000	0.001**
	(0.002)	(0.001)	(0.002)	(0.001)
Polity2	0.000	−0.000	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Trade/GDP	−0.556*	−0.445*	−0.552*	−0.445*
	(0.320)	(0.247)	(0.318)	(0.247)
Defense	0.001	−0.000	0.001	−0.000
	(0.001)	(0.002)	(0.001)	(0.002)
Emulation	29.984*	32.192**	27.659*	32.751**
	(15.195)	(16.061)	(15.427)	(16.139)
$Degree_t$			−0.067***	−0.052*
			(0.021)	(0.027)
$Betweenness_t$	−0.005	0.005		
	(0.003)	(0.003)		
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
n	1619	956	1619	956

Dependent variable is the share of military expenditure over GDP. A constant is estimated for all models but not shown. The coefficients and standard errors of GDP per capita and the share of trade over GDP are divided by 10,000, while those ones of the degree centrality measure by 100,000. Ordinary least squares estimates given. Robust standard errors (in parentheses) allow for arbitrary correlation of residuals within each country.

References

Alptekin, A., Levine, P., (2012), Military Expenditure and Economic Growth: A Meta-Analysis, European Journal of Political Economy, vol. 28, no. 4, pp. 636–650.

Bove, V., Nisticò, R., (2014a), Coups d'état and Defense Spending: A Counterfactual Analysis, Public Choice, vol. 161, no. 3–4, pp. 321–344.

Bove, V., Nisticò, R., (2014b), Military in Politics and Budgetary Allocations, Journal of Comparative Economics, vol. 42, no. 4, pp. 1065–1078.

Bove, V., Elia, L., Sekeris, P.G., (2014), Us Security Strategy and The Gains from Bilateral Trade, Review of International Economics, vol. 22, no. 5, pp. 863–885.

Bove, V., Gleditsch, K.S., Sekeris, P.G., (2015), 'Oil Above Water' Economic Interdependence and Third-Party Intervention, Journal of Conflict Resolution, 0022002714567952.

Caruso, R., (2006), A Trade Institution As a Peaceful Institution? A Contribution To Integrative Theory, Conflict Management and Peace Science, vol. 23, no. 1, pp. 53–72.

Caruso, R., Di Domizio, M., (2015), Interdependence Between Us and European Military Spending: A Panel Cointegration Analysis (1988–2013), Applied Economics Letters.

Colgan, J. D., (2014), The Emperor Has No Clothes: The Limits Market, International Organization, vol. 68, no. 03, pp. 599–632.

Dorussen, H., (2006), Heterogeneous Trade Interests and Conflict What You Trade Matters, Journal of Conflict Resolution, vol. 50, no. 1, pp. 87–107.

Dorussen, H., Ward, H., (2010), Trade Networks and the Kantian Peace, Journal of Peace Research, vol. 47, no. 1, pp. 29–42.

Dunne, J.P., Perlo-Freeman, S., (2003), The Demand for Military Spending in Developing Countries: A Dynamic Panel Analysis, Defence and Peace Economics, vol. 14, no. 6, pp. 461–474.

Dunne, J.P., Smith, R.P., (2010), Military Expenditure and Granger Causality: A Critical Review, Defence and Peace Economics, vol. 21, no. 5–6, pp. 427–441.

Dunne, J.P., Smith, R.P., Willenbockel, D., (2005), Models of Military Expenditure and Growth: A Critical Review, Defence and Peace Economics, vol. 16, no. 6, pp. 449–461.

Dunne, J.P., Perlo-Freeman, S., Smith, R.P., (2008), The Demand for Military Expenditure in Developing Countries: Hostility versus Capability, Defence and Peace Economics, vol. 19, no. 4, pp. 293–302.

Feenstra, R.C., Lipsey, R., Deng, H., Ma, A.C., Mo, H., (2005), World Trade Flows: 1962–2000, NBER Working Paper, (w11040).

Freeman, L.C., (1979), Centrality in Social Networks Conceptual Clarification, Social Networks, vol. 1, no. 3, pp. 215–239.

Jackson, M.O., Nei, S., (2014), Networks of Military Alliances, Wars, and International Trade.

Kim, H.M., (2009), Introducing the New Concept of National Power: From the Network Perspective, Peace Economics, Peace Science and Public Policy, vol. 15, no. 1, pp. 1–15.

Kinne, B.J., (2012), Multilateral Trade and Militarized Conflict: Centrality, Openness, and Asymmetry in The Global Trade Network, The Journal of Politics, vol. 74, no. 01, pp. 308–322.

Kollias, C., Paleologou, S.-M., (2013), Guns, Highways Growth in the United States, Economic Modelling, vol. 30, pp. 449–455.

Maoz, Z., (2009), The Effects of Strategic and Economic Interdependence on International Conflict Across Levels of Analysis, American Journal of Political Science, vol. 53, no. 1, pp. 223–240.

Murdoch, J.C., Sandler, T., (1984), Complementarity, Free Riding, and The Military Expenditures of NATO Allies, Journal of Public Economics, vol. 25, no. 1, pp. 83–101.

Nordhaus, W., Oneal, J.R., Russett, B., (2012), The Effects of the International Security Environment on National Military Expenditures: A Multicountry Study, International Organization, vol. 66, no. 03, pp. 491–513.

Olson, M., Zeckhauser, R., (1966), An Economic Theory of Alliances, The Review of Economics and Statistics, vol. 48, no. 3, 266–279.

Pieroni, L., (2009), Military Expenditure and Economic Growth, Defence and Peace Economics, vol. 20, no. 4, pp. 327–339.

Sandler, T., Murdoch, J.C., (1990), Nash-Cournot or Lindahl Behavior?: An Empirical Test for the NATO Allies, The Quarterly Journal of Economics, vol. 105, no. 4, pp. 875–894.

Smith, R.P., (2009), Military Economics: The Interaction of Power and Money, Palgrave Macmillan.

van Ypersele de Strihou, J., (1967), Sharing the Defense Burden among Western Allies, The Review of Economics and Statistics, vol. 49, no. 4, 527–536.

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