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Self-Containment: Achieving Peace in Anarchic Settings

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Abstract

In anarchic settings, potential rivals can be dragged into arms races degenerating in open wars out of mutual suspicion. We propose a novel commitment device for contestants to avoid both arming and fighting. We assume that the military decides the armament levels of a country, while the civilian decides whether to attack a rival country. When these decision-making bodies perfectly communicate, the decision makers are unable to credibly communicate to their foe their willingness not to arm and not to attack, thus implying that war ensues. With imperfect information, however, peace may ensue as countries credibly signal to their rival a more peaceful stance since contestants are more reluctant to enter in an armed confrontation with a potentially understaffed army. Using data on the 1975 to 2001 period, we provide supportive evidence that in countries where the head of the state or the defense minister are military officers, and are therefore better informed of their armies' fighting preparedness, the likelihood of observing an international conflict is higher.

Keywords

conflict, private information, commitment

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Wars produce both victors and losers and give rise to inefficiencies that affect all contenders. The inefficiencies may be direct such as human life loss and material destruction or indirect when it takes the form of resources devoted to the preparation of an armed confrontation. These two features of war constitute the backbone of the *war's inefficiency puzzle* explaining why rational agents fail to reach peaceful settlements (Fearon 1995; Powell 2006). Among the several mechanisms that have been identified and that explain war between rational agents, the informational channel seems particularly undisputed: leaders hold private information on their military capability, which may lead them to mistakenly estimate—and to potentially overestimate—their winning odds, thus resulting in undesirable military disputes (Blainley 1988; Fearon 1995; Powell 1999; Meirowitz and Sartori 2008; Baliga and Sjöström 2012). Meirowitz and Sartori (2008) uncover a fundamental mechanism tying information imperfection to conflict since they demonstrate that there exist configurations where when both contestants are armed, at least one contestant will want to declare war. This anticipation incentivizes both opponents to secretly arm thus fulfilling the expectation of an armed equilibrium and of war. In such contexts, more information is desirable since allowing players to communicate may contribute to reducing the likelihood of war (Baliga and Sjöström 2004). In this article, we reverse the argument since we demonstrate that better information may incentivize players to arm and to declare war.

One of the building blocks of our theory is the way we conceptualize the internal organization of governments and the communication among its different constituencies. The bulk of the literature on information quality in international relations has considered states as unitary actors. Yet, experts in civil–military relations remind us that this hypothesis is not always satisfied (Huntington 1957; Desch 1999; Feaver 2003). Governments have often pursued a separation of powers, with the military holding private information on sensitive issues regarding the country's security (Feaver 2003). In such instances, a country's domestic security and foreign policy become highly dependent on the degree to which the different decision-making bodies are able to communicate (Huntington 1996; Desch 1999; Feaver 2003).[1]

Before delving into the consequences of such information asymmetries on foreign policy, it is worth examining their roots. First, the civilian principal and the military agent may face agency problems and have misaligned objectives (Feaver 2003; Acemoglu, Ticchi, and Vindigni 2010). Communication problems constitute a second cause. Jervis (2010), for instance, exposes the communication problems between the United States' intelligence and the country's decision makers. This may in turn produce wrong evaluations of one's own capacity to cope with an international crisis. A third reason why civilian–military relations may be hurt by information imperfection lies in the civilian's accountability to the public opinion (Page and Shapiro 1983), which typically lacks the required expertise in military matters (Gelpi 2010) and yet influences foreign policy. Overall, it is reasonable to expect all these factors to simultaneously impact the quality of information.

With this empirical reality in mind, we now explore the theoretical implications of informational imperfections inside countries on the likelihood of war. The theory developed in this article builds on the seminal contribution of Skaperdas (1992), which models conflict as a zero-sum game. In such settings, peace is never reached because of an underlying arms race logic that constrains both parties to prepare for war, despite the Pareto superior nature of a weaponless and hence peaceful order. On one hand, a weaponless enemy constitutes a perfect prey, thus making the weaponless equilibrium unrealizable. On the other hand, arming to deter an aggression makes oneself increasingly willing to use these guns if the foe is expected to be lightly armed. At equilibrium, both contestants end up being armed and the setting being a zero-sum game, it is always (weakly) in the interest of one contestant to declare war.[2] This mechanism has been clearly explained by Jervis (1978), who termed the countries' tendency to arm out of mutual fear the *security dilemma*: "[M]any of the means by which a state tries to increase its security decrease the security of others" (Jervis 1978, 169).

In this article, we reverse the arms race logic by introducing in Skaperdas's (1992) benchmark model, a particular form of information imperfection. We graft on a standard "guns and butter" model information imperfections *inside* each country. From an individual viewpoint, reduced communication implies a less accurate knowledge of one's own military efficiency. Yet, a disregarded consequence is that the implied reduced military efficiency of a particular country may yield desirable equilibrium outcomes since the opponent will have incentives to reduce his militarization thereby triggering a de-escalation spiral. To clarify the underlying logic, consider two countries A and B, where the military in each country is in charge of armament decisions while the civilian decides whether to enter in a military confrontation with the rival country. Assume further that the military communicates to his civilian the country's striking capacity (i.e., amounts of weapons), yet in an imperfect manner, and that this is occurring in both countries. Should the military in country A build up a powerful army and communicate this information to his civilian, the latter nevertheless remains unsure of its army's striking capacity and could therefore refrain from attacking a rival whose expected strength is lower than one's *real* (yet unknown) striking capacity. In anticipation of their respective civilians' reaction, both militaries consequently have incentives to refrain from preparing for battle (i.e., from arming) with positive probability, thus feeding back in the civilians' reluctance to initiate conflict. Following this line of reasoning, the extreme case whereby no military arms and no civilian initiates hostilities constitutes an equilibrium, although not the only one. In contrast to Jervis's (1978) *security dilemma* and to the arms race literature, information imperfections would allow countries to enter in a de-escalation spiral. This is the novel mechanism we present in this article, which allows for the emergence of peaceful outcomes where the bulk of the theoretical literature predicts war.

It is noteworthy that we depart from the standard principal agent approach (Feaver 2003), where the civilian principal's and the military agent's preferences differ. The theory developed in this article assumes a combination of perfect alignment of incentives and of information imperfections. This assumption permits us to better highlight the implications of imperfect information, which would be present even if the two bodies' preferences were not perfectly aligned. Imposing a misalignment of incentives would further reinforce our results but would equally cast doubts on the *source* of the mechanism underlying our results.

Meirowitz and Sartori (2008) equally focus on information imperfections but reach diametrically opposed conclusions. The type of information asymmetries in these two articles differ, however, since we impose that they arise not only between opponents but equally inside each contesting party. In the peace equilibria we derive in this model, the probability that parties follow their hawkish strategy (i.e., invest in weapons) is strictly less than one because of information imperfections. Had the military and the civilian been able to perfectly communicate as in Meirowitz and Sartori (2008), however, anticipating that the opponent may be unarmed would incentivize oneself to purchase arms (with certainty) and thereafter to initiate hostilities. The very anticipation of this reaction would therefore rule out weaponless equilibria.

The theoretical findings of the article are the following: war occurs with certainty when two countries with perfectly informed decision makers face each other. If both countries suffer from information imperfections, peace can occur either as a pure strategy where both countries are weaponless or else as a mixed strategy where the probability of arming and of fighting are both strictly positive but less than unity. Allowing for an ill-informed country to confront an informed one yields intermediate results: either the informed country always finds it optimal to initiate conflict or else there exists scope for a mixed strategy equilibrium producing peace with a strictly positive probability. These findings imply that the more informed the country pairs, the more hawkish the countries are likely to be, while dovish behavior follows from information imperfections.

In the following section, we present some stylized facts suggesting that better informed regimes tend to be more belligerent. In the third section, we expose the model and the theoretical findings. Next, in the fourth section, we support our theory with empirical evidence, and in the fifth section, we confront our empirical results to potentially competing theories. The last section presents our conclusions.

Information Quality and Bellicosity: Stylized Facts

Measuring the Quality of Information

Since our presumption is that better informed regimes tend to be more belligerent, we first ought to devise a reliable way of measuring the quality of information. The military being a professional body, it possesses private information over important issues like tactics and logistics (Feaver 2003, 69). Desch (1999) and Feaver (2003) emphasize that the "civilian" fails both in having perfect knowledge of sensitive military information and in fully controlling the military. This point is even more relevant in light of the analysis of Jervis (2010), who exposes the problems of commitment between intelligence agencies and their respective governments. The exchange of information among key political and military decision makers typically takes place, however, under a veil of secrecy that prevents us from having direct access to such data. Alternatively, such data could be proxied by characteristics of the decision makers who facilitate the flow of information on an army's military preparedness, which is a combination of armaments levels, technology, military expertise, intelligence, and so forth. Since military officers are certainly among the better informed regarding their country's combat capacity, it is not unreasonable to assume that whenever a military official participates in the highest echelons of the government—as the head of the government or as a defense minister—the flow of information in the regime is higher than otherwise. For the remaining of the article, we adopt this assumption. Figure 1a allows us to obtain a first understanding of the links between information quality inside a regime and its bellicosity. In this figure, we have plotted for each country the (logarithm of the) average military expenditures as a percentage of gross domestic product (GDP) and the average probability of war over the period 1975 to 2009. Given the large number of countries that experienced zero conflicts over this period, we chose not to represent these on the figure for presentation reasons. The triangles designate military regimes (i.e., well informed), while the diamonds represent nonmilitary regimes (i.e., ill informed). The figure reveals that on average better informed regimes tend to be more belligerent, thereby giving a first indication of a possible link between information quality and a country's belligerence.

These rough stylized facts indicate a possible connection between information quality and foreign policy. It could be argued, however, that our categorization is problematic because of the potentially high correlation between our measure of information quality and the degree of dictatorship, eventually blurring the picture. Nevertheless, the data reveal that 28 percent of countries with positive Polity IV scores are "informed" following our definition, while 35 percent of the countries with negative polity IV scores are "uninformed." This can partly be seen by a visual comparison of Figures 1a and 1b. Figure 1b features the same elements as Figure 1a, and instead of depicting the degree of information, we are distinguishing regimes on the basis of how democratic they are. More specifically, the red crosses represent regimes with a polity IV score below the world median, and the blue crosses designate regimes with a Polity score above the median world score. We observe that the most bellicose countries tend to be more democratic. This observation does not contradict the democratic peace argument, given that the large majority of countries that we have not reported on the figure because of their peaceful history throughout the period under consideration are equally democratic. This does, however, hint to characteristics of some democratic regimes making them more bellicose than others: a small group of democracies seem to be disproportionally war-prone, and the bulk of (nonreported) democracies do not experience wars. The second interesting feature is that no clear pattern between the degree of information quality and the degree of democracy seems to emerge from a rough comparison of these two graphs. This not only comforts us in our choice of the information quality measure, but the fact that

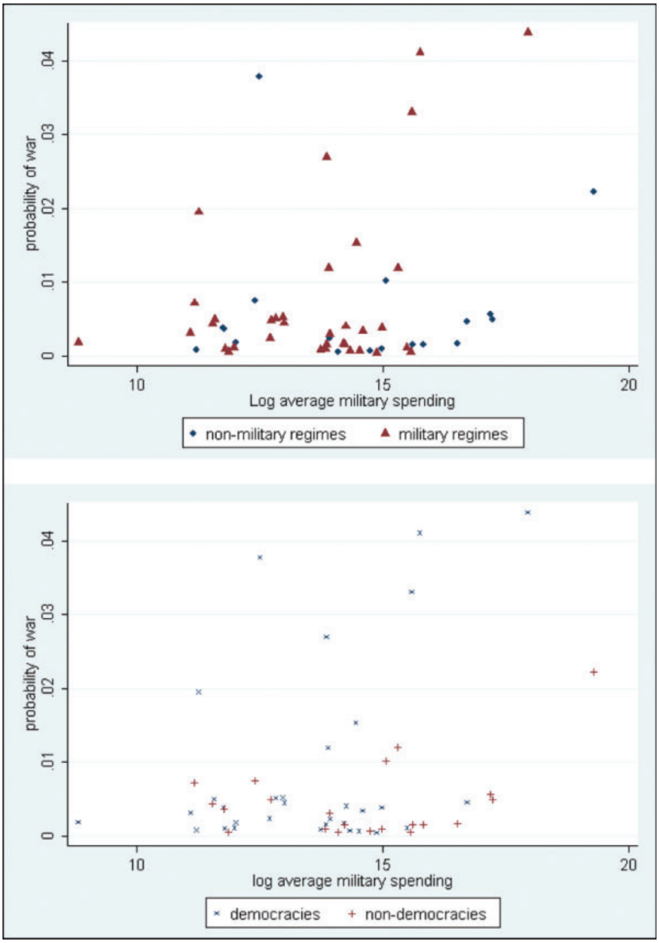

Figure 1. Stylized facts on regime types and the probability of war.

the most war-prone democracies are equally better-informed countries suggests that the characteristic polarizing democratic regimes in their bellicosity may well be the information quality.

Some concrete examples on the nonoverlap between our measure of information quality and regime type may help convince the skeptics. Kenan Evren who became chief of general staff of Turkey in 1978 led a military coup in 1980 and installed himself at the country's presidency where he remained until 1989. In July 1983, however, Evren resigned from the command of the army. Despite the fact that Turkey was being led by a former military putschist, democratic reforms, including the organization of free and democratic elections from 1983 onward, enabled the country to obtain a Polity IV score of 7 over 1984 to 1989, a score which objectively categorized Turkey among the democratic nations. Another characteristic example of an "informed democracy" is the case of Israel. Indeed, over the period covered by our sample, several heads of state (Yitzhak Rabin: 1974 to 1977, Binyamin Netanyahu: 1996 to 1999 and 2009–, Ehud Barak: 1999 to 2001, Ariel Sharon: 2001 to 2006, and Ehud Olmert: 2006 to 2009) and defense ministers (Ezer Weizman: 1977 to 1980, Yitzhak Rabin: 1984 to 1990 and 1992 to 1995, Yitzhak Mordechai: 1996 to 1999, and Shaul Mofaz: 2002 to 2006) have been at some point during or prior to their political career military officials. Nevertheless, Israel has systematically been attributed since its creation in 1948 a Polity IV score of 9 or 10.[3]

The stylized facts presented in this section seem to suggest a linkage between information quality in a country and the likelihood of being involved in an international conflict. The next section proposes a theory explaining these preliminary findings.

The Theory

The Setting

Two countries share a territory of total worth R, such that country 1 controls a share $\lambda \in [0, 1]$ of it, while country 2 has property rights over the remaining territory. Each country's territorial endowment $r^i \in R$ constitutes the unique input in the production of a consumable c^i $(i = \{1, 2\})$, given a unit marginal cost of production, and in the production of armaments a^i. These property rights, which should be seen as the status quo partition of the resources, can be contested by either side by going to war and are such that $r^1 = \lambda R$ and $r^2 = (1 - \lambda)R$. In each country, a civilian C^i $(i = \{1, 2\})$ is in charge of the decision to *fight* (i.e., declare war) or to *concede* (i.e., not declare war). If war takes place, the remaining "pie" at stake is therefore equal to $\lambda R - a^1 + (1 - \lambda)R - a^2 = R - a^1 - a^2$. The likelihood that country i wins is then described by a function $p(a^i, a^{-i})$ and depends on the amounts of armaments available in countries 1 and 2, respectively denoted by a^1 and a^2. The winner of the contest gains control over all the contested resources. The armament level of country i is decided by its military, M^i. Given that the marginal cost of arming is measured as an opportunity cost of foregone production, M^i has to respect its country's budget constraint: $r^i = c^i + a^i$. The function $p(a^i, a^{-i})$ is assumed to satisfy the following properties:

Hypothesis 1: $p^i = p(a^i, a^{-i}) = \frac{f(a^i)}{f(a^i)+f(a^{-i})}$ if $a^i + a^{-i} > 0$, with $f(0) = 0$, $f'(\cdot) > 0, f''(\cdot) \leq 0$.

Hypothesis 2: $(p^1, p^2) = (\lambda, 1 - \lambda)$ if $a^i + a^{-i} = 0$.

We thus assume that a country's fitness is decreasingly increasing in the size of its army, while in the absence of armies $(a^1 = a^2 = 0)$, the war outcome is assumed to be the same as the status quo.[4] Because of assumptions Hypotheses 1 and 2, the probability functions, and hence the war payoffs, experience a discontinuity in $(a^1, a^2) = (0, 0)$. As a consequence, throughout the article, we denote by σ^i the probability that country i arms $(a^i > 0)$, and $(1 - \sigma^i)$ therefore designates the probability country i remains weaponless $(a^i = 0)$. Moreover, we allow for mixed strategies in the *fight* and *concede* actions, and accordingly denote by Π^i the probability country i attacks country $-i$.

The countries can differ along their degree of centralization, which is reflected in the (exogenous) quality of information flowing from the country's military to its civilian. The military decides an arming strategy and then privately communicates to his civilian his arming strategy (i.e., the opposing country's actors do not observe the signal), but the flow of information is imperfect. Denoting the arming strategy set of country i's military by $S^i = \{s_1^i, \ldots, s_n^i\}$, if M^i plays $s_k^i \in S^i$, C^i receives a signal $\alpha^i = s_k^i$ with probability $(1 - \varepsilon)$. The ε probability of mistaken signals is uniformly distributed over the remaining set of arming strategies $S^i \backslash s_k^i$.[5] Notice that to keep the model meaningful, we restrict ε to the interval $[0; 1]$.[6] Throughout the analysis, we impose that a country's civilian and military derive the same utility.[7]

Given our modeling strategy, a natural question is whether the assumed information imperfections are compatible with the players' incentives to communicate each other information: Is it not in the interest of the military to perfectly communicate to its civilian the country's armament level for the latter not to take wrong decisions out of ignorance? Although we are merely assuming in the present version of the article that information imperfections subdue for reasons out of the players' control, our findings suggest that both players could be better off under imperfect information and that both players could therefore have incentives to commit not to unilaterally improve the flow of information from their own military to their civilian decision body. In the Online Appendix, we show using a limiting case (i.e., perfect symmetry) as an illustrative example that among the multiple equilibria of the game that emerge, there exists an equilibrium where some degree of imperfect information *is incentive compatible*, provided a commitment technology is available.

Using superscript w to designate the war outcome, and respectively, denoting the utility of decision makers in countries 1 and 2, by U and V, it follows that country 1's decision maker utility under war is given by the following expression:

$$U^w = p(a^1, a^2)\left(R - a^1 - a^2\right). \tag{1}$$

Using the superscript $\bar{w}$ to designate the peace outcome, we have

$$U^{\bar{w}} = \lambda R - a^1. \tag{2}$$

The timing of the game is sequential. In the first stage of the game, the agents responsible for the resource allocation—the military—decide the amount of guns to purchase and the amount of consumables to produce. In the second stage, the agents responsible of the war decisions—the civilians—simultaneously decide whether to attack their foe or not. If either civilian plays *fight*, war ensues. We solve for the game's *sequential Nash Equilibria*. We solve the game by backward induction.

Model with Full Information $\varepsilon^i = 0$, $i = \{1, 2\}$

Assume first no information imperfection. Given the timing of the game, we first derive the civilians' optimal decisions for any combinations of armament levels.

The decision of going to war. Since information is perfect ($\varepsilon = 0$), the civilians perfectly observe their own country's armament levels, and they are both aware their opponents do so as well. Hence, if civilian C^1 observes $a^1 = 0 \Leftrightarrow \sigma^1 = 0$, his or her expected utility of playing fight equals

$$U^f(a^1, a^2)|_{a^1=0} = \sigma^2 U^w(0, a^2) + (1 - \sigma^2) U^{\bar{w}}(0, 0), \tag{3}$$

where the first term stands for the payoff of civilian 1 when country 2 declares war, while the second term is civilian 1's payoff if country 2 does not declare war, that is, under peace.

Notice that since civilian C^1 does not observe the signal sent by M^2 to C^2, C^1 ought to rely on his expectations as to whether M^2 has armed or not. To lighten notation, we are slightly abusing notation and we take σ^2 to designate the expectation of C^1 that M^2 has armed. It is also noteworthy that if neither military has armed, so that $a^1 = a^2 = 0$, we have by Assumption 2 that the expected outcome is the same as under peace.

Playing instead *concede* yields

$$U^c(a^1, a^2)|_{a^1=0} = \pi^2 U^f(a^1, a^2)|_{a^1=0} + (1 - \pi^2)\left(\sigma^2 U^{\bar{w}}(0, a^2) + (1 - \sigma^2) U^{\bar{w}}(0, 0)\right), \tag{4}$$

where $u^f(a^1, a^2)|_{a^1=0}$ is given by equation (3) and is realized if civilian 2 decides to *fight*.

Combining these expressions allows us to obtain

$$U^c(a^1, a^2)|_{a^1=0} > U^f(a^1, a^2)|_{a^1=0} \Leftrightarrow U^{\bar{w}}(0, \alpha^2) > U^w(0, \alpha^2) = 0, \tag{5}$$

where the second strict inequality follows directly from $U^{\bar{w}}(0, a^2) = \lambda R > 0$. Hence, if $a^i = 0$, C^i always concedes.

If C^1 receives a signal $a^1 > 0 \Leftrightarrow \sigma^1 = 1$, we can again compute his or her utility when he or her either *concedes* or *fights*. If the civilian plays *concede*, his or her expected utility equals

$$U^c(a^1, a^2)|_{a^1>0} = \sigma^2 \pi^2 U^w(a^1, a^2) + \sigma^2 \left(1 - \pi^2\right) U^{\bar{w}}(a^1, a^2) + (1 - \sigma^2) U^{\bar{w}}(a^1, 0). \tag{6}$$

The expected utility of civilian 1 is now composed of three terms, standing for (1) country 2 being armed and declaring war, (2) country 2 being armed but refraining from declaring war, and (3) country 2 not being armed and therefore not declaring war as demonstrated earlier, in which case the payoff of civilian 1 is the peace payoff.

When playing *fight* instead, the utility of civilian 1 is given by

$$U^f(a^1,a^2)|_{a^1>0} = \sigma^2 U^w(a^1,a^2) + (1-\sigma^2)U^w(a^1,0). \tag{7}$$

Combining equations (6) and (7), C^1 prefers to concede rather than fighting when the following expression is verified:

$$U^{\bar{w}}(a^1,a^2) - U^w(a^1,a^2) \geq \frac{(1-\sigma^2)}{\sigma^2(1-\pi^2)}\left(U^w(a^1,0) - U^{\bar{w}}(a^1,0)\right). \tag{8}$$

The equivalent expression for C^2 is given by

$$V^{\bar{w}}(a^1,a^2) - V^w(a^1,a^2) \geq \frac{(1-\sigma^1)}{\sigma^1(1-\pi^1)}\left(V^w(0,a^2) - V^{\bar{w}}(0,a^2)\right). \tag{9}$$

These conditions combined yield the following lemma:

Lemma 1: When two fully informed regimes interact, for peace to occur it is necessary that either both participants are weaponless or both countries arm with certainty.

Proof: See the Online Appendix.

This lemma states that peace can only result under two configurations: when both countries are weaponless, in which case they obtain their peaceful payoffs by construction, and when both contestants are armed with certainty and are exactly indifferent between the peaceful partition of the pie and the expected outcome of conflict. Under any alternative configuration, war will always benefit to one of the contestants and will therefore occur.

The arms decision. Our setting gives rise to two arming strategies alone: the hawk strategy of arming in expectation of a conflict and the dove strategy of not arming in expectation of peace. While the two countries' militaries are allowed to develop any armament level they desire in the limits of their budget constraint, any such armaments not compatible with a nondominated strategy will never be picked, since such actions would not be a best response to any expected action of the other players.[8] We designate the arming strategy that maximizes the war payoffs by the term *hawk* strategy, whereas the (non-)arming strategy in expectation of peace is called the *dove* strategy. The problem at stake for each military is therefore unidimensional since by deciding which strategy to follow among the hawk and the dove strategy (σ^i), the militaries equally select a unique arming level compatible with that strategy, that is, a^{ih}, or $a^{id} = 0$.

The *hawk* strategy for M^1 consists in maximizing equation (1) with respect to a^1. Using subscripts to designate the variable with respect to which a function is derived, the first-order condition of this maximization problem is given by[9]

$$U_1^w = p_1(a^1, a^2)(R - a^1 - a^2) - p(a^1, a^2) \geq 0. \quad (10)$$

Given Lemma 1, both militaries know that peace could only result from either both sides being weaponless or both countries being armed with certainty and their payoffs from peace and war being equal. From Hypothesis 1, however, we deduce that provided the opponent is weaponless, an infinitesimally small investment in armaments grants the armed party the total resources under dispute if war occurs. Combining this with equation (10) allows us to conclude that if the opponent is expected to be unarmed, a deviation from the unarmed situation is always profitable since $p(\varepsilon, 0) = 1, \forall \varepsilon > 0$. This rules out the possibility of having a peaceful unarmed equilibrium. The only alternative yielding a peaceful outcome requires both contestants to be armed with certainty. If peace occurs with strictly positive probability, however, and since the arming decisions are private, it is optimal for both militaries to arm with a strictly positive probability. But this violates a necessary condition for obtaining peace, thus implying that such equilibria are impossible. Since only war equilibria can arise in our setting, both militaries will necessarily purchase strictly positive amounts of guns with unit probability. These optimal investments should satisfy equation (10) and the equivalent first-order condition for M^2. We can therefore establish the following proposition:

Proposition 1: When two fully informed countries interact, the status quo is always contested and war is the unique Nash equilibrium. Moreover, the optimal weapons' combination is unique.

Proof: See the Online Appendix.

Proposition 1 tells us that provided the civilian bodies in the two counties are fully informed of their own military capabilities, war between these two counties is inevitable. The mechanism behind this result is rooted in an arms' race logic whereby the expectation that the opponent will arm incentivizes both militaries to prepare for conflict. The resulting arms race always makes war the preferred outcome for at least one civilian.

Model without Full Information $\varepsilon^i > 0$, $i = \{1, 2\}$

We now consider the case where in both countries information imperfections undermine the communication between the civilian and the military of one same country. In each country, the civilian receives a signal on his military's strategy, but this signal conveys wrong information with strictly positive probability. The signal is not observed by the opposing country's civilian. Accordingly, the players now form expectations on each other's actions. Since the militaries have two strategies alone (hawk and dove), the likelihood that a particular country's civilian observes the "hawk signal" (respectively, dove) when his military actually played the dove strategy (respectively, hawk) equals $\varepsilon \in [0, 1]$. It is useful as a first step to focus on pure strategies alone to clarify matters. We can establish the following proposition:

Proposition 2: When two imperfectly informed regimes interact, the game admits two types of pure strategy sequential Nash equilibria: war equilibria with armed contestants and peace equilibria with weaponless countries.

Proof: See the Online Appendix.

This proposition establishes the rather counterintuitive result that peace equilibria emerge when communication is imperfect in both countries irrespectively of the quality of the signal. The logic behind this result is that irrespective of the message received by a specific civilian, there is a strictly positive probability that both countries' militaries played their dove strategy of not arming, hence incentivizing the civilian not to declare war despite the message potentially strongly pointing toward the hawk strategy. The militaries rationally anticipate this possibility, thus implying that there is a strictly positive probability that neither civilian declares war. Should such a scenario materialize, the military's best response is not to arm.[10]

Having shown the existence of the two types of pure strategy equilibria, we next introduce the possibility of playing mixed strategies. By contrast to pure strategies where players expect each other to play a specific strategy (in this context a specific action) with certainty, the particularity of mixed strategies is the uncertainty in the minds of the decision makers regarding the pure strategy played by the other players. In other words, if—for instance—the civilian of country A mixes between his two available actions *fight* and *concede*, this implies that the military of country A together with the military and the civilian of country B are all uncertain as to the actual action taken by civilian A, and accordingly rationally evaluate the likelihood of either strategy being implemented.

For civilian A to be mixing, he must be totally indifferent between playing either pure strategy, given the beliefs and expectations of the other decision makers. Despite this indifference on behalf of civilian A, however, he or she may very well deterministically implement a pure strategy without the other players being able to deduce this choice. Possible ways of choosing a pure strategy in such contexts include taking decisions on the basis of one's own mood, emotions, gut, superstition, and eventually luck.[11] This does not mean that the equilibrium probability with which pure strategies are being implemented is itself random. Instead, this equilibrium probability will be *chosen* by the player mixing so as to incentivize the opponents to follow a specific strategy that eventually maximizes the mixing player's utility.

The following proposition summarizes the findings when allowing for mixed strategies:

Proposition 3: When two imperfectly informed regimes interact there always exists a mixed strategy sequential Nash equilibrium where both war and peace occur with strictly positive probability, and where the contestants remain weaponless with strictly positive probability.

Proof: See the Online Appendix.

This proposition tells us that when the signal is imperfect, there is a strictly positive probability of either pure strategies (*hawk* and *dove* for the militaries and *concede* and *fight* for the civilians) being played.

To be able to compare the various equilibria of the game, it is useful to characterize the equilibria. In the arming stage, the militaries *privately* decide the amount of resources to devote to purchasing weapons, while knowing that the command of the army is in the hands of their ill-informed civilian. The motivations for arming are twofold: on one hand, a military will arm in expectation of his or her civilian's potential willingness to go to war; while on the other hand, there is a need to defend the country in case the rival civilian was to adopt an offensive stance. The maximization problem of M^1 is given by

$$\mathrm{Max}_{a^1}\left\{\Psi\left[\sigma^2 p(a^1,a^2)(R-a^1-a^2)+(1-\sigma^2)(R-a^1)\right]+(1-\Psi)(\lambda R-a^1)\right\}. \tag{11}$$

This allows us to (implicitly) derive M^1's hawk best response:

$$\Psi\sigma^2 p_1(R-a^1-a^2)-\Psi\sigma^2 p-\left(1-\Psi\sigma^2\right)=0. \tag{12}$$

By comparing this First Order Condition to equation (10), it is obvious that absent the third term in equation (12), we would obtain exactly the same reaction functions under perfect and imperfect information. This extra term designates the additional (marginal) cost of arming when peace is the outcome of the game. Because of the utility function's quasiconcavity, we have that $\tilde{a}^{1h}(a^2) < a^{1h}(a^2)$. Thus, the hawkish best response of M^1 with imperfect information takes a lower value to the one with perfect information, for any a^2.

Perfectly Informed versus *Imperfectly Informed States*

In this section, we shall assume without loss of generality that in country 1, the information flow between the military and the civilian is imperfect, whereas in country 2, it is perfect ($\varepsilon = 0$). All the proofs of this section are presented in the Online Appendix.

A first result is contained in the following proposition:

Proposition 4: When a perfectly informed regime interacts with an imperfectly informed regime, peace equilibria always involve a positive probability of contestants being armed.

This proposition rules out the existence of pure strategy weaponless Nash equilibria. Should the ill-informed military be expected not to arm with unit probability, the informed regime will always have incentives to arm and declare war on a weaponless opponent. If, on the other hand, the informed military was not to arm with unit probability, since with some strictly positive probability the opposing country would be holding weapons, the ill-informed civilian would always declare war. Such a war would result in either a status quo (if no military has armed) or a total victory of the ill-informed country (if the ill-informed military armed). In anticipation of this, the informed regime will always find it optimal to purchase some weapons, hence ruling out the weaponless equilibria.

The main result of this section is contained in the following proposition:

Proposition 5: When an imperfectly informed civilian interacts with a perfectly informed civilian, war is inevitable if the informed state can improve its expected sharing of the pie through conflict. Otherwise, there always exist a sequential Nash equilibrium, such that both war and peace occur with strictly positive probability, and the contestants remain weaponless with strictly positive probability.

Hence, while in the scenario with two informed countries, war is unavoidable, and in the scenario with two uninformed countries, peace is always possible, Proposition 5 tells us that when an informed country faces an ill-informed one, depending on the model's parameters, the outcome will resemble either the former scenario or the latter one. Indeed, if the initial distribution of territory is skewed in favor of the ill-informed country, the informed regime will always have incentives in forcing the redistribution of the territory through violent means. If, on the other hand, the informed regime initially controls a larger share of territory, it will find it optimal to exploit its opponent's information imperfections: since the rival country will not find it optimal to always declare war because of the information problems marring its success probability on the battleground, the informed country will abstain from arming with a strictly positive probability, hence nurturing a de-escalation process that allows peaceful equilibria to emerge.

Empirical Support

The Estimated Model

To inquire into the role of information quality between militaries and civilians on the probability of bilateral war, we use the Database of Political Institutions (T. Beck et al. 2001, updated 2010), which provides worldwide information about the involvement of the military in the government, either as the head of the government or as the defense minister, over the 1975 to 2009 period.

We follow the empirical methodology of Oneal and Russet (1997) and Gartzke (2007) by further introducing two variables that measure the degree of information in the regime. We thus use a cross-sectional time-series data set with country pairs as the unit. Our dependent variable is the militarized interstate dispute over the 1975 to 2001 period as coded in the Militarized Interstate Dispute database (version 3) of the Correlates of War 2 project. A significant number of countries, most of which are weakly militarized are nearly irrelevant for the probability of militarized disputes. We thus decided to drop all countries that for more than two years had military-to-total personnel ratio below 1/4 of the full country sample median and had no physical contiguity with another independent state. This restricts our sample to 139 countries of the initial pool of 197 countries.[12] Our sample contains 6,267 country pairs with an average number of years per country pair of 15.96, thus resulting in a final data set of 100,045 observations.

Accordingly, we estimate the following model:

$$\Pr[\text{war}_{ijt} = 1] = F(b_1\text{military}_{ijt} + b_2\text{military\_both}_{ijt} + b_3\text{Controls}_{ijt}). \qquad (13)$$

We are therefore inquiring into whether the probability that the state dyad *ij* will be involved in a military conflict in period *t* is determined by the density function *F*. We assume that *F* is the logistic function and thus estimate a logit model. According to de Marchi et al. (2004), this modeling strategy has a number of advantages. First of all, the model includes only variables motivated by the theory. And second the logit model is easily interpretable and is very useful for hypotheses testing, which is the main goal of the empirical section. Notice, however, that we also test the sensitivity of our results against the assumption that *F* is the normal density function (i.e., the probit model).

Following the methodology of Oneal and Russett (1997) and Gartzke (2007), the dependent variable is a discrete binary variable from the Correlates of War Project (see Jones, Bremer, and Singer 1996) that indicates whether a militarized interstate dispute occurred.[13] The various gradations of disputes we take into consideration are (1) the threat to use force, (2) the display of force, (3) actual use of force, and (4) full scale wars. In our sample, a full scale war is a rather rare event (3.61 percent of all occurrences) as most frequently disputes simply involve the display of force in some form of combat-free military demonstration, as well as simple use of force with no escalation to a full scale war. Since full-fledged wars are rare events, we follow the conventional wisdom in the literature and include all types of militarized disputes in our measure of conflict. The results are shown, however, to be robust to the restriction to violent events alone.

The key explanatory variables in our analysis are the variables *military* and *military both*, which are dummy variables constructed from the Database of Political Institutions (T. Beck et al. 2001, updated 2010), and take the value of 1 when, respectively, *one* or *both* countries in a country pair have a military official as the head of the state or as a defense minister.

Control Variables

We use the same control variables as in Oneal and Russett (1997) and Gartzke (2007; see Table 1 for a list of the definitions of the variables and data sources). Namely, we include a measure of trade interdependence, *Trade*, which is the logarithm of the lowest bilateral trade to GDP ratio in the dyad; military alliances, *Alliance*, which takes the value of 1 when a formal alliance ties two states; the military capabilities of the two states, *power*, which is constructed as the ratio of the maximal military capability in a dyad over the dyad's total military capability; economic factors, *GDP* per capita *Low* and *GDP* per capita *High* which correspond, respectively, to the lowest and highest logarithm of the GDP per capita in the country pair, as well as *Growth Low* and *Growth High*, which measure the lowest and highest growth rates of GDP per capita in the country pair; and geographic distance, *Distance*, which measures the great circle distance in kilometers between the capital cities of the two states. To capture the regional variability in interstate conflict (e.g., Gartzke 2007; Lemke 2002), we introduce regional dummies for each state in the pair for the regions of South and North America, Africa, the Middle East, Asia, and Europe.

Finally, to account for the Democratic Peace thesis (Maoz and Russett 1993; Gartzke 1998, 2007, and the references therein) and the fact that the *regime type* constitutes a good explanatory variable for interstate wars (Morgan and Campbell 1991; J. Levy 1994; Schultz 1998; Mesquita et al. 1999; G. Levy and Razin 2004; Jackson and Morelli 2007; Debs and Goemans 2010; Conconi, Sahuguet, and Mauirzio 2014), we introduce the variables *Democracy High* and *Democracy Low*. The variables are, respectively, defined as the maximum and the minimum measures of the Polity IV score among the two countries, thus giving a sense of the democratic and autocratic bounds of any pair.

Results

Table 2 contains the main results which suggest that "better-informed" regimes experience a higher probability of militarized dispute than "noninformed states" and that this probability is comparatively larger for country pairs with informed regimes.

In column 1, a logit model is estimated, which is our main model. The first panel presents the estimated coefficients and the *t* statistics (in brackets), whereas the second panel (column 1b) presents the odds ratios. Notice that the coefficient of the variable *military both* indicates the deviation in the probability of conflict when the second country in the pair is also informed. Thus, a positive coefficient reflects the marginal increase in the probability of observing conflict when both countries, compared to only a single one, are informed states. Hence, dyads where one country is

Table 1. Variable Definitions and Sources.

Variable	Definition	Source
War (dependent variable)	Dummy equal to 1 if Militarized Interstate Dispute is coded 2 or above	Correlates of War Militarized Interstate Disputes data set
Trade	The lowest of the (log) of the dyadic trade (imports + exports) to GDP ratio bilateral trade flows between the two countries over GDP in the country pair	IMF Trade Statistics
Military	Dummy equal to 1 when one country has a military official as head of their government or as a defense minister	T. Beck et al. (2010)
Military both	Dummy equal to 1 when both countries have a military official as head of their government or as a defense minister	T. Beck et al. (2010)
Democracy high	The maximum of the polity 2 score in the country pair	Polity IV
Democracy low	The minimum of the polity 2 score in the country pair	Polity IV
Distance	Great circle distances in km between capitals of the two countries	http://www.chemical-ecology.net/java/capitals.htm
Contiguity	Type of contiguity relationship	Correlates of War Direct Contiguity data set
Alliance	Dummy equal to 1 if both countries have a formal alliance	Correlates of War Alliance data set
Power	The maximum of the CINC in the dyad divided by the total CINC score	Correlates of War National Material Capabilities data set
GDP per capita low	The minimum of the real GDP per capita in the dyad	Penn World Tables
GDP per capita high	The maximum of the real GDP per capita in the dyad	Penn World Tables
Growth high	The maximum of real growth in GDP in the country dyad	Penn World Tables
Growth low	The minimum of real growth in GDP in the country dyad	Penn World Tables

Note: CINC = composite index national capabilities score; GDP = gross domestic product; IMF = International Monetary Fund.

better informed tend to have a higher probability of an armed conflict, with this probability being higher when both states are informed. The estimated odds ratio also suggests that this effect is quantitatively not negligible: states with a military

Table 2. Main Estimation.

Baseline model			Conditional logit	Logit with time dummies	Ordered logit	Probit	Random effects logit
Dependent variable	War (1)	(1b)	War (2)	War (3)	hostlev (4)	War (5)	War (6)
Military	0.651*** (4.171)	1.918*** (4.171)	0.610** (2.307)	0.613*** (3.946)	0.629*** (4.002)	0.307*** (5.246)	0.548*** (2.673)
Military both	0.452*** (2.949)	1.572*** (2.949)	0.458*** (3.188)	0.461*** (2.989)	0.465*** (3.000)	0.184*** (2.932)	0.269 (1.109)
Democracy high	0.073*** (5.781)	1.076*** (5.781)	0.072*** (3.792)	0.072*** (5.556)	0.074*** (5.758)	0.033*** (6.108)	0.012 (0.566)
Democracy low	−0.022* (−1.938)	0.979* (−1.938)	−0.033** (−2.461)	−0.033*** (−2.715)	−0.019* (−1.730)	−0.010** (−2.268)	−0.020 (−1.117)
Trade	−0.100*** (−3.189)	0.905*** (−3.189)	−0.105** (−2.335)	−0.106*** (−3.357)	−0.099*** (−3.214)	−0.031*** (−2.579)	−0.097** (−2.276)
Distance	−0.365*** (−10.230)	0.694*** (−10.230)	−0.374*** (−10.971)	−0.375*** (−10.421)	−0.363*** (−10.137)	−0.126*** (−8.269)	−0.393*** (−4.748)
Contiguity	−0.807*** (−19.049)	0.446*** (−19.049)	−0.810*** (−12.564)	−0.813*** (−19.160)	−0.805*** (−19.217)	−0.326*** (−20.433)	−1.218*** (−12.493)
Alliance	0.529*** (2.800)	1.697*** (2.800)	0.565*** (3.379)	0.568*** (2.967)	0.530*** (2.754)	0.185** (2.385)	−0.094 (−0.301)
Power	−1.108*** (−2.729)	0.330*** (−2.729)	−1.385*** (−3.754)	−1.391*** (−3.407)	−1.108*** (−2.720)	−0.309** (−1.972)	−0.356 (−0.401)
GDP per capita low	−0.277*** (−3.219)	0.758*** (−3.219)	−0.297*** (−5.552)	−0.297*** (−3.474)	−0.284*** (−3.330)	−0.093*** (−3.023)	−0.134 (−0.813)
GDP per capita high	0.522*** (5.280)	1.686*** (5.280)	0.519*** (7.072)	0.521*** (5.211)	0.497*** (5.154)	0.179*** (4.818)	0.761*** (4.029)
Growth high	0.026*** (2.605)	1.027*** (2.605)	0.023 (1.531)	0.024** (2.527)	0.027** (2.520)	0.010*** (2.835)	0.031*** (2.595)
Growth low	−0.040*** (−4.323)	0.961*** (−4.323)	−0.046*** (−5.648)	−0.046*** (−4.536)	−0.040*** (−4.317)	−0.016*** (−4.350)	−0.032*** (−2.586)
Log likelihood	−1688.908		−1587.157	−1644.125	−1995.623	−1683.508	−1359.228
Observations	100,045		100,045	100,045	100,045	100,045	100,045
Country pairs	6267		6267	6267	6267	6267	6267
Wald	2142.57		9203.61	2356.50	2165.19	1536.79	291.38
F time				79.69			
McFadden R^2	.31		.33	.32	.28	.31	

Note: Robust standard errors are given in parentheses. Column 1b denotes odds ratios. GDP = gross domestic product.
*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level of statistical significance.

officer as the head of the state or in the ministry of defense have approximately twice the chance of being involved in an armed conflict as compared to other states. Moreover, when the paired state also has a military officer in the government, the probability of an armed conflict is approximately 50 percent higher, thus implying that a dyad featuring two informed governments is more than twice as likely of being at war as compared to a dyad with two noninformed states.

Regarding the other explanatory variables, *Trade* has a positive sign and is statistically insignificant at all relevant levels of statistical significance. Most previous findings underline the positive relationship of trade on conflict (Russett and Oneal 2001; Hegre, Oneal, and Russett 2010). Yet, a nonnegligible number of scholars find a nonstatistically significant relationship (N. Beck, Katz, and Tucker 1998; Barbieri and Levy 1999) or conditional effects (Martin, Mayer, and Thoenig 2008; Stefanadis 2010). Consistently with conventional wisdom, the *Distance* coefficient is negative and highly statistically significant.

Table 2 reveals that a larger difference in military capabilities between paired states, as captured by the variable *power*, is associated with a lower probability of war. This finding seems to support the Power Transition theory (Organski 1958; Organski and Kugler 1980) as opposed to the Balance of Power theory (Morgenthau 1967).

The coefficients of *GDP per capita Low* and *GDP per capita High* are consistent with theories linking income levels to the incidence of conflicts. When there is convergence in income in the dyad, that is, *GDP per capita Low*, increases, the probability of conflict declines. On the other hand, higher *GDP per capita High*, that is, an increase in income of the rich country is associated with higher probability of conflict. Although these coefficients are statistically insignificant in the main equation, they become significant in some estimations in the robustness analysis. Our results also indicate a nonlinear effect of economic growth on the likelihood of conflict. When the growth rate of the country with the lower growth rate falls, the probability of conflict rises, suggesting that a country with a low economic performance may have an incentive to divert attention from the poor economic outcomes toward external "enemies" (Ostrom and Job 1986; Russett 1990; James and Oneal 1991). The positive coefficient of *Growth High* suggests that as the inequality in economic performance in the state pair increases, the likelihood of conflict increases.

Finally, the *Alliance* coefficient is positive and statistically significant, and the odds ratio reveals that "allied" countries are more than twice likelier to be at war. These findings are in accordance with Mesquita's (1981) intuition that alliances are often concluded in fragile and volatile environments.

In the remaining columns in Table 2, we explore the robustness of the main finding by estimating various alternative specifications of the model.[14] In columns 2 through 6, we present a conditional logit model (column 2), a logit model with time effects (column 3), a probit model (column 5), and a random effects logit model to take into account the cross-sectional time-series structure of our data set (column 6). In column 4, we show the results of an ordered logit with fixed effects, where the dependent variable is an ordinal variable with the level of militarized incidents being categorized into four subcategories: (a) the threat of force, (b) the display of force, (c) the use of force, and (d) war. As one can observe, all the results of the initial regression, with the exception of the GDP per capita low variable that becomes statistically significant in some specifications, remain unchanged.

Table 3 shows that our results survive some additional robustness checks. To exclude major military powers from the estimation, in column 1, we exclude all dyads where at least one state belongs to the North Atlantic Treaty Organization (NATO) and in column 2, we exclude from the sample the United States. In column 3, we exclude from the sample countries that experience internal conflict. Interestingly, all the results derived in the previous table remain qualitatively unchanged. More important, both variables of interest, *military* and *military both*, always remain positive and highly statistically significant. To control for Cold War politics and the consequences of extended deterrence, in column 4, we estimate our model on the post-1990 period. The information channel remains confirmed. Finally, in column 5, we consider a more restrictive measure of conflict: cases only featuring the threat to use force are being excluded.

Measuring and Testing the Information-arms Race Channel

The main theoretical finding of this article is that worse informed countries manage to convincingly convey a message to rival countries that their military preparedness will be lower because of their internal informational problems. This is expected to drive ill-informed regimes in a de-escalation spiral that eventually opens the way for more peaceful relations between rival countries. While the previous results seem to suggest a negative correlation between information quality and the probability of militarized interstate disputes, we have remained silent on the underlying armament levels of potential rivals. To explore the relationship between information quality and the level of militarization of countries, in Table 4 we estimate the relationship between having a military official as head of state or as defense minister and the likelihood of having high military expenditures, where the latter variable is taken from the Correlates of War Database. We follow the same modeling strategy as in the previous tables; with the dependent variable being the highest level of military expenditures in the dyad. According to the arms race literature, there should be a positive association between the military spending of potentially rival countries, so that the highest level of military spending in a dyad should be positively correlated with the lowest military spending in the dyad. This is indeed confirmed in columns 1 through 5. With respect to the main variable of interest, country pairs with a military officer in the civilian office tend to have higher military spending than country pairs with no military officer in power. Furthermore, dyads where a military officer sits in the civilian office in both countries tend to exhibit even higher military spending. This result holds when time fixed effects are excluded (column 2), when only the variables *military* and *military both* are used as independent variables (column 3), and

Table 3. Robustness Checks A.

Dependent variable	Excluding NATO country pairs	Excluding the United States	Excluding countries with internal conflict	Post-1991	Different definition of war (hostlev > 3)
	War				
	(1)	(2)	(3)	(4)	(5)
Military	0.647*** (4.037)	0.643*** (3.805)	0.698*** (4.420)	0.838*** (4.468)	0.629*** (4.000)
Military both	0.455*** (2.953)	0.458*** (2.849)	0.419*** (2.664)	−0.161 (−0.626)	0.483*** (3.151)
Democracy high	0.073*** (5.571)	0.056*** (4.196)	0.075*** (5.788)		0.074*** (5.807)
Democracy low	−0.019* (−1.706)	−0.008 (−0.671)	−0.019* (−1.671)		−0.022** (−1.990)
Trade	−0.095*** (−2.958)	−0.119*** (−3.785)	−0.117*** (−3.687)	−0.079* (−1.805)	−0.097*** (−3.033)
Distance	−0.351*** (−9.552)	−0.393*** (−7.997)	−0.372*** (−10.611)	−0.427*** (−8.958)	−0.361*** (−10.048)
Contiguity	−0.790*** (−18.004)	−0.761*** (−16.709)	−0.796*** (−18.529)	−0.760*** (−13.525)	−0.809*** (−19.039)
Alliance	0.497** (2.069)	0.423** (2.294)	0.561*** (2.934)	0.934*** (4.072)	0.544*** (2.884)
Power	−1.064** (−2.531)	−1.383*** (−3.148)	−1.269*** (−3.065)	−1.684*** (−3.156)	−1.056*** (−2.585)
GDP per capita low	−0.241*** (−2.765)	−0.172* (−1.725)	−0.265*** (−3.050)	−0.220* (−1.877)	−0.285*** (−3.295)
GDP per capita high	0.494*** (4.921)	0.385*** (3.544)	0.544*** (5.350)	0.577*** (4.469)	0.528*** (5.311)
Growth high	0.024** (2.281)	0.021* (1.654)	0.024** (2.047)	0.028*** (3.046)	0.027*** (2.702)
Growth low	−0.037*** (−3.984)	−0.035*** (−3.480)	−0.040*** (−4.252)	−0.024* (−1.920)	−0.041*** (−4.443)
Democracy 1				1.549*** (5.600)	
Democracy 2				−0.874*** (−4.264)	
Log likelihood	−1623.378	−1415.306	−1629.548	−954.771	−1673.619
Observations	97,690	97,506	95,794	49,715	100,045
Wald	2124.90	1633.99	2078.16	1242.80	2149.82
McFadden R^2	.30	.34	.31	.33	.31

Note: Robust standard errors are given in parentheses. GDP = gross domestic product; NATO = North Atlantic Treaty Organization.
*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level of statistical significance.

Table 4. Arms Race.

	Baseline model	No time effects	only military	Excluding NATO country pairs	Excluding countries with internal conflict
	Highest military spending in dyad				
Dependent variable	(1)	(2)	(3)	(4)	(5)
Military expenditure low	0.169*** (0.017)	0.310*** (0.018)		0.168*** (0.017)	0.169*** (0.017)
Military	0.062*** (0.012)	0.045*** (0.013)	0.089*** (0.011)	0.058*** (0.012)	0.068*** (0.012)
Military both	0.063*** (0.024)	0.043* (0.024)	0.103*** (0.020)	0.064*** (0.024)	0.066** (0.026)
Democracy high	−0.008*** (0.002)	0.014*** (0.002)		−0.008*** (0.002)	−0.009*** (0.002)
Democracy low	−0.008*** (0.001)	0.014*** (0.001)		−0.008*** (0.001)	−0.009*** (0.001)
Trade	0.013*** (0.004)	0.027*** (0.005)		0.013*** (0.004)	0.012*** (0.004)
GDP per capita low	0.035 (0.028)	0.215*** (0.040)		0.040 (0.029)	0.022 (0.029)
GDP per capita high	0.184*** (0.039)	0.541*** (0.058)		0.189*** (0.039)	0.189*** (0.040)
Growth high	−0.003*** (0.000)	−0.006*** (0.001)		−0.003*** (0.000)	−0.004*** (0.001)
Growth low	−0.001 (0.001)	0.002*** (0.001)		−0.001 (0.001)	−0.000 (0.001)
F test	604.733	332.298	1709.187	579.899	589.960
Observations	102,616	102,616	124,502	100,245	98,327
Country pairs	6,248	6,248	6,494	6,170	6,126
R^2	.433	.322	.362	.430	.436

Note: Robust *t*-statistics in the parenthesis. GDP = gross domestic product; NATO = North Atlantic Treaty Organization.
*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level of statistical significance.

when NATO country pairs and countries with internal conflict are excluded from the sample (columns 4 and 5, respectively). These results point toward a positive association between the degree of military–civilian communication and arms races.

Competing Theories

The fourth section proposes empirical support for our theoretical self-containment mechanism. Yet, our identification strategy could be questioned on three fronts.

Consider first the competing Democratic Peace theory. In the baseline regression of Table 2, we see that the coefficients on *Democracy High* and *Democracy Low* are consistent with the existence of a "Democratic Peace." To convince the reader that the results are not driven by the way we have introduced the democracy variables, in column 1 of Table 5, democracy is introduced as a dummy variable, that takes the value of one when one (*Democracy One*) or both (*Democracy Both*) countries have a Polity score above 5. While neither variable appears with the expected sign, when introducing the variables *military* and *military both* in column 2 both variables become positive and statistically significant. When reestimating the benchmark equation on the subsample of nondemocratic countries (Polity score strictly below 5), we see in column 3 that nondemocracies do not behave differently with respect to our theory.

Our results could be explained by the bias of military officers toward war (Debs and Goemans 2010; Baliga, Lucca, and Sjöström 2011; Chiozza and Goemans 2011). We therefore estimate the model with a dependent variable that takes the value of 1 when the originator of conflict is the first country in the state pair and use as measure of information quality the variables *Military_i* and *Military_j*, which take the value of 1 when there is involvement of the military in the government of the conflict originator and of the respondent of the aggression, respectively. If conflict is due to the bias of military officials, then the conflict should originate from states with military officials involved in the political decision-making process. In other words, the coefficient of *Military_i* should be greater than zero and the coefficient of *Military_j* should be equal to zero. The results contained in column 1 of Table 6 refute this thesis.

Moreover, ruling military officers or military officers occupying the sensitive position of defense minister could be more likely to practice brinkmanship and to drag their country in wars, thus invalidating our identification strategy. If militaries are intrinsically more likely to provoke armed conflicts irrespectively of their military preparedness, however, we should not witness a positive correlation between *military* and *arms race*. Table 4 confirms that countries with military officers in the civilian office tend to be more militarized, thus further supporting our theory, and implying that the bellicosity of such regimes is backed by military might.

Third, our explanatory variables *military* and *military both* could be endogenous if military officials are given higher responsibilities in times of crisis. In column 2 of Table 6, we instrument these variables with indicators of bureaucratic quality taken from the International Country Risk Guide. High bureaucratic quality is associated

Table 5. Robustness Checks *B*.

	Democracy dummy	Democracy dummy	Autocracies only
		War	
Dependent variable	(1)	(2)	(3)
Democracy 1	0.691*** (4.788)	0.849*** (5.760)	
Democracy 2	−0.583*** (−3.538)	−0.292* (−1.794)	
Trade	−0.106*** (−3.356)	−0.094*** (−2.974)	−0.110*** (−3.043)
Distance	−0.358*** (−10.053)	−0.371*** (−10.430)	−0.363*** (−9.766)
Contiguity	−0.814*** (−18.959)	−0.804*** (−19.286)	−0.761*** (−15.280)
Alliance	0.478*** (2.632)	0.449** (2.403)	0.388 (1.501)
Power	−1.401*** (−3.525)	−1.174*** (−2.895)	−1.045** (−2.157)
GDP per capita low	−0.332*** (−3.886)	−0.282*** (−3.277)	−0.258*** (−2.757)
GDP per capita high	0.467*** (5.093)	0.550*** (5.673)	0.498*** (4.509)
Growth high	0.023** (2.411)	0.026** (2.519)	0.028** (2.314)
Growth low	−0.039*** (−4.236)	−0.039*** (−4.302)	−0.037*** (−3.217)
Military		0.647*** (4.362)	0.717*** (3.303)
Military both		0.422*** (2.760)	0.596*** (3.522)
Democracy high			0.073*** (5.844)
Democracy low			−0.126*** (−3.605)
Log likelihood	−1705.43	−1688.793	−1136.048
Observations	100,045	100,045	65,297
Wald	2113.64	2107.22	1308.98
McFadden R^2	.31	.31	.29

Note: Robust standard errors are given in parentheses. GDP = gross domestic product.
*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level of statistical significance.

with sound institutional structure, which limits the power of the military in the political arena and consequently their involvement in the government. Once again, the coefficients of *military* and *military both* remain positive and statistically significant at the 1 percent level. Moreover, a standard Hausman test indicates that we cannot reject the hypothesis of exogeneity at the 1 percent level of statistical significance, thus providing only weak evidence for the presence of endogeneity. Finally, we also reestimate the main equation using lagged values for the main variables of interest, *military* and *military both.* The results presented in column 3 show no significant differences as compared to our previous results.

In column 4 of Table 6, we control for how long the head of state or the defense minister has been in office. If these officials were brought into office due to an imminent international conflict, we would expect a negative relationship between tenure in office and the probability of conflict. Moreover, we should then expect the significance of *military* and *military both* to decline with the introduction of tenure in office. Although, consistent with the earlier discussion, the variable that measures

Table 6. Robustness Checks *C*.

	Originator	I.V. probit	Lags	Years in office
	War			
Dep. variable	(1)	(2)	(3)	(4)
Military originator	0.807*** (4.931)			
Military respondent	0.365** (2.295)			
Democracy high	0.064*** (4.406)	0.048*** (5.875)	0.082*** (5.960)	0.081*** (6.404)
Democracy low	−0.036** (−2.479)	−0.006 (−1.129)	−0.025** (−2.203)	−0.017 (−1.515)
Trade	−0.082** (−2.203)	−0.041*** (−3.228)	−0.107*** (−3.284)	−0.102*** (−3.250)
Distance	−0.354*** (−7.250)	−0.139*** (−8.007)	−0.376*** (−10.451)	−0.370*** (−10.236)
Contiguity	−0.895*** (−15.614)	−0.314*** (−18.678)	−0.812*** (−18.389)	−0.803*** (−18.987)
Alliance	0.088 (0.357)	0.267*** (3.006)	0.536*** (2.633)	0.547*** (2.931)
Power	−1.063** (−2.207)	−0.357* (−1.899)	−1.224*** (−2.910)	−1.231*** (−3.057)
GDP per capita low	−0.406*** (−3.631)	−0.067 (−1.633)	−0.256*** (−2.845)	−0.248*** (−2.879)
GDP per capita high	0.626*** (4.840)	0.133*** (2.867)	0.555*** (5.277)	0.521*** (5.308)
Growth high	0.016 (0.870)	0.010** (2.269)	0.032*** (3.695)	0.025** (2.449)
Growth low	−0.043*** (−3.728)	−0.016*** (−3.443)	−0.038*** (−3.730)	−0.038*** (−4.233)
Military		0.422*** (5.958)		0.844*** (4.429)
Military both		0.081 (0.892)		0.894*** (4.247)
Military (lagged)			0.616*** (3.850)	
Military both (lagged)			0.550*** (3.468)	
Lowest years in office of military in the pair				−0.065*** (−2.796)
Highest years in office of the military in the pair				−0.017* (−1.649)
Log likelihood	−1156.974	−67300.00	−1570.725	−1681.708
Observations	100,045	72,148	93,327	100,045
Wald	1635.04	9788.729	2125.133	2169.716
Wald test of equality of military originator and respondent	4.03			
McFadden R^2	0.32		0.32	0.31

Note: Robust standard errors are in parentheses. Dep. = dependent; GDP = gross domestic product; I.V. = independent variable.
*, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent level of statistical significance.

the tenure in office is negative and significant, the results regarding *military* and *military both* remain unchanged.

Conclusion

In this article, we propose a novel mechanism for potentially conflictive parties to credibly commit not to divert productive resources to appropriative activities and thereby not to get trapped in inefficient conflicts. Our modeling strategy consists in grafting on a standard "guns and butter" model two features: the breaking down of the decision-making process and information imperfections. We show that when the arming and fighting decisions are assigned, respectively, to the military and to the civilian and provided the flow of information between these two bodies is not perfect, the civilian cannot dismiss the possibility that the military is arming in expectation of war when in fact the military forgoes arming in anticipation of peace. The civilian is therefore more reluctant to declare war as compared to a perfect information scenario, and the expectation of a more peaceful civilian prompts the military to further adopt a dovish strategy. Since the game involves two countries ruled by rational decision makers, should one's foe rationally expect such reduced incentives to arm and to fight, the incentives for the other country to improve its military preparedness are equally reduced. In a perfect information scenario, we prove that the military in both countries arm in expectation of a conflict that is always initiated by the civilian of some country. Hence, information imperfections pacify international relations. From this finding stems a second one stating that at equilibrium, the prospects of peaceful outcomes incentivize the militaries to reduce the waste of resources in arms investments by a double token: (1) the arms are less likely to be used, thus it is optimal to acquire fewer guns, and (2) since the rival reduces his military preparedness, it is equally optimal to downsize one's own army.

The theoretical analysis was restricted to a particular class of games. For instance, for tractability reasons, we have constrained the entire analysis to two countries. Increasing the number of contestants would incentivize the contestants to spend more resources in the fully informed scenario without however the self-containment mechanism being compromised. While this task is left for future work, we conjecture that extending the analysis to $n > 2$ countries would not modify the results qualitatively. We equally decided to focus on zero-sum games. Extending our theory to positive costs of fighting (e.g., Jackson and Morelli 2009) would add a layer of analytical complexity since this would create scope for an additional strategy on behalf of the players: the deterrence strategy whereby militaries arm in anticipation of the opposing country being deterred from declaring war. Imperfect information in such a more complex setting would create further uncertainty on the civilian's side, who would then attribute positive probabilities to the three pure strategies being played at equilibrium. As a consequence, the weaponless pure strategy Nash equilibrium identified in this article and the related results survive the addition of destruction to our framework. In summary, the essence of the commitment mechanism identified in this article extends to a wide range of alternative settings. The mechanism we uncover consists in credibly committing not to enter in an arms race by delegating to an independent body part of the strategic decisions. It bears emphasis that this mechanism is rooted in the inability of the distinct decision makers to perfectly communicate, since from an individual perspective, improving the communication inside one's own country would always be profitable if possible. Yet, taking the information structure as given, contrary to most of the existing contributions in the theoretical literature on conflicts, informational imperfections can have a salvaging effect in our setting. Indeed, rather than hampering potential peaceful bargains, informational asymmetries allow the players to commit not to arm, and hence not to attack each other.

To provide empirical support to our theoretical findings, we relied on real-world data by seeking to determine whether better communication among civilian and military officials results in a higher likelihood of war. We therefore inquired whether having a military official as the head of the government or as defense minister increases the propensity of nations of getting involved in militarized incidents. We ran our conditional logit regression on a sample of dyads over the 1975 to 2001 period and showed that having an informed state in a dyad doubles the likelihood of conflict, while when both nations have military officers occupying key political positions, the likelihood of observing militarized incidents roughly increases by an additional 50 percent. Our results were found to be robust to a host of alternative specifications. Moreover, we showed that our findings are not merely proxying for "Democratic Peace" arguments, and we also tackled reverse causality concerns. Although no causal evidence can be confidently drawn from our empirical test, both our theoretical and empirical analyses seem to suggest that higher quality of information from the military body to the civilian increases the likelihood of war. Hence, information spurs hawkish attitude, while ignorance is conducive to dovish behavior.

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Notes

1. On the related question of the optimal amount of power the civilian should grant the military, see Bielling and Garfinkel (1997); Besley and Robinson (2010); Acemoglu, Ticchi, and Vindigni (2010); Bove and Nisticò (2014); and Leon (2014).
2. In negative-sum games, peaceful outcomes may emerge at equilibrium (Grossman and Kim 1995; Jacobsson 2009; De Luca and Sekeris 2013). In this article, we unveil the self-containment mechanism in a zero-sum game environment that otherwise produces war equilibria. This mechanism can straightforwardly be extended to negative-sum games.
3. Another potential concern with our measure of information quality emerges from the constitutional design imposing in many countries that highly ranked civilian officials renege on their active involvement in the military (without usually compelling the military to resign from their position in the army). Notice, however, that such constraints reinforce our information-based explanation since they filter out the potential for a country's warproneness being the consequence of a civilian official having vested interests in the army.
4. All the results remain qualitatively true for any $p(0, 0) \in [0, 1]$.
5. We follow Bagwell's (1995) way of introducing information imperfection in the strategies of the players rather than in their actions as is usually assumed.
6. Allowing ε to equal unity would create situations where "very bad" signals (i.e., $\varepsilon = 1$) provide the players as much information as "very good" signals ($\varepsilon = 0$). We dismiss these unrealistic cases that would bring no additional insights to the analysis.
7. Results are robust to relaxing this assumption.
8. For instance, the deterrence strategy identified in Jackson and Morelli (2009), Jacobsson (2009), and De Luca and Sekeris (2013) is dominated because there is no destruction in our model.
9. Unless otherwise specified, we are referring to interior solutions throughout the article. Yet, all the results remain valid for both interior and corner solutions (see Online Appendix).
10. This pure strategy Nash equilibrium reflects Bagwell's (1995) finding that when restricting the analysis to pure strategies, signals are completely uninformative. Just as in the classical coordination problem exemplified by the stag-hunt game, receiving a message to coordinate on hunting the stage with high probability does not imply that both players hunting the hare stops being a pure strategy Nash equilibrium.
11. For instance, such elements typically decide individuals in choosing head or tails in the context of coin tossing, which is the most obvious situation of total indifference.
12. Notice also that our results are robust to the inclusion of the entire sample.
13. Results are robust to using instead an ordinal dependent variable.
14. To explore whether our results are plagued with multicollinearity, we have also estimated the logit model, first with only the variables *military* and *military both* and then with only the rest of the explanatory variables. In both cases, the coefficients obtained are qualitatively the same as in column 1. These results are available from the authors upon request.

Supplemental Material

The online appendix is available at http://jcr.sagepub.com/supplemental.

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