Governance and Norms as Determinants of Arming

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Abstract: In this paper, we explore two factors that can limit arming and, more generally, the costs of enforcement within and across states: *governance* or the formal organizations and institutions that help define and enforce property rights, and *norms*, or the informal arrangements in settling potential disputes. We examine the effects of these two factors in a simple static contest model, in which two sides choose levels of arming and whether to engage in actual conflict or settle in the shadow of conflict. We show how arming critically depends on both governance and norms, and therefore how societies with potentially conflictual relations can make either high or low levels of expenditures on security without any difference in the levels of security they actually enjoy. We also explore how investments in governance can reduce arming.

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1 Introduction

Military expenditures differ widely across countries, ranging from less than 1 percent to more than 10 percent of GDP (see SIPRI, 2008). Are the relatively high expenditures observed in some countries inherently necessary? That is, does the security of these countries require such high expenditures, or is it somehow possible for these countries to reduce their military expenditures without essentially changing the level of security that they enjoy?

In a similar vein but considering security within countries, are the costs of crime, incarceration, policing and enforcement always socially necessary? Why would one country have less crime and, at the same time, fewer costs for its control compared with another country?

In the four decades before World War I, German and French forces were repeatedly confronting one another across their common border. Yet, since World War II, nothing of the sort has been necessary. Now the border is freely crossed without any checks. Both the German and French economies have benefited, perhaps immensely so, from these more recent arrangements since a significant percentage of their respective incomes is no longer expended on non-productive defense expenditures and can instead be channelled to consumption and productive investment. But, what accounts for such a dramatic change in posture?

One would suspect that "institutions"—various formal and informal arrangements that can mediate conflict and lead to more efficient social outcomes—are somehow responsible (see, for example, North, 1990). Similarly, but not equivalently, in a "Nirvana" or a "cross-my-heart" society (Schelling, 1960) where crossing one's heart implies perfect commitment, one can have perfect security without expending any resources on enforcement. Such a level of security, however, would be difficult to achieve in a Hobbesian polity regardless of the amount of enforcement expenditures made. Moreover, with such expenditures included in measured GDP, it might appear that the Hobbesian polity is better off than the "cross-my-heart" society despite the latter's much higher level of security and possibly higher overall welfare. Actual economies and societies fall somewhere in between these two extremes. Nevertheless, enforcement costs and security expenditures can vary widely even across these more moderate cases.

In this paper, we explore two factors that can limit arming and, more generally,

the costs of enforcement within and across states: *governance* and *norms*. We refer to governance as, roughly, the formal organizations and institutions that help define and enforce property rights. In domestic settings these include courts, regulatory and enforcement agencies, and the police. In transnational settings, governance refers to organizations and institutions that mediate and govern disputes. In the case of France and Germany, transnational governance started with the Steel and Coal Union of the late 1940s that evolved into the European Economic Community and later into the European Union. As these organizations evolved, the scope for disputes between France and Germany became ever more narrow; and, in some ways, such disputes became domestic rather than transnational, since some domestic sovereignty was relinquished in favor of European-Union-wide laws and institutions.

We refer to norms as the informal arrangements in settling potential disputes. The "cross-my-heart" society is one such norm. Its main attribute for the contexts we are concerned with is that arming and other enforcement measures would be completely unnecessary. At the other extreme, we consider a norm according to which the sole determinant of settling disputes is the relative amount of arms (or other enforcement measure) made by the contenders.

We examine the effect of governance and norms in a simple static contest model, in which two sides choose levels of arming as well as whether to engage in actual conflict or to settle in the shadow of conflict. We show how arming critically depends on both governance and norms, and therefore how societies with potentially conflictual relations can make either high or low levels of expenditures on security without any difference in the levels of security they actually enjoy.

Moreover, the level of governance itself can be considered a collective good that depends on the building of formal institutions and organizations; as such, it can be thought of as being endogenous in the long run, just as it has been in the case of France and Germany. We thus discuss and formally demonstrate how investments in governance reduce arming.

Our analysis combines various features related to conflict found in prior work but not yet combined. The two most directly relevant for comparison are Anbarci, Skaperdas, and Syropoulos (2002) and McBride, Milante, and Skaperdas (2011). The former paper examines various bargaining norms under the threat of conflict, but does not distinguish between secure and insecure income. The latter distinguishes between secure and insecure income arising from governance quality, but does not consider

different bargaining norms. Our paper combines both governance and norms.[1]

In what follows, we present the basic model that allows us to explore the determinants of differential security costs. Next, we characterize the equilibrium choices of arming and whether to fight or to settle. We then turn to study the endogenous determination of governance. We conclude with some broader discussion of the implications of our analysis, including possible avenues for further research.

2 Governance and Norms in a Contest for Income

Consider two parties, labelled A and B, together having a total (gross) income of Y. Suppose A holds secure possession of σ_A portion of that income, whereas B's secure share is σ_B. As such, a share $\sigma \equiv \sigma_A + \sigma_B \in [0,1]$ of total income is secure and thus not subject to dispute. If the parties reside within the same country, the security of that income can be viewed as being guaranteed by the state. If the parties are located in different countries or if they are countries themselves, security could emanate from practically enforceable international law, the international collective security arrangements that have prevailed in the post-war period, or through other bilateral and multilateral agreements. We think of that sort of security as being due to "governance," supported by the state's formal institutions (e.g., laws, courts and policy).

The remaining income, $(1-\sigma)Y$, is insecure, contestable by the two parties through arming. Let g_i denote arming by party $i = A, B$. One possibility is that the two parties fight outright for this income, as in a winner-take-all contest. Assuming that some fraction of the contested income, $1-\phi \in (0,1)$, is destroyed when the parties fight, only $\phi(1-\sigma)Y$ is left to the winner. The loser receives none of the contestable income. Depending on the amount of arming by each side, party i's probability of winning, denoted by p_i, is given by the *contest success function* (CSF):

$$p_i(g_A, g_B) = \begin{cases} \frac{g_i}{g_A+g_B} & \text{if} \quad g_A + g_B > 0; \\ \frac{1}{2} & \text{if} \quad g_A + g_B = 0, \end{cases} \tag{1}$$

for $i = A, B$. This specification implies that each party's probability of winning is

[1] More generally, as discussed below, our paper fits into the literature on bargaining and conflict with arming under complete information (see, for example, Fearon, 1995; Garfinkel and Skaperdas, 2000; and, Powell, 2006).

increasing in his own arms, but at a decreasing rate; furthermore, it is decreasing in his opponent's arming. When the two parties fight, they have the following expected incomes:

$$y_i^f(g_A, g_B) = \sigma_i Y + \frac{g_i}{g_A + g_B}\phi(1-\sigma)Y - g_i, \tag{2}$$

for $i = A, B$.

However, the two parties need not fight outright. We consider an alternative possibility—namely, "peaceful" settlement, in which the two players agree to a division of the contested income, and in doing so avoid the destructive effects of fighting.

Each party's share of the contested income under settlement, denoted by v_i, again depends on the relative amounts of arming by each party, but perhaps only partly so, if at all:

$$v_i^\beta(g_A, g_B) = \beta\frac{g_i}{g_A + g_B} + (1-\beta)\tfrac{1}{2}, \tag{3}$$

for $i = A, B$, where $\beta \in [0, 1]$. This class of rules includes the following three possibilities:

(i) When $\beta = 0$, the contested income is divided in half regardless of each side's choice of guns (as in a "cross-my-heart" society).

(ii) When $\beta = \phi$, the contested income is divided according to any symmetric axiomatic bargaining solution (including the Nash and Kalai-Smorodinsky solutions) where the disagreement payoffs are those under fighting.[2]

(iii) When $\beta = 1$, the contested income is divided solely on the basis of the two sides' relatives holdings of arms, such that each side's share is given by what would be his probability of winning ($p_A = \frac{g_A}{g_A+g_B}$ and $p_B = \frac{g_B}{g_A+g_B}$) if the two were to fight.

More generally, we think of the rule of division and, in particular, the value of β as reflecting *norms*, the sensitivity of the rule of division to arming and, by extension,

[2]In contrast to the setting of Anbarci, Skaperdas, and Syropoulos (2002) where the Pareto frontier is strictly convex, the Pareto frontier in the present setting is linear; as such, all axiomatic bargaining solutions in this analysis collapse to the case where $\beta = \phi$.

the degree of commitment the two parties have in settling disputes without resorting to arms. The smaller is the value of β, the stronger is that degree of commitment and the less important are the players' first-stage choice of guns. For any given $\beta \in [0, 1]$, the two parties' incomes under settlement are as follows:

$$y_i^{\beta}(g_A, g_B) = \sigma_i Y + \left[\beta \frac{g_i}{g_A + g_B} + (1 - \beta)\tfrac{1}{2}\right](1 - \sigma)Y - g_i, \tag{4}$$

for $i = A, B$.

We are agnostic here about the origin of these norms. We treat them as parametrically given. Obviously, history and third party influences are two possible sources. A society with a prior history of much warfare and violence might be expected to place more emphasis on arming as a rule of division. By contrast, a society with a long history of peace and cooperation might place little or even no emphasis on arming. How the rest of the world behaves is another source of influence, since such rules can be contagious across societies. It would seem that, in the post-World War II period in particular, there has been a fairly potent norm against the changing of borders through violent means or even against the mere threat of violence. Arguably, this norm has reduced arming as well as the number of international wars compared to previous historical periods.[3]

To summarize, we consider the following sequence of moves:

Stage 1. Parties A and B choose their costly levels of arming, g_A and g_B.

Stage 2. Given the arming choices made in stage one, each side decides whether (i) to fight, taking all of the insecure income that remains after destruction with the probability as specified in equation (1) or (ii) to settle, dividing the contested income according equation (3). Whereas settlement requires both parties to agree to the rule (3), fighting arises if just one chooses to fight.

As in prior work on conflict and bargaining (for example, Fearon, 1995; Garfinkel and Skaperdas, 2000; Powell, 2006; and more recently McBride, Milante and Skaperdas, 2011), when conflict breaks out, it is not due to misperceptions about the parties' relative strength or any tactical advantages one party might have in information. Like

[3]See Leeson and Coyne (2011) for a discussion of the emergence of norms. They argue that norms are more likely to emerge precisely when formal institutions of governance are lacking. For in such settings their potential benefits are greater.

the settings studied in this literature, there is complete information here. In this prior work, the outbreak of conflict is attributed to the combination of two factors: (i) the inability of the parties to commit to or enforce long-term contracts on arming; and (ii) the effect of current conflict to give the victor a strategic advantage in future conflict. But, because the setting of the present analysis is static, we are abstracting from this second factor. The outbreak of conflict arises in this setting solely due to the parties' inability to commit to their choices of arming and whether to settle or to fight.

In any case, the distinction we make here between secure and insecure income allows us to examine the potential for partial but imperfect enforcement. At the same time, our consideration of the class of rules in equation (3) allows us to examine the implications of various norms to settle disputes.

In the next section, we derive the equilibrium choices of the two parties. Our focus will be on Subgame Perfect Equilibria (SPE), where each party is able to anticipate the fight-or-settle decision when arming in stage 1. This equilibrium concept is widely used for sequential games of imperfect but complete information such as in this model.

3 Equilibrium Analysis

Given the amount of arming by each party, g_A and g_B, along with the settlement incomes in (4) and the expected conflict incomes in (2), party i will choose to settle if and only if $v_i^{\beta}(g_A, g_B) \geq p_i(g_A, g_B)\phi$ for $i = A, B$. Using equations (1) and (3), this condition becomes

$$\tfrac{1}{2}(1-\beta) \geq (\phi - \beta)\frac{g_i}{g_A + g_B}, \tag{5}$$

for $i = A, B$. Because fighting is destructive ($\phi < 1$) for any given choice of guns (g_A, g_B) there exists a range of possible division rules (3) parametrized by β that satisfy the condition in (5) for both parties. Indeed, focusing on symmetric outcomes in arming ($g_A = g_B$) so that $p_A = p_B = \frac{1}{2}$, we see immediately that the condition in equation (5) is satisfied for any $\beta \in [0, 1]$. However, as we show in this section, a symmetric SPE with settlement need not exist for all possible rules of division shown in equation (3). But, first we derive the symmetric equilibrium outcome of the contest under fighting.

3.1 Fighting

Assuming that one of the two parties chooses to fight in the second stage, the other party's second-stage choice is inconsequential. Accordingly, both players choosing to fight can always be sustained in an SPE. The expected incomes shown in equation (2) constitute a well-defined game conditional on fighting in the second stage. The Nash equilibrium choices of guns, denoted by (g_A^f, g_B^f), satisfy the following first-order conditions:

$$\frac{\partial y_i^f}{\partial g_i} = \frac{g_j}{(g_A + g_B)^2}\phi(1-\sigma)Y - 1 = 0, \tag{6}$$

for $i = A, B$. At an interior optimum, each player balances the marginal benefit of arming, which is increasing in the amount of insecure income net of destruction from fighting ($\phi(1-\sigma)Y$), against arming's marginal cost.[4]

Focussing on symmetric outcomes, these conditions imply the following solutions for arming conditional on fighting:

$$g_A^f = g_B^f \equiv g^f = \tfrac{1}{4}\phi(1-\sigma)Y. \tag{7}$$

The corresponding equilibrium expected incomes are the equal to:

$$y_i^f(g^f, g^f) = \sigma_i Y + \tfrac{1}{4}\phi(1-\sigma)Y \quad i = A, B. \tag{8}$$

As revealed by these solutions, the symmetric SPE arming levels are increasing in the degree of insecurity $(1-\sigma)$. Since such expenditures are unavailable for consumption or other purposes and thus are costly, the sum of the parties' SPE expected incomes is decreasing in $1-\sigma$.[5] Furthermore, while an increase in the destructive effects of fighting $(1-\phi)$ reduces equilibrium arming, the direct, negative effect of the destruction dominates, implying that expected incomes are decreasing in $1-\phi$.

[4]Note that $g_A = g_B = 0$ can be ruled out as an equilibrium. In particular, given that one player (i) chooses $g_i = 0$, the other player (j) can seize all of the undestroyed, contestable income with probability equal to one, by choosing an infinitesimally small but strictly positive amount of guns. Of course, player i recognizes this possibility and thus will not choose $g_i = 0$.

[5]If, for example, the increase in security is equally distributed to the two parties ($d\sigma_i = \frac{1}{2}d\sigma$), then each side's expected income will rise as σ rises.

3.2 Settlement

The settlement incomes in (4), given the specific division rule in equation (3), constitute a well-defined game under settlement. The Nash equilibrium choices of guns, denoted by (g_A^β, g_B^β), conditional on settlement satisfy the following first-order conditions:

$$\frac{\partial y_i^\beta}{\partial g_i} = \frac{g_j}{(g_A + g_B)^2}\beta(1-\sigma)Y - 1 = 0, \tag{9}$$

for $i = A, B$. These necessary conditions balance the marginal benefit of arming, which depends positively on β as well as the income up for grabs ($(1-\sigma)Y$), against the marginal cost of arming.[6]

Again, focusing on symmetric outcomes, these conditions imply the following solutions for arming conditional on settlement:

$$g_A^\beta = g_B^\beta \equiv g^\beta = \tfrac{1}{4}\beta(1-\sigma)Y, \tag{10}$$

and the corresponding equilibrium incomes are:

$$y_i^\beta(g^\beta, g^\beta) = \sigma_i Y + \tfrac{1}{4}(2-\beta)(1-\sigma)Y \quad i = A, B. \tag{11}$$

Note how both gun choices and equilibrium incomes under settlement depend on the security or governance parameter σ and on the rule of division or "norm" parameter β. If either all property is secure ($\sigma = 1$) or guns play no role in the division of insecure income ($\beta = 0$), no guns are chosen and incomes are maximal. As property becomes more insecure (i.e., σ falls) or as more weight is attached to the disagreement point in bargaining (i.e., β rises), more resources are expended on guns and less income is left for consumption.

However, as we shall now see, settlement need not be an SPE for all values of the norm parameter, β. In particular, to verify that each player choosing the strategy g^β and settlement is an SPE, we must rule out possible unilateral deviations. There are three to consider. The first is for one party (i) to set $g_i \neq g^\beta$ in the first stage and to choose settlement in the second. However, since conditional on settlement, g^β is the Nash equilibrium of the single-period arming decision, we can easily rule out this

[6]The reasoning outlined above in footnote 4 for why $g_A, g_B > 0$, applies here as well when $\beta > 0$.

deviation.

The second possible deviation is for one player (i) to set $g_i = g^\beta$ like the opponent in the first stage, but to choose to fight in the second stage. In view of the deviating party's choice to fight, fighting will take place. Comparing the expected incomes from choosing peace and choosing settlement in the second stage, conditional on both parties choosing g^β in the first stage, shows that this deviation can be ruled out provided that

$$\sigma_i Y + \tfrac{1}{2}(1-\sigma)Y > \sigma_i Y + \tfrac{1}{2}\phi(1-\sigma)Y.$$

But, since fighting destroys some of the insecure part of Y ($\phi < 1$), this condition is necessarily satisfied, and we can rule out this second deviation.

That leaves us with the third possible deviation. In this deviation, one party (i) sets $g_i \neq g^\beta$ in the first stage and chooses to fight in the second, while the other party (j) sets $g_j = g^\beta$. This deviation by the first player (i) can be ruled out, if the income when both players choose $g_i = g^\beta$ and settlement (y^β) is greater than the maximized value of expected income under this deviation:

$$\sigma_i Y + \tfrac{1}{4}(2-\beta)(1-\sigma)Y \geq \sigma_i Y + \max_{g_i}\left\{\frac{g_i}{g_i + g^\beta}\phi(1-\sigma)Y - g_i\right\}. \tag{12}$$

In considering the optimizing choice of guns in this deviation (denoted by g^d), given the other party chooses $g_j = g^\beta$, we first suppose that $\beta = 0$. In this case, the solution for g^β as shown in equation (10) indicates that $g_j = 0$. But, then, the optimizing deviation in the choice of guns by party i, g^d, equals some infinitesimal but strictly positive level of guns (call it $\epsilon > 0$). For in the second stage upon rejecting the settlement and having chosen $g^d = \epsilon$ in the first stage, this party can seize all of the insecure income not destroyed in the fight with probability equal to one. Nonetheless, the deviating party's expected income in this case, given by

$$y_i^f(\epsilon, 0) = \sigma_i Y + \phi(1-\sigma)Y - \epsilon,$$

will be strictly less than the income the player enjoys under settlement,

$$y_i^\beta(0,0) = \sigma_i Y + \tfrac{1}{2}(1-\sigma)Y,$$

provided that fighting is sufficiently destructive, or more precisely $\phi \leq \frac{1}{2}$. However, if $\phi > \frac{1}{2}$, then we cannot rule out the deviation.

Now suppose that $\beta > 0$. In this case, player i's optimizing choice of guns in deviating from the settlement outcome satisfies the following first-order condition:

$$\frac{\partial y^d}{\partial g_i} = \frac{g^\beta}{(g_i + g^\beta)^2}\phi(1-\sigma)Y - 1 \leq 0. \tag{13}$$

This condition will be met as an inequality for $g^d = 0$ and as a strict equality for $g^d > 0$. Using the solution for g^β as shown in equation (10) and imposing the constraint that $g_i \geq 0$, the condition above implies the following solution for the optimizing deviation in the choice of arming:

$$g^d = \begin{cases} \frac{1}{4}(2\sqrt{\beta\phi} - \beta)(1-\sigma)Y > 0 & \text{if } 0 < \beta < 4\phi; \\ 0 & \text{if } \beta \geq 4\phi. \end{cases} \tag{14}$$

Note that when $\beta \geq 4\phi$ implying that $g^d = 0$, the optimized value of income under this deviation equals $\sigma_i Y$. But since $y_i^\beta(g^\beta, g^\beta) > \sigma_i Y$ from equation (4), we see that the condition shown in equation (12) is always satisfied. Thus, we can immediately rule out a deviation from the equilibrium with settlement when $\beta \geq 4\phi$.

When $\beta < 4\phi$, the solution in equation (14) implies that the condition to rule out this last deviation (12) becomes

$$D \equiv \tfrac{1}{2}\beta - \sqrt{\beta\phi} + \phi - \tfrac{1}{2} \leq 0. \tag{15}$$

Given the destructive effects of fighting (as negatively reflected in the parameter ϕ), the left hand side of the above condition (denoted by D) decreases from $D = \phi - \frac{1}{2}$ as β increases from 0; when evaluated at $\beta = \phi$, D reaches a minimum at $D = \frac{1}{2}(\phi - 1) < 0$; as β increases above ϕ approaching 1, D increases monotonically and approaches $D = \sqrt{\phi}(\sqrt{\phi} - 1) < 0$. Thus, if fighting is sufficiently destructive ($\phi < \frac{1}{2}$), the condition is satisfied for all $\beta \in [0, 1]$. Accordingly, and consistent with our findings above, the "cross-my-heart" society, where $\beta = 0$ and thus $g^\beta = 0$, is sustainable as an SPE. Otherwise, when $\phi > \frac{1}{2}$, there exists a threshold value of $\beta < \phi$, denoted by $\hat{\beta}$, for which the condition is just satisfied ($D = 0$), and $\beta \gtrless \hat{\beta}$ implies $D \lesseqgtr 0$. As one

can verify, $\hat{\beta}$ satisfies the following

$$\hat{\beta} \equiv 1 - 2\sqrt{\phi(1-\phi)}. \tag{16}$$

The minimum value of β that can be sustained in an SPE with positive guns expenditures, when $\phi > \frac{1}{2}$, is strictly positive: $\hat{\beta} > 0$. For values of $\beta < \hat{\beta}$, this third deviation cannot be ruled out, implying that the strategy of setting $g_i = g^f$ in the first stage and choosing to fight in the second stage is the only SPE strategy.

Figure 1 brings these results together, showing in (β, ϕ)-space when settlement is an SPE. In particular, all values of β on and above the horizontal axis (up to $\phi = \frac{1}{2}$) and on or above the curve (equation (16) for $\phi > \frac{1}{2}$) represent that part of the parameter space for which settlement is an SPE.[7] Of course, over this parameter space, fighting is also an SPE. But, for $\phi > \frac{1}{2}$, fighting is the only SPE for values of β below the curve. Furthermore, as the figure shows, while settlement with $\beta = 0$ ("cross-my-heart") is not always a possible SPE, settlement with $\beta = \phi$ (axiomatic bargaining) and $\beta = 1$ (conflict strength) are.

In general, we see how enforcement costs and incomes can vary widely across different jurisdictions depending on the governance and norms that determine how parties in actual or potential conflict interact. Different levels of security costs are consistent with widely different levels of overall security and incomes. Overall security when two parties fight is simply σ, and that when the two parties settle is $\sigma + (1 - \beta)(1 - \sigma) = 1 - \beta(1 - \sigma)$. Whether the two parties fight or settle, their arming is decreasing in the respective measure of overall security. Now comparing two conflicts, one in which the parties fight and the other in which the parties settle, we can find that the overall level of security for the two sets of parties $k = 1$ (fighting) and $k = 2$ (settling) is the same when $\sigma_1 = 1 - \beta_2(1 - \sigma_2)$; since $\phi < 1$, arming will be lower for the two parties that fight, but expected income will be lower as well. Or we could consider the set of parameters such that arming in the two conflicts is identical: $\phi(1 - \sigma_1) = \beta_2(1 - \sigma_2)$. This equality implies that overall security and income are both higher for the two parties that settle.

[7] Notice the condition that $\beta > 4\phi$, which gives $g^d = 0$, plays no role in the figure. That is because $\beta > 4\phi$ is only possible if $\phi \leq \frac{1}{4}$, and the condition that $\phi < \frac{1}{2}$ is sufficient to ensure that settlement with any $\beta \in [0, 1]$ can be sustained as an SPE.

4 Endogenously Determined Governance

Next we turn to explore the endogenous determination of governance (σ) under settlement. Here we envision the contending parties as investing in governance as a collective good that determines the value of σ, or the fraction of income Y that is not under dispute. Such investment reduces the two parties' incentive to arm, given norms (as reflected in β).[8] Accordingly, investment in governance, even if costly, could be viewed as beneficial to both parties.

Following McBride, Milante and Skaperdas (2011), we specify the "production" of governance as $\sigma = \sigma(E)$, where E denotes the stock of accumulated investment in building institutions of governance. This stock consists of two parts: (i) the pre-existing stock inherited from the past, which we denote by E_0, and (ii) additions to the stock due to the current efforts or expenditures by the two parties, which we denote by $e_A + e_B$. Assume that $\sigma(E)$ is increasing in E ($\sigma' > 0$), strictly concave ($\sigma'' < 0$) and twice differentiable. Of course, any increase in σ would be reflected in an increase in σ_A, σ_B or both. To fix ideas, we assume that investments in security benefits both players equally. Thus,

$$\frac{d\sigma_A}{dE} = \frac{d\sigma_B}{dE} = \frac{1}{2}\frac{d\sigma}{dE}.$$

Analyzing the possibility of investment in governance by the two parties requires that we extend the model back one stage. Specifically, we suppose that the two parties first choose their level of investment and then proceed with the game studied in the previous section. Investment is costly to both parties. Let λ represent this cost per unit of investment.

Income under settlement with investment in governance equals

$$y_i^{\beta} = \sigma_i(e_A + e_B + E_0)Y + \tfrac{1}{4}[1 - \sigma(e_A + e_B + E_0)](2 - \beta)Y - \lambda e_i, \tag{17}$$

[8]Note that this indirect effect of investment in governance is operational whether the two parties choose to fight or to settle peacefully. In addition, in the case that the two parties fight, the increase in income that is not subject to dispute when the parties invest in security implies less overall destruction. Indeed, as one can easily verify, the total marginal benefit of an increase in σ on each side's expected income, assuming as we do below that the increase in σ is equally distributed among the two parties, is greater under fighting than under settlement. Thus, our focus on the case of settlement reveals the lower bound of the two contending parties' incentive to invest in governance.

for $i = A, B$. When evaluated at $e_i = e_j = 0$, this expression simplifies as

$$y_i^\beta = \sigma_i(E_0)Y + \tfrac{1}{4}[1 - \sigma(E_0)](2 - \beta)Y,$$

As long as such investment yields a strictly positive net marginal benefit, or

$$\frac{\partial y_i^\beta}{\partial e_i} = \tfrac{1}{4}\sigma'(E_0)\beta Y - \lambda > 0, \tag{18}$$

each party i will have an incentive to invest. The first term shows the marginal benefit of such investment, while the second term represents the marginal cost, which is increasing in λ.

At an interior optimum (i.e., where $E > E_0$), these two terms are balanced against one another. An increase in λ, all else the same, reduces the two parties' incentive to invest. The marginal benefit itself captures the effect of an increase in security to reduce the two parties' incentive to arm, which is increasing in magnitude in Y. Given the symmetry in the two parties' choices, the reduction in arming has no effect on the relative division of the insecure portion of income, but of course increases the income left for consumption.

Note further that norms influence this marginal benefit. In particular, as β decreases such that guns play a smaller role in the division of insecure income under settlement, the potential savings afforded by lowering equilibrium arming fall; as such, the incentive to invest in governance falls. At an extreme, where norms alone support the "cross-my-heart" society ($\beta = 0$), the optimizing choice of investment equals zero.[9] But, when $\beta > 0$, the two parties might very well invest in governance.

Not surprisingly, however, when the parties choose their investments independently there will generally be an underprovision of governance. To see this, consider the choice of E that maximizes social welfare, denoted by W:

$$W(E) = y_A^\beta(E) + y_B^\beta(E) = \sigma Y + \tfrac{1}{2}(1 - \sigma)(2 - \beta)Y - \lambda(E - E_0),$$

given the initial capital stock, E_0. The welfare-maximizing choice of capital, denoted

[9] Of course, as shown above, this requires that fighting be sufficiently destructive.

by E^*, satisfies the following first-order condition:

$$\frac{\partial W}{\partial E} = \tfrac{1}{2}\sigma'(E)\beta Y - \lambda = 0 \tag{19}$$

Given the concavity of $\sigma(\cdot)$, a comparison of this equation with equation (18) shows that $E^* - E_0$ will be greater than the sum of the individual optimizing investment choices by the two parties. As one can easily verify, the extent to which there is underprovision of governance is larger, the larger is the number of parties there are contesting Y.

5 Concluding Remarks

This paper demonstrates how governance and norms together determine overall security, arming levels and the prevalence of conflict. We present a simple model in which governance quality is represented as a share of income that is secure for the contending parties, and where norms are represented as different rules of division in peaceful settlements. We find that conflict or fighting is always a possible equilibrium outcome whenever governance is imperfect so that some income is contested. Equilibria with peaceful settlement sometimes, depending on the norms in place and the degree of destruction that comes with fighting, also exist in the presence of imperfect governance. Indeed, the norms of Schelling's "cross-my-heart" society can even be sustained in a self-enforcing peace, but only if fighting is sufficiently destructive. When fighting is not sufficiently destructive and governance is imperfect, arming will be unavoidable.

Of course, improving or strengthening the formal institutions and organizations of governance would help to reduce such arming and the costs associated with it. But, improving governance, not to mention establishing it in the first place, is costly itself, and any such costs incurred should be included in the measure of the costs of enforcement. The individual contenders might choose to make costly investments in governance, but the resulting provision is generally less than what is deemed to be socially optimal.

Our formal analysis illuminates several avenues for further inquiry. One possibility is to allow the parties to set the norms endogenously. We readily admit that building norms is distinct from building institutions of governance, the latter often

forming endogenously through intentional action and the former often emerging from unintended actions. Norms in our simple framework, however, specifically refer to the terms of negotiated settlements, and there could be scope for the parties to agree to explicit bargaining rules from which proposed settlements are derived.

A different direction is to consider additional contending parties ($N > 2$). As N increases, the total amount of arming increases even when the prize Y remains unchanged. A result is that settlement with $\beta = 0$ becomes less likely, and (as mentioned above) the degree to which the parties collectively under provide security (relative to the social optimum) increases. Thus, conflict intensifies on all margins as more parties compete for the prize. Exploring the endogenous emergence of norms becomes even more important in this setting.

Another direction of future work is to extend our single interaction analysis to a repeated game setting. The common intuition is that settlement would be more likely under repeated interaction because the parties can use threats of future punishment to enforce settlements in the present. However, as previously shown (e.g., Garfinkel and Skaperdas, 2000; McBride, Milante, and Skaperdas, 2011; McBride and Skaperdas, 2011), the effects of fighting on future bargaining strength produces incentives that yield an opposite effect. The role of norms in fostering settlements in this repeated setting has not yet been studied.

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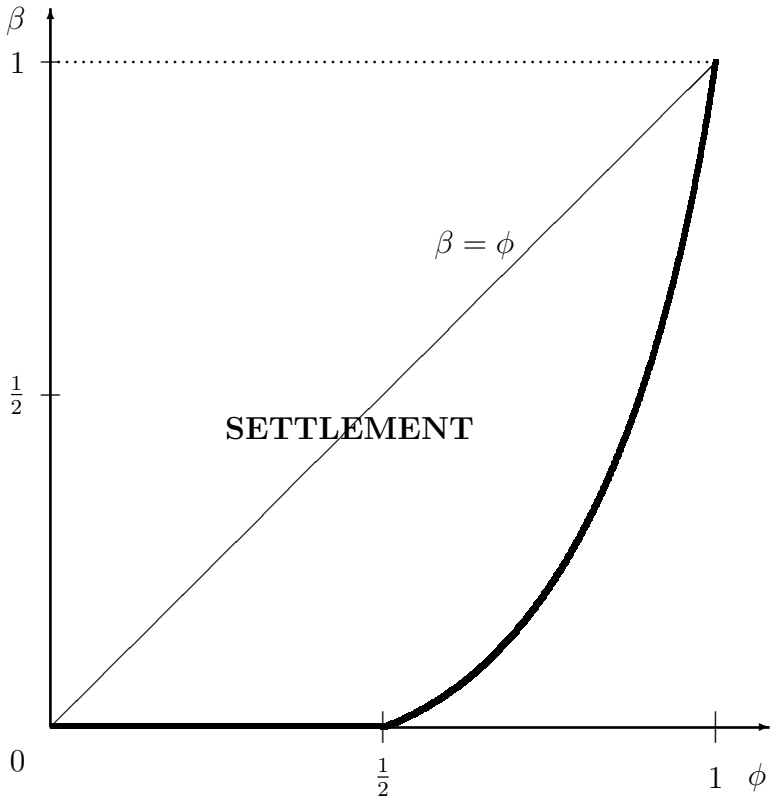

Figure 1: Combinations of β and ϕ consistent with settlement as an SPE