

# **Geographical and Temporal Patterns of Interstate Security Competition: Global and Regional Evidence**

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## Introduction

This article tests what seems to be a reasonably widespread perception, namely that the last few years have witnessed intensified interstate security competition in several of the world's regions. This perception commensurates with real or perceived changes in global and regional balances of power and patterns of geopolitical influence (Layne, 2012; MacDonald and Parent, 2011; Zakaria, 2008). At the level of symptoms, the end of the last decade witnessed a more aggressive, militarized posture by Russia – exemplified by its brief 2008 war with Georgia – and a more assertive China in the wake of the global financial crisis (Christensen, 2011; Johnston, 2013). These years also saw a United States with a badly damaged domestic and international reputation after the failure to complete the Afghanistan and Iraq missions, fueling doubts about the hegemon's future credibility as a stabilizer in vital regions.

Some three decades ago, however, the end of the Cold War sparked substantial optimism about the future of international politics. Many voices claimed that interstate war, security competition, and security dilemmas were now all but obsolete in most regions of the world (Fukuyama, 1989; Goldgeier and McFaul, 1992; Mueller, 1989). Others were far more pessimistic; some prominent analysts claimed at the time that history – and with it, intense security competition and arms races – would soon return to the anarchic, self-help international system (Mearsheimer, 1990; Waltz, 1993). To the extent that history has returned and that the “world has become normal again” (Kagan, 2008: 3), we would expect to witness the continued and general presence of action-reaction types of state behavior, of which arms races and security dilemmas constitute core elements. What still purportedly applies, then, is the *security dilemma*, which simply describes a situation “where one state's attempts to increase its security appear threatening to others and provoke an unnecessary conflict” (Montgomery, 2006: 152).

This article aims to investigate empirically whether or not the security dilemma is still a relevant factor in international politics – and, more specifically, whether it has become *more*

relevant in very recent years. Following a recent strand of literature that recommends and uses a geographic information system (GIS) approach to conflict (Branch 2016; Buhaug and Gleditsch 2008; Gleditsch and Weidmann 2012), our research design specifically matches that of four additional studies that use spatial techniques to measure arms policies as a function of others' arms-spending decisions (Author; Goldsmith, 2007; Skogstad, 2016; Yesilyurt and Elhorst, 2017). With a sample of 148 countries over 27 years, we test whether or not states' military budgets tend to change as a function of changes to the armaments levels of neighboring states. Our dependent variable, measured as a three-year moving average, uses data on military expenditures from Stockholm International Peace Research Institute (SIPRI) to calculate states' year-to-year percentage changes in military spending. Our main independent variable codes the weighted average of arms-spending changes among the neighbors of the state in question.

We then conduct two different yet supplementary empirical analyses, both of which include relevant controls. First, we specify a least-square dummy variables (LSDV) model, whose results we map using standard GIS software. Focusing on the period 2008/2009-2014 (which also includes numbers for the year 2007, given how the key variable is measured), our "hot-spot" analysis suggests that action-reaction dynamics are present in certain regions – most notably the Middle East, large parts of Central and Southern Africa, and the South Caucasus. On the other hand, neither South nor East or Southeast Asia seem to be ridden by severe security competition. Unsurprisingly, arms-spending patterns in Europe exhibit a clustering pattern that is of a negative, "cold-spot" sort, indicating a lower-than-expected level of arms-spending growth.

In the second analysis, a spatial-lag model, we check for any eventual action-reaction dynamics for a global sample of 148 countries. Findings indeed indicate the existence of such a general pattern. The relationship is highly significant, and while results are valid for the whole post-Cold War era (1988-2014), they are still to a substantial degree driven by the most recent

period. The years 2006/2007-2011 mark a fairly clear break from the preceding period with respect to action-reaction dynamics, lending some support to the “pessimistic” arguments cited above. Interstate security competition, our results show, is now apparently an important element of international politics – albeit hitherto only in some regions. Our findings also reveal the potential for corresponding spirals of *disarmament*.

### **The obsolescence of war and security competition?**

The end of the Cold War sparked widespread claims that the international political environment would henceforth be relatively benign. Several mechanisms were purportedly causing this. Some pointed to ideational or attitudinal changes permeating the world system. In particular, liberalism had all but shed itself from all realistic ideological competitors (Fukuyama, 1989). The spread of *political* liberalism would enhance trust among nations and significantly ease security dilemmas due to institutional and normative constraints on warfare (Bueno de Mesquita et al., 1999; Maoz and Russett, 1993). Furthermore, the spread of *economic* liberalism would, *inter alia*, strengthen economic interdependence, making security competition and war prohibitively costly (Mousseau et al, 2003). Such mechanisms were also augmented, some argued, by an increasingly growing web of (liberal) international institutions (Ikenberry, 2001). Scholars also agree that the projected costs of (major-power) war have become absurdly high due to the existence of nuclear weapons. For all these reasons, therefore, in the post-Cold War period a far looser connection existed between structure and the age-old trap of the security dilemma. Absent any will to fight, the *competition* for armaments and for security would also lessen considerably.

Others strongly disagreed with such predictions, though, referring to “the first intellectual cycle of the Post Cold War [as] an era of illusions” (Kaplan, 2012: 4). Many of the “pessimists” belong to the realist school of thought, which typically emphasizes that the

anarchic international system necessitates self-help and a basic of distrust of others (Mearsheimer, 2001: 30-3). The post-Cold War optimism was bound to be short-lived, it was claimed, as it merely represented yet another example of the general tendency for people to proclaim that “power politics is ending” once peace is reinstated (Waltz, 1993: 78). Under anarchy, preponderant power would eventually be balanced, and the United States’ dominance and global commitments could not and would not last forever (Mearsheimer, 1990; Waltz, 1993). The eventual “return of history” – or a return to “normalcy” – was inevitable (Kagan, 2008: 3); and with it, one should expect a return of security competition and security dilemmas.

### **The timelessness of the security dilemma?**

The security dilemma depicts a situation where, “what one does to enhance one’s own security causes reactions that, in the end, can make one less secure” (Posen, 1993: 28). Originally coined by John Herz (1950), the concept and its core mechanisms have since been refined by many others, notably Robert Jervis (1978) and Charles Glaser (1997). The fundamentals of the dilemma, however, were captured centuries ago; it rests on the “Hobbesian” idea that the absence of a sovereign in the international system creates pervasive insecurity for all, even if most or all members of the system are defensive-minded. Augmenting one’s military capabilities, therefore, can be seen as a prudent, rational response to an uncertain environment where planning for worst-case scenarios functions as insurance against serious security threats (Glaser, 2004: 46).

#### *Modifiers of the security dilemma*

The security dilemma is a *generally* working mechanism in an anarchic international system. Its *severity*, however, varies across time as well as regions and dyads. The literature has singled out a small handful of particularly plausible modifiers of the dilemma. First, *intentions* might

matter. Whether or not the existence of “greedy” states in the system is decisive in this respect has been a much-discussed issue (Glaser, 1997; Schweller, 1996). Randall Sweller (1996), for example, argues that the theoretical possibility of greedy or revisionist states logically unperpins the dilemma. Others disagree. Charles Glaser claims that such a view “fail[s] to appreciate the central role that uncertainty plays in structural realism” (Glaser, 1997: 145). Second, and arguably a less contentious modifier, *geography* or *proximity* certainly matter to states’ security concerns. Empirical studies clearly show that wars and militarized conflicts overwhelmingly involve neighboring countries, usually fighting over territorial issues (Kocs, 1995; Senese, 2005; Vasquez, 1995). The third modifier of the security dilemma is the *offense-defense balance* (Van Evera, 1999: 117ff). This concept reflects the importance of, in particular, military technology. If technology privileges the offense, security concerns and security dilemmas will be prevalent; if the offense-defense balance instead tilts toward the defense, cooperation and peace can more easily be attained (Lieber, 2000). This is especially so if defensive weapons cannot (easily) be used for purposes of offense; that is to say, if one can differentiate between offense and defense. Finally, the fourth determinant of the severity of the security dilemma is the *distribution or balance of power* in the system. For example, the end of the Cold War marked a rapid shift from bipolarity to unipolarity. According to the hegemonic stability theory, this greatly strengthened systemic peace and order, and it worked to dampen security competition among states (Wohlforth, 1999; Brooks and Wohlforth, 2008).

#### *The security dilemma and recent developments in international politics*

Our empirical analysis centers on developments in armaments-related security dilemmas after 2008/2009, though the post-Cold War period as a whole provides a benchmark. As for the modifiers of the security dilemma, the first – states’ intentions, or the prevalence of revisionist states in the system – cannot realistically be modeled. However, we have little reason to believe

that there has been any major change in this respect in the period under study. The second modifier – contiguity – we do model, though, by conceiving of arms-spending changes as a function of corresponding such changes in neighboring countries. The third modifier – the offense-defense balance – cannot be modeled directly. It is no doubt difficult, if not impossible, to pinpoint exactly what kind of offense-defense mix has characterized the post-Cold War system. One place to start is the very general statement, that “it is almost always easier to defend than to attack” (Lieber, 2000: 75). If this is so, we would expect our analysis to reveal only *dampened* action-reaction patterns – if any at all. The existence of positively survivable nuclear weapons only adds to this.

With respect to explanations of any variation connected to the transition between time periods, the fourth modifier – balance of power – should be more relevant than the former three. Granted, the *timing* of any eventual general rise in conflict and security competition is debatable. Yet, a closer look at arguments as well as significant events points to the years right before and at the turn of the current decade. This is so considering the interplay among purported root sources and intermediate causes of international tensions. As for the root causes, International Relations scholarship has traditionally emphasized significant balance-of-power changes among the major states of the system. The proposition is that such changes always pose challenges to world and regional order and usually help generate (sometimes system-wide) conflict (Debs and Monteiro, 2014; Gilpin, 1981; Kissinger, 2015). Many have long anticipated the end of unipolarity, or at least a significant relative decline in the power and influence of the United States (Layne, 2012; MacDonald and Parent, 2011; Zakaria, 2008). Unipolarity, or so runs the argument of the international-security version of hegemonic stability theory, works to ameliorate security dilemmas; such a system structure “favors the absence of war among the great powers and comparatively low levels of competition for prestige or security for two reasons: the leading state’s power advantage removes the problem of hegemonic rivalry from

world politics, and it reduces the salience and stakes of balance-of-power politics among the major states” (Wohlforth, 1999: 23).

Conversely, the period of transition into a different system structure – whether bipolarity or multipolarity – is fraught with uncertainty. According to power-transition theorists, unequal rates of economic growth among major powers is the basic driver of more intense, system-wide security competition and a heightened risk of war (Organski and Kugler, 1980). Tensions are fueled both by the growing dissatisfaction and ambitions of the rising state(s), and by the growing insecurities of the declining state (Debs and Monteiro, 2014). The declining unipole, moreover, becomes steadily less able to uphold its hegemonic presence, thereby creating territorial and political “vacuums” the filling of which only adds to secondary states’ insecurities and incentives for arming. In theory, at least, processes of power transition should increase the saliency of security dilemmas for major and lesser states alike.

The balance of power is not a straightforward concept, however. This is all the more so as the International Relations literature wavers between viewing power as the possession of material resources and power-as-influence (Rose, 1998: 151). The latter, relational definition is notoriously hard to operationalize. With regard to the former, standard measures of power resources reveal that, insofar as any process of power transition was afoot in the period under study here, it was by no means close to being completed (Beckley, 2011/2012; Brooks and Wohlforth, 2015/2016). Estimating relative power is riddled with challenges, though. Ultimately, “objective” measures of power are filtered through the minds of state leaders before they affect foreign policies. Several studies – many of which are associated with neoclassical realist theory – argue that *perceptions* are a key intermediate variable in international politics, conditioning the effects of the balance of power on foreign policy outcomes (for an overview, see Ripsman et al., 2016: Chs. 1-3). There doesn’t exist any “smoothly functioning mechanical transmission belt” between the international distribution of power and foreign policy behavior;

to the contrary, “the translation of capabilities into national behavior is often rough and capricious over the short and medium term” (Rose, 1998: 158). Sometimes external shocks fundamentally alter perceptions, as when the U.S. decisively won the 1898 Spanish-American war, a victory that “crystallized the perception of increasing American power both at home and abroad” (Zakaria, 1998: 11).

Some relatively recent shocks may well have had the opposite effect on perceptions of U.S. power. Notably, the financial crisis of 2008-2009, the effects of which were unevenly distributed across major powers, is often highlighted as an intermediate (or even immediate) cause of the *hastening* of balance-of-power shifts (Altman, 2009; Zakaria, 2008). Whether or not this is so, the crisis did at least alter the impressions many held of both U.S. power and the legitimacy of the U.S.-shaped international system. This was particularly true for the U.S.’s main challenger, China. Christensen (2015: 242-3) writes that “large segments of the Chinese public and elites feel that China’s global power has risen quickly since the financial collapse of 2008,” and that the “traditional hectoring from the Americans and Europeans about the superiority of their economic and political systems [seems] particularly inappropriate now.” Such sentiments were not exclusive to China: both rivals and allies of Washington expressed the view that the financial crisis was really “a sign that the United States’ global leadership is coming to an end” (Nye, 2010: 143). The crisis, moreover, coincided with a growing sense that the costly and by then vastly unpopular U.S. wars in Afghanistan and Iraq could never really be won. This, in effect, made allies both in the Middle East and elsewhere question the commitment, resolve, and credibility of their protector (Christensen, 2015: 243; Gerges, 2013: 300; Kramer, 2016: 53). Insofar as the “quasi-hierarchy” associated with U.S. unipolarity was disintegrating – or was *perceived* to be disintegrating – in those years, this would signal the return of a more purely anarchic, self-help system in which the augmentation of national

military power, for some states, would represent a necessary hedge against rising uncertainty and the arming by others.

## **Data and Analysis**

We follow here a recent strand of literature that recommends and uses a geographic information system (GIS) approach to conflict (Branch 2016; Buhaug and Gleditsch 2008; Gleditsch and Weidmann 2012). Four additional studies are of particular interest here considering that they, drawing on Richardson's (1960) original ideas, attempt to model arms expenditures for a large number of countries using spatial techniques (Author; Goldsmith, 2007; Skogstad, 2016; Yesilyurt and Elhorst, 2017).

A first cut at the issue was made by Goldsmith (2007). Using the security-dilemma reasoning as a theoretical backdrop, his single-year study of 1991 showed that states' defense burdens in general do exhibit spatial clustering. Skogstad's (2016) study usefully expands the time frame in an investigation of action-reaction patterns for the period 1993-2008. The regional patterns that appear suggest the existence of high-defense-spending clusters in the Middle East (and adjacent sub-regions), parts of Africa, and South Asia, and low-defense-spending clusters in much of Europe, Central America, East Asia, and some parts of Africa. Investigating roughly the same time period, Yesilyurt and Elhorst (2017) also find that military spending is primarily shaped by other states' defense spending – in particular, though not exclusively, the spending of neighboring states. These three studies use defense burden (i.e. military expenditures as a share of GDP) as the key variable of interest. A recent study by (Author) instead employs a variable measuring *changes* in military spending; it finds that, for a global sample in the period 1988-2014, the growth of states' military budgets is significantly determined by arms-spending changes of neighboring states.

The present analysis draws on the general research design constructed by the above-mentioned works. We analyze the whole period for which data are available (1988-2014), but our main focus is on the most recent years (2008/2009-2014). We conduct two different yet supplementary empirical analyses, both of which include relevant controls. First, we specify a least-square dummy variables (LSDV) model, whose results we map using standard GIS software. In the second analysis, a spatial-lag model, we check for any eventual action-reaction dynamics for a global sample of 148 countries.

## **Variables**

### *The dependent variable*

Our dependent variable – *Milexpct* – draws on inflation-adjusted military-expenditures data from Stockholm International Peace Research Institute (SIPRI) and measures year-to-year percentage changes in arms spending. We calculated a three-year moving average of such changes by adding, for each country-year, the value of the current year’s percentage increase or decrease to the values of the previous and the following year (and dividing by 3), as is common in the literature (Author; Gibler et al., 2005; Hewitt, 1992). SIPRI itself recommends using moving averages as “deliveries of arms can fluctuate significantly from one year to the next” (Wezeman and Wezeman, 2014: 1). A moving average helps remedy this by smoothing out the data.

### *The independent variable*

Our main independent variable – *Milexneighbpct* – codes the weighted average of arms-spending changes, in percentage terms, among the neighbors of the state in question. (Here, too, we use a three-year moving average.) Before calculating these changes, we added together the spending of all neighbors in question, so as to give additional weight to the most powerful ones.

In order to calculate this variable, an  $n \times n$  spatial-weights matrix that defines the neighbors of each country was constructed for each year. We adopted the Correlates of War (COW) Project's Type-2 definition of neighboring states (Stinnett et al., 2002).<sup>1</sup> This includes all states sharing land or river borders as well as those separated by 12 miles or less of water, a distance corresponding to the limits of a state's territorial waters. Whereas a definition that only counts as neighbors countries that share a border (COW's Type 1) is clearly too stringent for our purposes, others are too encompassing. The "stopping power of water" generally makes power projection across substantial distances quite demanding (Mearsheimer, 2001: 87-96); this sharply reduces threat perceptions and thus also the likelihood of action-reaction armaments patterns.

Granted, using only one single weighting matrix (for each year) does represent a simplification of reality, even if it adds clarity. Our models do not encompass all potential possible cases of action-reaction dynamics. One such omission are the major global and regional powers of the system, which should be inclined to react to the behavior and armaments of other major powers, even geographically non-proximate ones. Still, the specific objective of this article is to investigate whether the arms spending of states, in general, is shaped by neighboring states' arms spending. The rationale underpinning our analysis follows the gist of the empirical literature on interstate conflict, which indicates "that physical contiguity is a near-necessary condition for the initiation of interstate war" (Kocs, 1995: 166).

Another issue concerns the dynamics between and among allies, which cannot be expected to follow a security-dilemma logic in their arms spending. This is most relevant, of course, for clusters of multiple close allies (without any non-allied neighbors) – first and foremost the "security community" of Western Europe. In our main analysis, however, we do not separate *a priori* between allies and non-allies. Neither does the coding make prior assumptions about the existence of any current serious (territorial) disputes between or among

neighbors. Analytically and logically, such assumptions are not unproblematic, as states can be international competitors or rivals on many dimensions “without ever experiencing an armed encounter, and using disputes to establish the rivalry periods biases the sample” (Gibler et al., 2005: 137). Neither realist theory nor the logic of the security dilemma distinguishes between rivals and non-rivals. Alliances, for their part, are sometimes quite brittle, as evidenced *inter alia* by the current (at the time of this writing) conflict between Qatar and several of its formal Gulf Cooperation Council allies, and by the long-lasting antagonism between NATO allies Turkey and Greece. In any case, it is also of interest to identify any eventual regional or local “cold spots”; that is to say, countries, or groups of countries, exhibiting lower-than-expected values of military-expenditure growth.

Changes to state borders necessitated the construction of several matrices each of which corresponds to a single year. Notably, changes affecting our data took place in the periods and years 1990-1993 (the break-up of the Soviet Union and Yugoslavia, the reunification of Germany, the Czechoslovak “divorce,” the unification of Yemen, and the independence of Eritrea); 2002 (East Timor); 2006 (Montenegro); and 2011 (South Sudan). Prior to constructing *Milexneighbpct*, we needed to fill in missing values for the underlying SIPRI measure of constant military expenditure so as to avoid random, unexplained shifts from one year to the next. For cases with missing observations in the first (last) years of the time-series, a backward (forward) three-year running average was used to extrapolate our values. Missing values within a time series were replaced by way of linear interpolation. (However, to avoid generating too many “artificial” values, we do not use the interpolated versions of the dependent variable (*Milexpct*) in the analysis.)

A few countries lack military-expenditure data altogether, and these are neither included among the country-years under study nor in *Milexneighbpct*. This overwhelmingly concerns tiny states, with Somalia, Myanmar, and North Korea representing the only noticeable

exceptions. (Given the high tensions on the Korean Peninsula, we also removed South Korea from our analyses.) An additional batch of countries do not have military-expenditures data for the period 2008/2009-2014. Apart from the island states of the Caribbean and South Pacific, this is mostly the case for smaller countries in Sub-Saharan Africa. Lastly, nine additional (island) states were also excluded from the models, as these do not have any close neighbors. *Table 1* lists all countries missing from the analysis.

**Table 1. Countries missing from the analysis**

<b>Island states with military-expenditures data but no neighbors</b>	Cape Verde, Cuba, Fiji, Iceland, Madagascar, Malta, Mauritius, New Zealand, Seychelles
<b>Missing (no military-expenditures data)</b>	Andorra, Antigua and Barbuda, Bahamas, Barbados, Bhutan, Comoros, Dominica, Grenada, Kiribati, Liechtenstein, Maldives, Marshall Islands, Micronesia, Monaco, Myanmar, Nauru, North Korea, Palau, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, São Tomé and Príncipe, Solomon Islands, Somalia, South Yemen, Tonga, Tuvalu, Vanuatu

*Notes:* We use UN membership as a benchmark when identifying missing countries; South Korea was removed by us from the analyses.

### *Control variables*

We also need to control the most plausible other correlates of arms-spending changes. In the main analysis, we include four such variables that have previously been identified as particularly robust correlates of arms-spending changes (Author). By restricting the number of independents in the base models, we follow those who argue that the problem of “omitted variable bias” is often quite exaggerated, and that the inclusion of too many variables risks instead confounding the relationships of main interest (Achen, 2005). However, in the sensitivity-analysis section we report results from more expansive models.

First, the rate of growth of the national economy naturally acts as a vital constraint on changes in military budgets, with high economic-growth rates offering the opportunity for military-spending increases that do not affect existing non-military parts of a government’s budgets. Therefore, we include a measure of annual per-capita percentage growth rate, with

data from the World Bank's World Development Indicators (WDI) (*Growth*).<sup>2</sup> Similarly, natural resource-rich economies might translate windfall economic gains into military spending (d'Agostino et al., 2018: 11). Therefore, we include a measure of total resource rents as a percentage of GDP, with data from the World Bank's WDI (*Natrent*).

Third, we also control the total defense burden of a country, as the potential for high growth rates in military spending should, *ceteris paribus*, be larger for states with a low level of current capabilities (Sample, 1998: 164-5). The variable reflects military spending as a percentage of GDP (and logged), with data from SIPRI (*Milexgdp*). Furthermore, we expect that states involved in war are more inclined than others to increase their military budgets, all else being equal (Goldsmith, 2007; Skogstad, 2016). We therefore control for such involvement by including a dummy measure that takes the value 1 if the country-year in question is currently involved in a war with at least 1,000 yearly battle deaths (*War1000*) (Gleditsch et al., 2002). The dummy was computed based on data and definitions provided by the Uppsala University and Peace Research Institute Oslo (PRIO). We used their "Location" measure, which identifies the government(s) with a primary interest in the conflict in question. The variable encompasses both interstate and civil wars, with the latter being the dominating form of armed conflict. This leads to the question of whether or not results could be clouded insofar as arms spending by neighbors are directed toward the same transnational threat from *non-state* actors. While we cannot fully rule this out, the problem is probably not a major one, not least because it does not pertain to many regions or sub-regions. And where it does, such as in West Africa, where the five-country strong Multilateral Joint Task Force is fighting against several jihadist groups, results presented later actually show that this region exhibits no significant clustering of military-spending changes. For most countries, counterinsurgency is probably a relatively low-cost endeavor that is often poorly reflected by aggregate military spending (Hartfiel and Job, 2007: 17) – especially when compared to spending aimed at countering more traditional

military threats stemming from states commanding much larger resources than do non-state actors.

Descriptive statistics are presented in *Table 2*. There, we distinguish between two periods: 1988-2014 and 2009-2014, with the latter forming the mainstay of our subsequent analyses. All independent variables are lagged one year, so most of the models effectively take 2008 as the starting point. In fact, given that the main variable is a three-year moving average, arms-spending changes for a state's neighbors for 2007 are also included in the numbers. Equivalently, the dependent variable, also a three-year moving average, includes numbers for 2008 as well. We therefore sometimes refer to our models as an analysis of the period 2008/2009-2014.

**Table 2. Descriptive statistics: 1988-2014, 2009-2014**

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. dev.</b>	<b>Min.</b>	<b>Max.</b>
<b><i>1988-2014</i></b>					
Milexpct	3,152	4.750	21.896	-43.962	480.339
Milexneighbpct	2,924	3.075	8.812	-54.621	96.778
Growth	3,083	3.913	4.687	-50.248	35.224
Natrent	3,105	9.436	13.578	0	77.293
Milexgdp	3,102	0.597	0.766	-2.606	4.765
War1000	3,152	0.043	0.203	0	1
<b><i>2009-2014</i></b>					
Milexpct	689	3.125	9.360	-24.684	52.954
Milexneighbpct	635	3.605	5.952	-22.297	24.953
Growth	682	3.027	4.766	-46.083	21.021
Natrent	682	9.441	12.271	0	60.222
Milexgdp	682	0.427	0.723	-2.019	2.782
War1000	689	0.028	0.164	0	1

*Note:* Statistics based only on observations that have non-missing values for *Milexpct*.

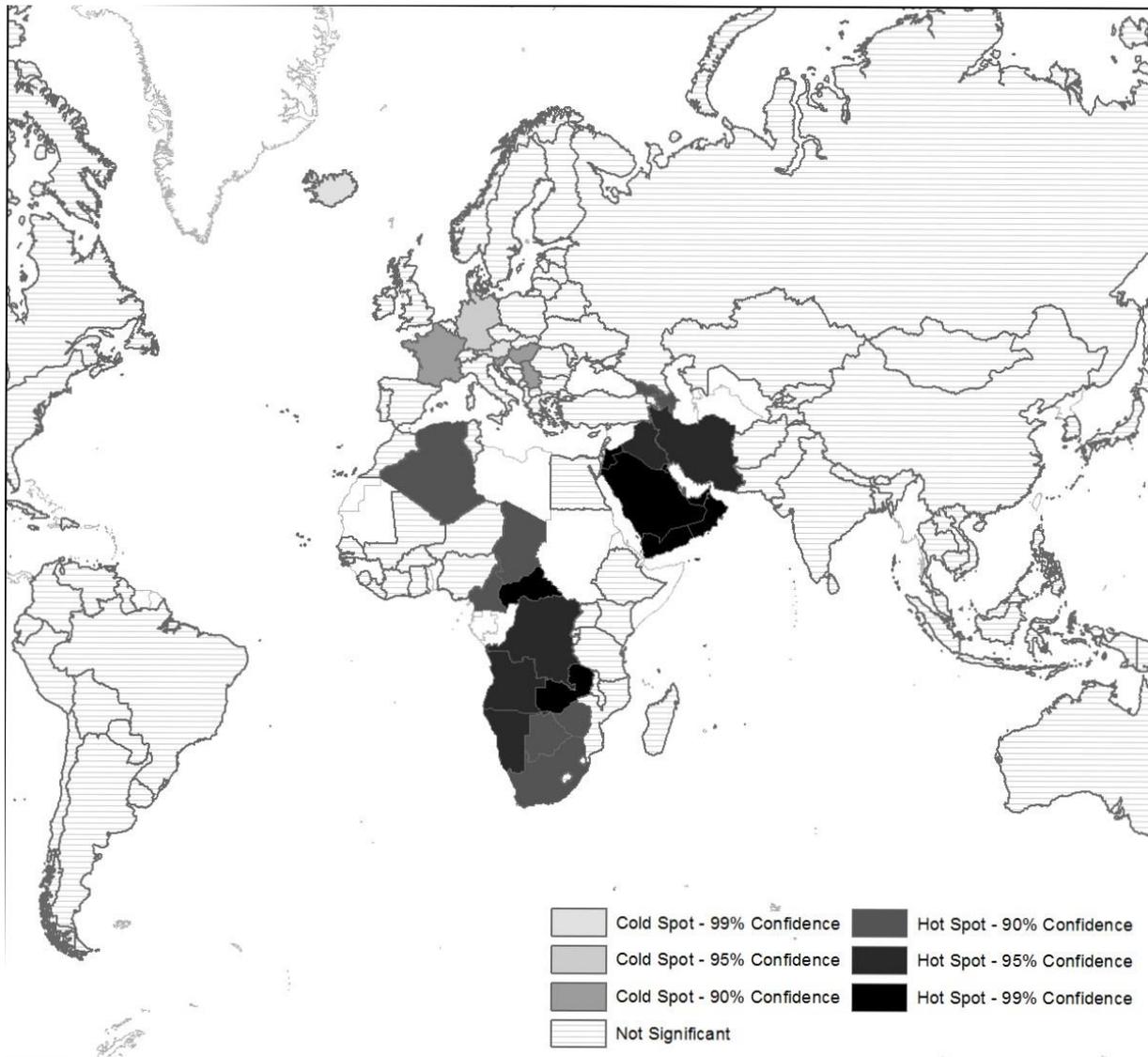
## **Methods and analysis**

Our first approach to identifying possible action-reaction dynamics among neighboring states involves a least-square dummy variables (LSDV) model. This is chosen over the equivalent

fixed-effects (FE) estimator for panel data because our interest lies primarily in the “fixed effects” that are conditioned out in FE models. What we are after is the marginal country effect on change in military-spending when controlling for other theoretically relevant determinants. By applying the LSDV model on the pooled 2008/2009-2014 sample, we thus obtain measures of average country effects for the period.

These effects have a geographical distribution that can be mapped using geographic information system software, an approach that is used with increasing frequency in the conflict-studies literature (Branch, 2016; Gleditsch and Weidmann, 2012).<sup>3</sup> We do this with a hot-spot analysis in the form of the Getis-Ord  $G_i^*$  statistic,<sup>4</sup> which is a local measure of spatial correlation (Getis and Ord, 1992). For each feature (in this case countries), a  $z$ -score is calculated by considering the context of neighboring features. The local sum for a feature and its neighbors is compared proportionally to the sum of all features, and a  $z$ -score is produced that reflects the departure of the local sum from the expected local sum. Hence, each country receives a  $z$ -score that signifies the intensity of clustering. Negative  $z$ -scores indicate a clustering of low values (“cold spots”), while positive  $z$ -scores indicate clustering of high values (“hot spots”). Having assigned  $z$ -scores to each country, these can then be displayed on a world map, which we do in *Figure 1*.

**Figure 1. Hot-spot analysis of marginal country effects on percentage changes in military spending for 2008/2009-2014**



Notes: Getis-Ord  $G_i^*$  analysis; dependent variable is *Milexpct* (% change in military expenditures, measured as a three-year moving average; Times World projected coordinate system (ESRI); missing countries are in white with pale gray borders.

In *Figure 1*, the lightest shades indicate significant clustering of low values in military-spending changes (cold spots), while the darkest shades indicate significant clustering of high such values (hot spots). For hot (cold) spots, the darker (lighter) the shade, the more significant is the relationship. Countries without significant clustering are shown with stripes, whereas missing data are depicted in white. For the period under consideration, significant negative clustering can be seen for some countries in Central and Western Europe, while positive

clustering is evident in the Middle East and the South Caucasus (Georgia and Azerbaijan), as well as in large parts of Central and Southern Africa (and in Algeria).

What these results show us is that, first, after controlling for other plausible independent variables, there remains a concentration of countries in West and Central Europe (including France, Germany, Austria, Hungary, Slovenia, and Serbia) that have significantly *less* growth in their military spending than what would be expected under the null hypothesis.<sup>5</sup> Second, for the Middle East, the South Caucasus, and parts of the African continent there are concentrations of countries that have significantly *higher* growth rates in military spending than predicted by the null hypothesis. On the other hand, neither Asia (east of Iran) nor the Americas seem to witness any severe armaments competition.

What we have demonstrated so far is the existence of spatial correlation in arms-spending changes for some regions for the period 2008/2009-2014. To arrive at more definitive conclusions, though, we should model this effect explicitly in our statistical analysis. Such a model, more generally referred to as a spatial-lag model (Anselin, 2013), can be expressed as:

$$y_{it} = \beta \sum_{j \neq i} \omega_{ijt-1} y_{jt-1} + X_{it-1} \theta + \varepsilon_{it}.$$

where  $y_{jt-1}$  is the vector of  $y$ 's for the neighboring states, and  $X_{it-1}$  is a vector of the characteristics of  $i$  that co-determine government preferences for arms spending  $y_{it}$ . The  $\beta$  and the vector  $\theta$  are the parameters to be estimated, and  $\varepsilon_i$  is the error term. The  $\omega_{ij}$  are the spatial weights that define if other countries are of strategic relevance to the arms-spending decisions of a government. Similarly to the previous correlation analysis, an  $n \times n$  connectivity matrix  $\mathbf{W}$  is defined to represent the hypothesized pattern of strategic dependence, where  $\mathbf{W}$ , in this model, conforms to the Correlates of War (COW) Project's Type-2 definition of neighboring countries. If a country  $i$  is defined as the neighbor of another country  $j$ , the element  $w_{ij}$  is

assigned the value of one; otherwise it is zero. The  $t$  subscript reflects the temporal dimension, and  $t_{-1}$  represents time lags in the adjustment.

**Table 3. Spatial lag model, determinants of changes in military expenditures (three-year moving average)**

	<b>1</b>	<b>2</b>	<b>3</b>
	Milexpct	Milexpct	Milexpct
	1988-2008	2009-2014	1988-2014
<b>L.MILEXNEIGHBPCT</b>	0.104*** (0.0142)	0.254*** (0.0291)	0.0304* (0.0120)
<b>D.G2 (2009-2014)</b>			-1.901*** (0.297)
<b>D.G2#CL.MILEXNEIGHBPCT</b>			0.128*** (0.0380)
<b>L.GROWTH</b>	0.256*** (0.0291)	0.220*** (0.0332)	0.153*** (0.0218)
<b>L.NATRENT</b>	0.143*** (0.0222)	0.165*** (0.0165)	0.149*** (0.0171)
<b>L.MILEXGDP</b>	-2.358*** (0.317)	-0.904*** (0.222)	-1.697*** (0.289)
<b>L.WAR1000</b>	6.116*** (0.999)	-1.673 (1.687)	1.499* (0.618)
<b>CONSTANT</b>	2.819*** (0.314)	-0.0677 (0.216)	2.009*** (0.278)
<b>OBSERVATIONS</b>	2128	624	2755
<b>COUNTRIES (N)</b>	146	132	148

**STANDARD ERRORS IN PARENTHESES**

**\* P<0.05, \*\* P<0.01, \*\*\* P<0.001**

*Notes:* All independent variables are lagged one year; a feasible generalized least squares estimator that allows correction of panel heterogeneity is used to account for reduced panel variance over time. A measure of explained variance ( $R^2$ ) cannot be calculated for the feasible generalized least squares estimator because it is not possible to break down the *total sum of squares* into *model sum of squares* and *residual sum of squares*. However, a random effects analysis of models 1 and 2 yields explained variances ( $R^2$ ) of 0.06 and 0.21, respectively.

We have defined two sub-periods of interest, namely 1988-2008 and (2008/)2009-2014. Initially, these periods are analyzed separately in models 1 and 2 of *Table 3*. The spatial lag is highly significant in both models, clearly indicating the existence of a year-by-year response to changes in neighboring states' military spending commensurate with action-reaction dynamics. These results are obtained in the presence of four control variables, all but one of which are highly significant in the expected directions (*War1000* is insignificant in the latest period). Interestingly, comparing the two periods, the size of the effect of the spatial lag is more than double for the latter period. This suggests that there has indeed been a *general increase* in countries' responsiveness to the armaments decisions of neighbors over the two periods. To evaluate the significance and size of this change, we pool the two time periods and analyze them together in a third model. A period dummy variable is generated for the latter time period, and it is also interacted with the spatial lag. The results in model 3 show significant effects for both the period dummy and the spatial lag, as well as for the interaction between them. To ease interpretation of the combined effect of these elements, we created a predictive margins plot (*Figure 2*).

**Figure 2. Predictive margins plots of spatial lag on changes in military expenditures (three-year moving average, alternative cut points)**

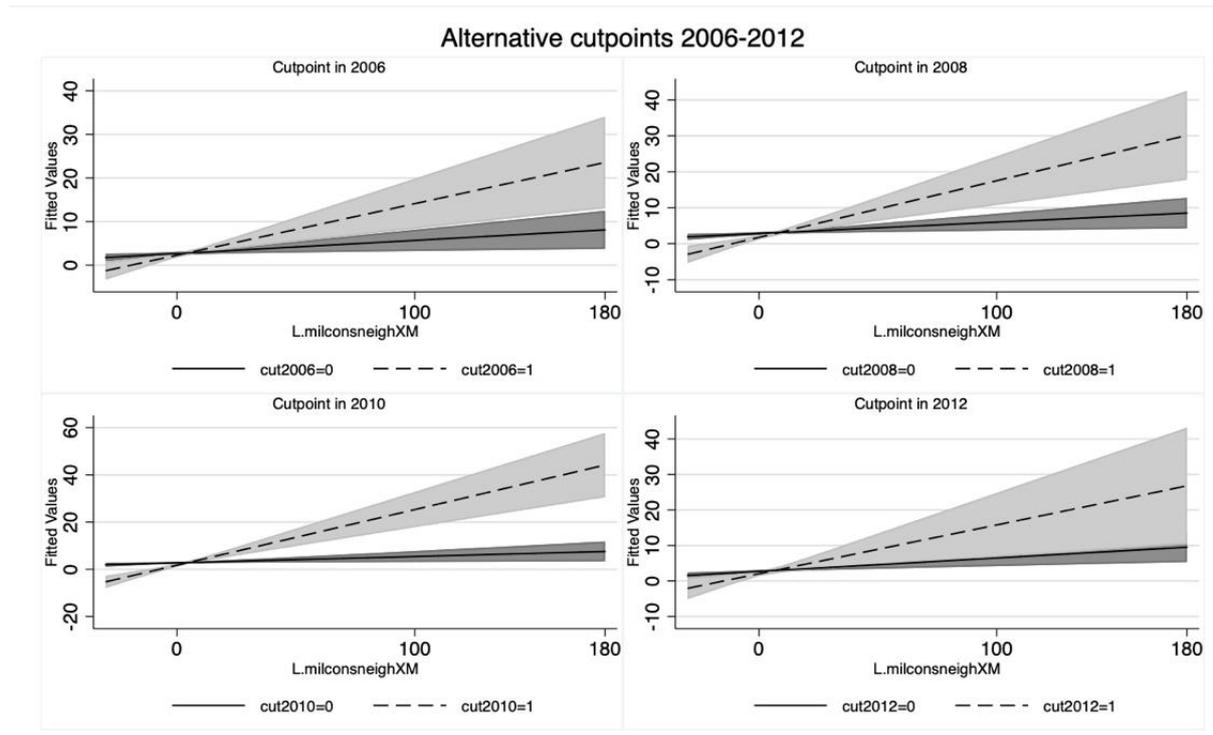


Figure 2 shows the predicted marginal effect of the spatial lag for the period 1988-2014, sectioned into two graphs by a cut point defining the two sub-periods. The figure displays four versions with four different cut points (2006, 2008, 2010, and 2012), since it is reasonable to expect that the hypothesized change in the effect of the spatial lag takes place over some time. From 2006, there is a (small) significant change in the marginal effect of the spatial lag. The significance of this pattern is strengthened for the later cut points up until 2010, after which levels of significance begin to decline. In 2012, a significant change in the effect of the spatial lag can no longer be observed. The data taken as a whole, therefore, suggest that the strategic dependence on the military-spending decisions of neighboring countries is higher in the most recent years than it was in the two preceding decades, and that that the bulk of this change took place during the latter years of the first decade of the 20<sup>th</sup> century. It is also worth noting that the predicted effect for sizable *reductions* in the neighboring countries' military spending is negative within the observed range for the latter period (cut points 2008 and 2010), which

suggest that countries will also *disarm* as a response to neighboring countries' disarmament. Vitaly, this creates the potential for self-reinforcing spirals of *disarmament*.

### *Sensitivity analysis*

We also performed additional analyses to ensure that results are robust. Our first sensitivity test was to run the basic models with a 5-year moving average instead of a 3-year one. This strengthened the significance levels of our models even further, but the variables' effects were only slightly altered (and the change comes with the loss of around two hundred observations).

Second, we ran the basic model (*Table 3*, model 3) with an additional batch of theoretically plausible variables included simultaneously. These were: GDP per capita (logged); military conscription (a dummy); acts of terrorism per 100,000 population; a dummy for European Union member states; trade (i.e. exports plus imports divided by GDP and logged); U.S. overseas troops (logged); a measure of democracy (Polity); and three dummy variables (one of which was omitted) measuring the difference in military power between a country and a weighted average of its neighbors.<sup>6</sup> Of these, only the democracy measure and the EU dummy were significant (at the 0.05 and 0.001 levels of confidence, respectively). Our main variables of interest were by and large left unchanged, however, although the interaction of the period dummy and the spatial lag dropped to the 0.01 level of significance. It increased to the 0.001 level of significance again when we, in a second extended model, removed the nonsignificant variables (but kept the EU dummy and the democracy measure, both of which were significant at the highest level of confidence).

Finally, we conducted sundry additional analyses (an extended report of these results – along with data and do-files – is available from PRIO at...). In the presence of the variables of our base model, we entered, one at a time, a total of 83 variables in order to check both their effects and the effects of our main independent variable for both the latest and the full time

period. The variables were organized into the following clusters, each of which is a plausible determinant of changes in arms spending: domestic economic and financial status (such as GDP per capita and government expenditure as a share of GDP); militarization and power (e.g. mandatory conscription, military power relative to the power of neighbors); security environment (various measures of war and militarized interstate disputes); liberal peace (e.g. level of democracy and human-rights protection, trade, economic freedom); and hegemonic peace (alliance relationship with the U.S., U.S overseas troops). The results can briefly be summed up as thus: First, the highly significant relationship between *Milexneighbpct* and the dependent variable proves highly robust. Second, results are consistently stronger for the latest period. Third, arms-spending changes are also related to some of the five clusters. Overall, the hegemonic-peace cluster and the militarization and power variables exhibit the weakest effects. The security environment (which is also captured by our dependent) has a stronger effect, as have domestic economic factors. Liberal-capitalist democracies, it seems, are associated with significantly lower growth levels in military budgets. Taken together, this shows that several factors help shape arms-spending policies. Still, the arms-spending choices of one's neighbors again proves to be a highly robust determinant of changes in military expenditures – in particular in the most recent period.

## **Discussion of regional patterns**

Thus far we have established that the most recent years have witnessed an increase in the spatial clustering of armaments-spending changes. This clustering, though, as demonstrated by the hot-spot analysis, varies considerably among regions. Below follows a brief, region-specific discussion of the results.

### *Europe and the South Caucasus*

Cluster effects are present in the South Caucasus. This is not surprising as this regional hot spot includes partially dismembered Georgia. It also includes Azerbaijan, which is embroiled in a long-running dispute with Armenia (whose effects are not significant) over the fate of, among other areas, Nagorno-Karabakh.

Results for non-Russian Europe display the opposite pattern, but they are hardly surprising either. The region as a whole has long rightfully been regarded as the poster child of security communities. In very recent years, however, discussions about European security have been associated by a certain change of tone: Scholars now talk of “The return of geopolitics” (Mead, 2014) and even “The death of Europe” (Sakwa, 2015). Such contributions allude not least to the actual or expected or recommended comeback of “geopolitical” thinking in European foreign and security policy, in particular in the wake of the 2014 conflict in and over Ukraine. Our data do not indicate that Russia’s short war against Georgia in August 2008 had any bearing on the armament policies outside the South Caucasus; and any effects of Russia’s invasion and annexation of Crimea, or its subsequent intervention into Ukraine’s civil war, are not covered by our data. However, the latter events now clearly help shape arms-spending decisions also for some states situated within the European security community (Author).

### *The Middle East*

Clustering effects are conspicuously present in the Middle East, as Skogstad (2016) demonstrated was the case for the preceding period as well. *Figure 1* shows that the clear majority of Middle Eastern states (North Africa apart) have marginal country effects significant at a high level of confidence. This includes all of the Gulf Cooperation Council (GCC) countries, with the exception of Qatar (significant at the 90-percent level). It also includes conflict-ridden Yemen and Iraq – but not Syria (though data for Syria only cover 2009 and

2010) – as well as Jordan. Lebanon and Israel, for their part, fail to exhibit any significant clustering effects.

We might point to three sets of forces that help cause the pattern depicted in *Figure 1*. First, according to one argument, for various state elites in the Middle East, interstate rivalry and the genuine or assumed presence of external threats have long had a positive effect on state building (Lu and Thies, 2013). Rivalry short of war, or of war preparation, effectuates a “vast expansion of military bureaucracies and expenditures as well as the emergence of domestic political economies constructed around the regional and international pursuit of strategic rents” (Lu and Thies, 2013: 242). *Actual* Middle Eastern wars, on the other hand, weaken states instead, which in turn creates the unfortunate foundation (or, rather, prerequisite vacuum) for more instability and wars. Second, and linked to the above, many Middle Eastern states have only dubious legitimacy, which the 2010-2011 “Arab Spring” in particular brought into sharp relief (Ahram and Lust, 2016). Attempts to mend state-elite legitimacy deficits – whether they are signified by Arabism, Islamism, sectarianism, or anti-Westphalianism – often center on a “diversionary foreign policy” and the attendant militarization of the state (Lu and Thies, 2013: 242; Solingen, 2007: 774).

Third, the Middle East, when viewed as a self-contained region, has arguably long been a multipolar one – perhaps even one without any great powers at all (Lustick, 1997). Yet, the question of regional “leadership” was long a moot point anyway considering the substantial regional presence and influence exerted by the United States. In recent years, however, considerable attention has been devoted to the alleged waning of U.S. influence. In particular in the wake of the Iraq war, the Arab revolutions, and, more recently, the Syrian War, perceptions are widespread that Washington, “after a wildly erratic spree of misadventures, is backing out of the region” (Kramer, 2016: 53). This may or may not fully reflect reality, but it

is nonetheless clear that several regional players are increasingly, and independently of the U.S., vying for power and influence.

### *Asia*

Our data show that the action-reaction dynamics evident in the Middle East are not representative for Asia as a whole. In fact, the analysis suggests instead the *absence* of any substantial security competition. For the South Asian regional security complex, this is not too surprising. Some of these states – such as Nepal, Bhutan, Sri Lanka, and Bangladesh – are, on account of their small size and/or geostrategic location, considerably constrained geopolitically. As for the hostile relationship between India and Pakistan, any action-reaction dynamics in terms of *conventional* armaments might be tempered by the existence nuclear weapons on both sides.

The non-significant results for East and Southeast Asia are perhaps more surprising. Political insecurities and security worries in this area are fundamentally linked to the growth of China. Some scholars point to 2008-2009 as the years when Beijing largely started shedding its strategy of “peaceful rise” in favor of a more assertive or abrasive posture (Christensen, 2011: 54-5; Liff and Ikenberry, 2014). Our analysis does not support such a view, however. With the caveat that the two Koreas are left out of the analysis, we have at the very least grounds to state that any security competition seems significantly tempered. Others have reached the same conclusion, showing that the armaments data instead indicate “a surprising lack of interest in boosting ... military expenditures in response to China’s massive increases” (Fu, 2015: 181). This fits with the view that long-term economic, institutional, normative, and domestic-political changes have worked, and presumably still work, to prolong and entrench a *Pax Asiatica* that has existed since the 1979 Sino-Vietnamese War (Choi, 2016; Goldsmith, 2014; Solingen, 2007).

The Asian security complex is complex, though, involving both adversity and partnerships; and the latter is in part linked to the quite conscious Chinese strategy of encouraging bandwagoning rather than balancing (Friedberg, 2011: 200-3). Others effectively insist that the conflicts that are visible in the region represent a *continuation* rather than a change (Johnston, 2013). Besides, the presence of the United States as a key preserver of the regional balance also represents continuity (Silove, 2016). Indeed, the essential rivalry in East Asia is that between China and the U.S. (Friedberg, 2011). This rivalry, to be sure, involves a profound military component, not least in the maritime domain (Montgomery, 2014) – but one which our data, which center on geographic contiguity, cannot encompass. As for the Asian states themselves, evidence is scant that they are locked into any severe military competition.

### *South America*

Neither does the Americas exhibit any action-reaction patterns. South America’s “splendid little wars” might have become almost extinct (Sanchez Nieto, 2011), and this is apparently also the case for rivalries and arms races. This is so despite the argument that the continent is now rapidly entering a “post-hegemonic” era characterized by a lessening of U.S. influence (Crandall, 2011); despite empirical evidence that suggest that state building in Latin America has long been boosted by interstate conflict and rivalry (Thies, 2005); and despite that there is no shortage of *potential* such rivalries with roots long back in history.

### *Africa*

This leaves the African continent. Around twenty out of over fifty countries in Africa are not included in the analysis, due either to missing data or because they are island states without close neighbors. Eleven of the rest exhibit insignificant clustering effects in our model. In terms of sub-regions, West Africa generally shows no clustering; in North Africa, Algeria, a long-

term rival of Morocco, exhibits significant effects; whereas action-reaction dynamics are quite prominent in Southern and Central Africa.

War has been relatively common in Africa, but the vast majority of African countries, whose state capacity is often limited, have not participated in any “traditional” *interstate* war post-independence (Herbst, 1990: 117). Thus, some of the action-reaction pattern we identify might be driven by civil wars – or the threat of such wars – in particular considering the contagiousness of armed conflict on the continent (Buhaug and Gleditsch, 2008). The interstate dimension can still conceivably have a marked impact on armaments policies. For one, territorial disputes between states, which often center on borders that partition ethnic groups, are fairly widespread (Goemans and Schultz, 2017). Furthermore, state weakness and the existence of “vacuums” also often spur interstate rivalry and external intervention (Tamm, 2016). The wars in the Democratic Republic of Congo, in particular the 1998-2003 Second Congo War, are especially illustrative; it quickly drew in the military of eight other African states, leading to a regional conflagration wherein the lines between the intra- and interstate levels were significantly blurred (Tamm, 2016: 147). Although parts of the continent – notably West Africa – serve as a somewhat rosier example with respect to interstate rivalry, for the time being, Africa as a whole is still a continent suffering an inordinately high level of both internal violence and – as our data suggest – interstate security competition.

## **Conclusion**

This article has tested whether or not interstate security competition – operationally defined as spatial clustering of arms-spending changes – is now prominently in play in international affairs. Our study has sought to measure if states’ military budgets tend to change as a function of (a weighted average of) neighboring countries’ arms-spending decisions. The empirical answers we have obtained say that they do – to an extent. First, our hot-spot analysis of the

period 2008/2009-2014 shows that action-reaction dynamics are visibly present in some regions. This is most clearly the case in the Middle East, parts of Africa, and the South Caucasus. Europe, for its part, tilts more toward being a “cold-spot” area. Perhaps more surprisingly, in South, East, and Southeast Asia, no spatial clustering can be observed. The second analysis, a spatial-lag model, uncovered a *general* pattern of such action-reaction dynamics for a global sample, as others have also suggested (Author; Goldsmith, 2007; Skogstad, 2016; Yesilyurt and Elhorst, 2017). While this result, to an extent, encompasses the whole post-Cold War period (1988-2014), it is still substantially driven by the most recent years. It does, therefore, seem that a change in security competition among states began to take place around the years 2006/2007-2011.

Where does our study’s results fit into the broader debate about international security and the risk of interstate conflict in the post-Cold War era? The simple answer is that we tilt moderately toward the “negative” camp. Security competition is clearly not a thing of the past only. The evolution and (partial) spread of democratic norms and institutions, and of international organization, and of cross-border economic interactions may well have dampened military rivalries and action-reaction dynamics a bit – when compared with earlier epochs. But they have not removed them. By extension, war is not obsolete. Arms are purchased and military budgets are strengthened under the knowledge that they might someday be used in a real battle against an adversary.

It should be emphasized, however, that the arguments of “optimists” have normally included explicit qualifications. For example, the main conclusion emanating from the voluminous democratic-peace literature is that such a peace is primarily (or maybe exclusively) a *dyadic* phenomenon; (liberal) democracies are very rarely embroiled in militarized disputes or wars with other democracies, but there is little to suggest that they are, *in general*, less war-prone than non-democracies (Lake, 1992). Thus, the lack of security competition in some

regions, with Europe and the Americas as the two obvious examples, could in part be explained by the fact that these regions overwhelmingly consist of democracies. Security dilemmas do not exist in “security communities.” But mutual trust is in shorter supply – and security dilemmas are therefore more prominent features – in *unlike* dyads where at least one of the states is a non-democracy, which is still the case for the majority of dyads consisting of neighboring countries.

It is clear that “optimistic” conclusions about world security also tended to rest on arguments that were specific to particular regions, to the “core” of global politics, or to one particular “world” wherein “economic interdependence, political democracy, and nuclear weapons [would] lessen the security dilemma” (Goldgeier and McFaul, 1992: 469). But this “two-world thesis” rested on the existence of a second world as well, where security dilemmas would persist. The regions and sub-regions identified in the present analysis as being beset with arms-spiral dynamics – the Middle East, the South Caucasus, and substantial parts of the African continent – suggest the tenacity of a more traditional “world” with more traditional security worries, more traditional responses to such worries, and more traditional patterns of reciprocal armaments.

We should still emphasize that our analysis does yield some good news. First, such spatial clustering also involves a clear potential for corresponding spirals of *disarmament*. Second, large parts of the world – not only the Americas and Europe but also the bulk of Asia – do not as yet experience any relentless security competition. History, geography, and geopolitics might have “returned” (if they ever really left, that is), but thus far, in most regions and sub-regions, they primarily seem to appear in a reasonably attenuated form.

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<sup>1</sup> The dataset – Direct Contiguity Data, 1816-2006 (v. 3.1) – is available at: <http://correlatesofwar.org>.

<sup>2</sup> Available at: <http://data.worldbank.org>.

<sup>3</sup> We employ ESRI's ArcGis Desktop, ArcMap 10.5 ([www.esri.com](http://www.esri.com)).

<sup>4</sup> The Getis-Ord local statistic is given as: 
$$G_i^* = \frac{\sum_{j=1}^n w_{ij} x_j - \bar{x} \sum_{j=1}^n w_{ij}}{s \sqrt{\frac{n \sum_{j=1}^n w_{ij}^2 - (\sum_{j=1}^n w_{ij})^2}{n-1}}}$$

The same type of  $n \times n$  connectivity matrix  $\mathbf{W}$  is applied in the Getis-Ord  $G_i^*$  statistic as in the calculation of Moran's  $I$ .

<sup>5</sup> The null hypothesis specifies a random dispersion of growth rates.

<sup>6</sup> The GDP per capita variable is measured at market-exchange rates in constant 2005 U.S.\$ (data are from the World Bank at <http://data.worldbank.org>). The military conscription dummy and the U.S. troops variable were constructed based on data from several sources; please see (Author) for a description. Data on terrorism are from the START's Global Terrorism Database at <http://www.start.umd.edu/gtd/>. Trade data are from the World Bank. The democracy variable use data from the Polity IV project; the variable ranges from -10 (fully institutionalized autocracy) to +10 (fully institutionalized democracy) and is available at: <https://www.systemicpeace.org/polity/polity4.htm>. Three power difference dummies were also included. The first is coded 1 if the country(-year) in question is outspent militarily by its neighbors by a ratio of 10 or more. The

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second uses a ratio between 3 and 10 (in favor of neighbors). The third, which served as the reference category, takes the value 1 if the ratio is less than 3. Calculations were done based on data from SIPRI.