Outcome Commitments in Third-Party Intervention: Theory and Application to U.S. Policy in Iraq

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Abstract: This paper presents a model of strategic interaction in which a third party intervenes on behalf of a government in its conflict with insurgents. It examines whether it is better for the intervenor to adopt an input-based strategy (i.e., specify the total resources it will spend) or an outcome-based strategy (i.e., specify the goal that it will achieve), and it shows that outcome-based strategies are better for the intervenor than input-based ones if and only if in the absence of intervention the insurgents are stronger than the government. A system of benchmarks that are tied to the efforts of both parties outperforms both input-based and outcome-based strategies. Lessons from the theory are applied to U.S. strategy in Iraq.

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1 Introduction

Much of the debate over U.S. policy in Iraq focuses on the *level* of U.S. commitment. Some wish to begin withdrawal immediately, while others argue for a longer-term presence. However, embedded in this debate is another dimension over which the parties diverge, and that his how the U.S.'s commitment in Iraq should be cast. Should the commitment be outcome-based, specifying goals that must be reached before we withdraw, or should it be input-based, specifying the resources to be devoted to the effort and/or the amount of time we are willing to spend, without setting out particular goals?

The former approach has been adopted by many Republicans, in particular by George Bush, who has stated his position as "we will help the Iraqi people build a new Iraq with a constitutional, representative government that respects civil rights and has security forces sufficient to maintain domestic order and keep Iraq from becoming a safe haven for terrorists,"[1] or, more famously, as "as they stand up, we'll stand down."[2] Along similar lines, John McCain has stated that "America's ultimate strategy is to give Iraqis the capabilities to govern and secure their own country," and declared that "a greater military commitment now is necessary if we are to achieve long-term success in Iraq."[3]

Many Democrats, on the other hand, have called either for immediate withdrawal from Iraq, or specification of a "date certain" for withdrawal. Rather than being outcome-driven, these types of approaches call for specification of the level of resources that will be committed to the conflict (e.g., a timetable for troop withdrawal) rather than declaring a particular goal. For example, on his campaign web site Barack Obama proposes a plan that immediately limits the extent of U.S. involvement in Iraq: "Obama will immediately begin to remove our troops from Iraq. He will remove one to two combat brigades each month, and have all of our combat brigades out of Iraq within 16 months."[4] He later reiterated this statement, saying "We can safely redeploy our combat brigades at a pace that would remove them in 16 months. ... [A] residual force in Iraq

[1] "National Strategy for Victory in Iraq," November 30, 2006. http://www.whitehouse.gov/infocus/iraq/iraq_strategy_nov2005.html, accessed May 26, 2008.

[2] http://www.whitehouse.gov/news/releases/2006/03/20060322-3.html, accessed March 26, 2008.

[3] http://www.johnmccain.com/Informing/Issues/fdeb03a7-30b0-4ece-8e34-4c7ea83f11d8.htm, accessed April 26, 2008.

[4] http://www.barackobama.com/issues/iraq/, accessed March 26, 2008.

would perform limited missions: going after any remnants of Al Qaeda in Mesopotamia, protecting American service members and, so long as the Iraqis make political progress, training Iraqi security forces."[5] While Obama mentions goals, it is clear that the troop commitment determines the extent to which these goals are achieved, rather than the other way around. Similarly, in her campaign's statement on Iraq policy, Hillary Clinton stated "It is time to begin ending this war – not next year, not next month – but today," continuing on to specifically reject the president's posture: "we have heard for years now that as the Iraqis stand up, our troops will stand down. ... Well, the right strategy before the surge and post-escalation is the same: start bringing home America's troops now."[6]

Motivated by the Iraqi conflict, this paper develops a game-theoretic model in which a third party intervenes in a conflict between a country's government and an insurgent group in order to consider the strategic importance of adopting an input-based or outcome-based approach.[7] We show that the question of whether it is better for the intervenor to adopt an input- or outcome-based approach can be separated from its choice of the level of commitment to the conflict. Hawks may adopt input-based strategies, specifying a large commitment of resources to the project, while doves may adopt outcome-based strategies, specifying an unambitious goal. The importance of adopting an input-based or outcome-based approach lies in the fact that adopting one or the other of these postures involve sending different signals to the government and insurgents about how the intervenor will respond to various actions. As such, they engender strategic effects that the intervenor may use to its advantage.

This analysis builds off of Miller and Pazgal (2006, hereafter MP), which considers, in the context of competition between two rival firms, the strategic implications of adopting an "input-setting" approach to competition, where the firm specifies the resources it is willing to spend in pursuit of its goals, versus setting an "output-setting" approach, where the firm specifies a particular outcome it wishes to achieve and commits to spending the resources necessary to do so. Intuitively, the mechanism is best illustrated in the context of competition between firms who set advertising

[5] Barack Obama, "My Plan for Iraq," The New York Times, July 14, 2008. http://www.nytimes.com/2008/07/14/opinion/14obama.html

[6] http://www.hillaryclinton.com/issues/iraq/, accessed March 26, 2008.

[7] Of course, in the case of the Iraqi conflict, the U.S.'s original decision was to remove Saddam Hussein from power; the conflict between the government and insurgents started only later.

budgets that determine their sales levels.[8] If Firm A sets an advertising budget, in response Firm B chooses its advertising budget in order to set the marginal cost of advertising equal to the marginal revenue from sales. However, if Firm A sets a sales target, it is implicitly committing to respond to any increase in Firm B's advertising expenditure by increasing its own advertising in order to maintain its sales. This commitment dampens Firm B's incentive to advertise, as it knows that when it increases advertising Firm A will increase advertising as well, which reduces the marginal benefit to Firm B. The main results in MP show that when facing an output-setting opponent, players tend to be less aggressive. Thus, when a firm wants its rival to be aggressive it should choose an input-setting posture, while if the firm wants its rival to be timid, it should set an output-setting posture.

Extending the ideas of MP from competition between firms to strategy in third-party intervention suggests that if the intervenor adopts a outcome-based approach to the conflict this should make the other players in the game less aggressive. Indeed, this paper's analysis confirms this. However, the implications of this for optimal policy are not straightforward, since this is a three-player game rather than a two-player game. Adopting an outcome-based posture will make both the government and the insurgents less aggressive. While the intervenor wants the insurgents to be less aggressive, it actually wants to the government to be *more* aggressive. Ultimately, whether an input-based or outcome-based approach is superior will depend on which of these effects is stronger.

In addition to the input-based and outcome-based approaches, we also consider a third alternative, which we call benchmarking. This approach, which ties the intervenor's resource commitments to the efforts of the government and insurgents, represents a generalization of the income- and outcome-based approaches. To a certain extent, benchmarking has already made its way into U.S. policy. In particular the Section 1314 of the "U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007," sets out a series of benchmarks for progress in Iraq, requires the president to report to Congress on progress in meeting those benchmarks, and declares that "the United States strategy in Iraq, hereafter, shall be conditioned on the Iraqi government meeting benchmarks, as told to members of Congress by the President, the

[8] Miller and Pazgal (2007) discusses in detail the case of input and output strategies in advertising competition. The analysis is also related to the industrial organization literature on the difference between price and quantity competition. See Singh and Vives (1984), Miller and Pazgal (2001), and the references therein.

Secretary of State, the Secretary of Defense, and the Chairman of the Joint Chiefs of Staff, and reflected in the Iraqi Government's commitments to the United States, and to the international community." However, the language of the bill is vague about the nature of the response: "The President shall submit reports to Congress on how the sovereign Government of Iraq is, or is not, achieving progress towards accomplishing the aforementioned benchmarks, and shall advise the Congress on how that assessment requires, or does not require, changes to the strategy."[9] In our consideration of benchmarking below, we characterize the optimal nature of the benchmarking policy, allowing the intervenor to benchmark the insurgents' activity as well as the government's.

While this paper focuses on issues of external strategy, i.e., how the intervenor's choice affects the conflict between the government and insurgents, the choice of a strategic approach also has important internal incentive effects. Input-based strategies and outcome-based strategies, such as declaring specific goals that will be reached, have different effects on internal constituencies as well. Although this paper, for the most part, abstracts away from these internal concerns, we briefly discuss them in Section 4, and developing a fuller understanding of their nature and importance is the subject of ongoing work.

This paper follows in the intellectual tradition begun by Thomas Schelling in his seminal work, *The Strategy of Conflict* (Schelling, 1960), which brought the tools of game theoretic reasoning to bear on problems of international strategy. Schelling was careful to point out that while game theory can be useful in helping to understand conflict, due to necessary abstractions and simplifications, the theory provides at most a guide for thinking carefully about the problem. Ultimately, theoretical insights must be interpreted in light of a broader understanding of the conflict:

> If we confine our study to the theory of strategy, we seriously restrict ourselves by the assumption of rational behavior – not just of intelligent behavior, but of behavior motivated by a conscious calculation of advantages, a calculation that in turn is based on an explicit and internally consistent value system. We thus limit the applicability of any results we reach. If our interest is the study of actual behavior, the results we reach under this constraint may prove to be either a good approximation of reality or a caricature. Any abstraction runs a risk of this sort, and we have to be prepared to use judgment with any results we reach

[9] http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_public_laws&docid=f:publ028.110, accessed March 26, 2008.

> The advantage of cultivating the area of "strategy" for theoretical development is not that, of all possible approaches, it is the one that evidently stays closest to the truth, but that the assumption of rational behavior is a productive one. ... It permits us to identify our own analytical processes with those of the hypothetical participants in a conflict; and by demanding certain kinds of consistency in the behavior of our hypothetical participants, we can examine alternative courses of behavior according to whether or not they meet those standards of consistency. (Schelling, 1960, p. 4).

This paper is offered in such a spirit. The analysis greatly simplifies a highly complex situation. However, it does so in order to understand the strategic implications of adopting the different approaches to third-party intervention0. To our knowledge, this is a choice that has not previously been studied. Thus, understanding the relevant trade-offs in a simplified world provides a necessary and important first step toward understanding their application in real, complex environments. As is discussed in the section on extensions, while adding additional complexity to the model introduces other effects that should also be weighed in choosing a strategic approach, it does not appear that the fundamental strategic trade-offs identified in the basic model cease to exist in more complex ones. In this sense, these strategic effects are robust phenomena that should be considered even in more complicated situations.

The paper proceeds as follows. Section 2 develops a simple model of the conflict and derives the equilibrium under the assumption that the U.S. chooses an input-setting posture, an outcome-setting posture, and a "benchmarking" approach to the problem, and compares the outcomes. Section 3 considers extensions to the basic model, and Section 4 considers how the alternative strategic approaches affect the incentives of the intervenor's allies and domestic stakeholders. Section 5 discusses the results and concludes.

2 Model

Let g denote the government, n denote the insurgents, and t denote the third-party intervenor (TPI), who intervenes on the side of the government.[10] Let x_i denote the resources expended by each of the three parties, where $i = g, n, t$. Resources x_i are meant to be a summary measure

[10] We assume that each party is a unitary actor, ignoring the role of multiple constituencies within each party. This represents a significant simplification. While the main strategic effects we identify here would persist even when the parties are not unified, other effects (e.g., altering the bargaining power between government factions) might also arise, and should be considered alongside the strategic effects that are the focus here.

capturing the value of money, lives, time, national resources, etc. that are dedicated to the conflict. While being able to convert different forms of resources to a common metric simplifies the analysis, the analysis extends to the case where different categories of resources are treated separately.

The cost of resources is given by $c_i(x_i)$, where $c_i' > 0$, $c_i'' > 0$, $c_i(0) = 0$, and $c_i'(0) = 0$. Resource commitment $x_i = 0$ should not be taken literally. Each of the parties has certain non-discretionary expenditures that must be devoted to the conflict merely to be involved. For example, for the intervenor to intervene at any scale, it must invest in administrative and logistic support (e.g., bases and transportation systems). Thus, $x_i = 0$ is best interpreted as *minimal* investment, rather than no investment at all. Although most of the analysis assumes that TPI intervenes and focuses on comparing different approaches to the conflict, we briefly discuss the entry question.

The benefit of expending resources is given by $S_i = x_g + x_t - x_n$ for $i = g, t$ and $S_n = x_n - x_g - x_t$ for n. By modeling the insurgents' benefit in this way, we assume that the insurgents' goal is to win the conflict, and thus that its benefit is diametrically opposed to those of the other parties'. However, other objectives are possible. For example, it may be that the insurgent just wants to be a nuisance, and thus benefits from inducing the other parties to expend resources as well. This suggests an objective function such as $\hat{S}_n = x_n + x_g + x_t$. We consider considers objective functions of this form in Section 3.4.

We assume that the government and the insurgents, g and n, always compete by setting inputs, i.e., choosing x_g or x_n to maximize benefit less cost, $S_i - c_i(x_i)$. The manner in which the intervenor approaches the conflict will vary as we consider the different regimes: input-based strategies, outcome-based strategies, and benchmarking.

Our treatment of only the intervenor as choosing between input- and outcome-based strategies is also closely tied to the nature of outcome-based commitments. Outcome-based commitments, which essentially commit to provide whatever resources are necessary to achieve a goal, must be credible to give rise to strategic effects (i.e., to induce the other players to react to those commitments). Mechanisms for making these commitments credible include reputation and political accountability, both of which are more likely to be available to the intervenor than the other players. As an established player, a TPI such as the U.S., U.N., or NATO is likely to be more able to have established and benefit from a reputation than a newly established or beleaguered government, or a

secretive insurgency. Further, if the outside intervenor is a democracy or coalition of democracies, then the political process will hold them accountable for the truth of their statements in a way that non-democratic actors cannot be. Leaders who promise to achieve a particular goal but later renege on those commitments face reprisals at the polls, which will give them a private incentive to stick to their commitments. Thus, accountability lends credibility to the TPI's commitments. On the other hand, fledgling governments and insurgent forces are not held as accountable, and to the extent that they are viewed as short-run players, may have difficulty establishing reputations. Further, these actors are likely to be less open to external scrutiny than the TPI, which also makes it difficult to establish and benefit from reputations.[11]

2.1 Input-based Strategies

We begin by considering the case where the TPI adopts an input-based strategy, specifying the level of resources it will devote to the conflict. Each player chooses its resource commitment to maximize expected payoff, given the other players' strategy choices. Here and throughout the paper we will use over-bars to denote best response functions, e.g., $\bar{x}_t(x_g, x_n)$, and single asterisks to denote equilibrium **values** of variables, e.g., $x_t^* = \bar{x}_t\left(x_g^*, x_n^*\right)$. When it can be done without confusion, we will omit the arguments on best response functions, e.g., write $\bar{x}_t(x_g, x_n)$ as $\bar{x}_t$.

The government's payoff is $V_g = x_g + x_t - x_n - c_g(x_g)$, and its best response to x_t and x_n is given by:

$$c_g'(\bar{x}_g) = 1. \tag{1}$$

Similarly, best response functions for the insurgents and TPI are defined by:

$$c_t'(\bar{x}_t) = 1, \text{ and} \tag{2}$$

$$c_n'(\bar{x}_n) = 1. \tag{3}$$

Due to the separable form of the security function, player i's best response function does not

[11] MP considers games where two parties chooose between input- or outcome-based strategies, and shows that the choice between types of strategies depends on factors that are unlikely to be affected by the TPI's choice of strategic approach. Thus, even allowing for the other parties to choose strategic approaches, the issue of what is the best approach for the TPI comes down to the effect of the TPI's choice on the game played by the other two parties, and it is this impact that we study in this paper.

depend on the other players' actions. Optimal resource commitments are therefore given by x_i^*, where $c_i(x_i^*) = 1$. Each player chooses the level of resources where the marginal cost just equals its marginal benefit. The input choice that sets a player's marginal cost equal to one (i.e., marginal benefit) will be important throughout the analysis, and we will denote these quantities by x_g^{**}, x_t^{**}, and x_n^{**}. Payoffs are therefore $V_i^{IB} = x_g^{**} + x_t^{**} - x_n^{**} - c_i(x_i^{**})$.

2.2 Outcome-based Strategies

Suppose that rather than choosing an input-based strategy, the TPI instead makes an outcome-based commitment to achieve a particular level of security, s. Implicit in this commitment is that, given the other players' strategy choices, the TPI will do whatever is necessary to bring security to this level. Once again, all three parties choose their strategies simultaneously. For the TPI, the strategy choice is the level of the security target, s. After all three have chosen their strategies, the TPI provides whatever input is necessary to realize its outcome commitment.

If the TPI chooses target security level s it commits to supplying resources such that $x_t = t(x_g, x_n, s) = s - x_g + x_n$.[12] Note that $\partial t/\partial x_g = -1$ and $\partial t/\partial x_n = 1$. That is, by committing to a security target, the TPI commits to meet any increase in the government's effort by decreasing its own effort 1-for-1, and to meet any increase in the insurgents' effort by matching it 1-for-1. We assume that the TPI's commitment is credible, and thus that the other parties believe that the TPI's outcome commitment determines its reaction (i.e., $\partial t/\partial x_g = -1$ and $\partial t/\partial x_n = 1$) to any changes in their strategy choices.[13]

To characterize the equilibrium, begin by considering the government's resource choice. The government's payoff is:

$$V_g = x_g + t(x_g, x_n, s) - x_n - c_g(x_g) = x_g + (s - x_g + x_n) - x_n - c_g(x_g) = s - c_g(x_g).$$

Since, taking into account the TPI's output commitment, security does not depend on x_g but resources are costly for the government, its optimal strategy is $x_g^* = 0$, regardless of s and x_n.

[12] It is possible that $t(x_g, x_n, s) < 0$, i.e., the TPI can achieve its goal without spending any resources. In this case, define $t(x_g, x_n, x) = 0$. This case is not relevant in equilibrium.

[13] This bears a resemblance to the conjectural variations literature in industrial organization. See, for example, Vives (1999).

Next, consider the insurgents' problem. Its payoff is:

$$V_n = x_n - x_g - t\left(x_g, x_n, s\right) - c_n\left(x_n\right) = x_n - x_g - \left(s - x_g + x_n\right) - c_n\left(x_n\right) = -s - c_n\left(x_n\right).$$

As in the case of the government, it is optimal for the insurgents' to choose $x_n^* = 0$.

The intuition behind these results is straightforward and is the main driver behind the results of this paper. The government knows that if shirks in its responsibility to provide resources for security, the TPI will provide them in its place, and it will fully replace any shortfall. Thus the government has no incentive to expend resources. The insurgents, on the other hand, know that if they increase their resource expenditure, the TPI will match that increase, negating any benefit from doing so. Consequently, the insurgents have no incentive to put forth effort.

Finally, consider the TPI's optimal choice of the security target s. Suppose the government and insurgents choose strategies x_g and x_n, respectively. The TPI's payoff is:

$$\begin{aligned} V_t &= x_g + t\left(x_g, x_n, s\right) - x_n - c_t\left(t\left(x_g, x_n, s\right)\right) = x_g + \left(s - x_g + x_n\right) - x_n - c_t\left(s - x_g + x_n\right), \\ &= s - c_t\left(s - x_g + x_n\right). \end{aligned}$$

The TPI's optimal choice of s is given by:

$$c_t^{'}\left(\bar{s} - x_g + x_n\right) = 1.$$

Although the TPI's best response depends on x_g and x_n, in any Nash Equilibrium $x_g^* = x_n^* = 0$, and hence the equilibrium choice of s is where $c_t'\left(s\right) = 1$, and so $s^* = x_t^{**}$, i.e., the target outcome level is the level of resource expenditure that the TPI puts forth in the input–based commitment case.

Thus, the TPI chooses the same level of resources whether adopts a input–based or outcome-based approach to the conflict. However, when it adopts an outcome–based commitment, it drives both the government and insurgents to reduce their strategies. This highlights the distinction between the level of commitment and the strategic approach to the problem discussed in the introduction. In equilibrium, the TPI has the same resource commitment under either input-

based or outcome-based commitments. However, due to the differential strategic effects of the two approaches, the outcomes differ.

2.3 Comparison of the Input- and Outcome-based Approaches

We now turn to the main question of the paper. Is it better for the TPI to choose an input-setting or outcome-setting posture? Since its inputs are the same, the answer depends entirely on the level of security achieved in the two scenarios. In the outcome-based scenario, the TPI's payoff is $V_t^{OB} = x_t^{**} - c_t'(x_t^{**})$, while under the input-based approach its payoff is $V_t^{IB} = x_g^{**} + x_t^{**} - x_n^{**} - c_t(x_t^{**})$. Hence:

Proposition 1: The TPI prefers input-setting over outcome-setting if and only if $x_g^{**} > x_n^{**}$.

The intuition behind Proposition 1 is straightforward. Adopting an outcome-setting posture induces both the government and insurgents to reduce their effort to zero. While the TPI benefits from the insurgents' reduction, they are harmed by the government's. Thus, the TPI's preferred posture will depend on which effect is larger.[14]

Whether the strategic effect on the government or insurgents is stronger depends on the relative strength of the two parties in the absence of intervention. When the insurgency is strong relative to the government, then there may be greater benefit from inducing them to reduce their strategy than harm from the government's reduction. After all, if the government isn't doing much in the first place, then there is little impact from their effort reduction.

Whether the other parties benefit from the TPI adopting an outcome-setting posture is also theoretically ambiguous. Under the optimal outcome-based commitment, the TPI supplies the same resources as it does with input-based strategies. Thus, for the government switching to an outcome–based commitment reduces security by $x_g^{**} - x_n^{**}$ and cost by $c\left(x_g^{**}\right)$. For the insurgents, the U.S. adopting an outcome-based commitment reduces security by $x_n^{**} - x_g^{**}$ and cost by $c\left(x_g^{**}\right)$.

[14] That goal-based strategies drive the other parties' expenditures to zero is a particular feature of this model and derives from the fact that $S_t = S_g = -S_n$. However, the qualitative phenomenon is quite general. Goal-based strategies make the other players less aggressive: both the government and the insurgents have lower resource expenditure under goal-based strategies than under input-based strategies. Thus, goal-based strategies are preferred when the benefit from the insurgents' reduction outweighs the harm from the government's.

Proposition 2: If $x_n^{**} > x_g^{**}$, then the government's payoff is higher under outcome-based commitment. If $x_g^{**} > x_n^{**}$, then the insurgents' payoff is higher under outcome-based commitment.

The intuition behind Proposition 2 is straightforward as well. Adopting an outcome-based commitment reduces security by $x_g^{**} - x_n^*$ for the government. If $x_g^{**} < x_n^{**}$, then this amounts to an increase in security. Thus, outcome-based commitment increases security and reduces cost.

Corollary 1: If the TPI prefers outcome-based commitment, then the government does as well. However, the government may prefer outcome-based commitment in situations where the U.S. prefers input-based commitment.

Appendix B presents a simple example that illustrates the circumstances under which each of the parties benefits from outcome-based commitments and shows that there are specifications of the parameters where outcome-based commitments are preferred by (1) only the insurgents, (2) only the insurgents and government, (3) only the government and TPI, or (4) all three parties.

2.4 Benchmarking

As the previous section illustrates, adopting an outcome-setting posture effectively involves committing to responding to increases in effort by the government by reducing effort, $\partial t/\partial x_g = -1$, and responding to increases in effort by the insurgents by increasing effort, $\partial t/\partial x_n = 1$.

When seen in this light, it becomes apparent that outcome-setting is only one type of contingent strategy that the TPI can adopt. Why should the TPI limit itself to choosing $\partial t/\partial x_g = -1$ and $\partial t/\partial x_n = 1$? We now extend the model to allow the TPI to make commitments beyond just those implied by outcome-setting.

To maintain the simplicity of the model, we will assume that these commitments are linear. In particular, we assume the TPI's strategy is $t(x_g, x_n, t) = t + \alpha_g x_g + \alpha_n x_n$, where α_g and α_n represent its responses to increases in government and insurgent effort, respectively, and t is a constant representing the TPI's input expenditure when the other parties' provide zero resources. We limit ourselves to $t(x_g, x_n, t) \geq 0$ and $t \geq 0$. That is, while we allow the TPI to commit a positive amount of resources even when the other parties choose to commit zero resources, we allow

neither this fixed commitment nor the TPI's overall commitment to be negative.[15]

We assume that the government and insurgents observe α_g and α_n before choosing their resource commitments. Thus, the timing of the game is as follows. First, the TPI announces α_g and α_n, which are observed by the other parties and become common knowledge. Next, all three parties choose their strategies, consisting of x_g and x_n for the government and insurgents, respectively, and t for the TPI. Finally, the TPI adjusts its resource expenditure by $\alpha_g x_g$ and $\alpha_n x_n$, given the realization of the other two parties' strategies. Fixing α_g and α_n, the payoff to the government is:

$$V_g = x_g + t\left(x_g, x_n, t\right) - x_n - c_g\left(x_g\right) = x_g + t + \alpha_g x_g + \alpha_n x_n - c_g\left(x_g\right),$$

which implies first-order condition:

$$1 + \alpha_g = c_g'\left(\bar{x}_g\right).$$

Similarly, solving the insurgent's problem yields:

$$V_n = x_n - x_g - t\left(x_g, x_n, t\right) - c_n\left(x_n\right) = x_n - x_g - \left(t + \alpha_g x_g + \alpha_n x_n\right) - c_n\left(x_n\right),$$

which has first-order condition:[16]

$$1 - \alpha_n = c_n'\left(\bar{x}_n\right).$$

Thus, by choosing α_g and α_n, the TPI alters the perceived returns to resource expenditures. For the government, $\alpha_g > 0$ increases the return, and thus increases the government's optimal choice of resources. The opposite is true for the insurgents: $\alpha_n > 0$ reduces the perceived return to expenditure and consequently the insurgents' optimal strategy.

Finally, consider the TPI's optimal choice of t. The TPI's payoff is:

$$V_t = x_g + t + \alpha_g x_g + \alpha_n x_n - c_t\left(t + \alpha_g x_g + \alpha_n x_n\right).$$

[15] Assuming a $t\left(x_g, x_n, t\right)$ is a linear function is a simplification. Allowing for a more general functional form would expand the set of tools the TPI has available to it, and thereby (weakly) increase the performance of the optimal benchmarking regime.

[16] The assumption that $c_i'\left(0\right) = 0$ implies an interior solution whenever $\alpha_g \geq -1$ and $\alpha_n \leq 1$. The discussion below makes clear that this condition holds at the optimum.

The first-order condition for V_t is given by:

$$c_t'\left(\bar{t}+\alpha_g x_g+\alpha_n x_n\right)=1.$$

Since $t \geq 0$, the optimal choice of t is $\bar{t}=0$ if $\alpha_g x_g+\alpha_n x_n \geq x_t^{**}$, and $\bar{t}=x_t^{**}-\left(\alpha_g x_g+\alpha_n x_n\right)$ otherwise.

We now turn to the first stage of the game, where the TPI chooses α_g and α_n. Optimal behavior in the second stage implies the government and insurgents' strategies can be written as $x_n\left(\alpha_n\right)$ and $x_g\left(\alpha_g\right)$, respectively. Substituting these into the TPI's TPI's first-period objective:

$$V_t=x_g\left(\alpha_g\right)+t\left(\bar{x}_g\left(\alpha_g\right),\bar{x}_n\left(\alpha_n\right),\bar{t}\right)-x_n\left(\alpha_n\right)-c_t\left(t\left(\bar{x}_g\left(\alpha_g\right),\bar{x}_n\left(\alpha_n\right),\bar{t}\right)\right).$$

Begin with the optimal choice of α_n. Since the TPI's payoff decreases as the insurgents increase x_n, the best the TPI can do is drive the insurgents to choose $x_n=0$. We saw in the last section that one way to do so is by choosing $\alpha_n=1$.[17] If the TPI commits to match increases by the insurgents with increases of their own, the insurgents will rationally choose to reduce their effort to zero.

Next, consider the TPI's optimal choice of α_g. First, we establish via a technical lemma that the TPI's total effort is greater under the optimal benchmark than under input-based commitments, so that $t^*=0$, and the TPI's total expenditure is $\alpha_g \bar{x}_g\left(\alpha_g\right)$.

Lemma 1: At the TPI's optimal choice of a_n and a_g, $\alpha_g^* \bar{x}_g\left(\alpha_g^*\right) \geq x_t^*$ and $t^*=0$.

Proof: See the Appendix for the proofs of Lemma 1 and Proposition 3.■

In light of Lemma 1, assume $\alpha_g x_g\left(\alpha_g\right) \geq x_t^{**}$, and let $t^*=0$. The TPI's payoff is:

$$V_t=\bar{x}_g\left(\alpha_g\right)+\alpha_g \bar{x}_g\left(\alpha_g\right)-c_t\left(\alpha_g \bar{x}_g\left(\alpha_g\right)\right)$$

[17] In fact, choosing any $x_n \geq 1$ will induce the insurgents to choose $n=0$. Hence "over-matching" expenditures will work as well.

The first-order condition with respect to α_g yields:

$$1 + \frac{\bar{x}_g'(\alpha_g)}{\left(\alpha_g \bar{x}_g'(\alpha_g) + \bar{x}_g(\alpha_g)\right)} = c_t'\left(\alpha_g \bar{x}_g(\alpha_g)\right). \tag{4}$$

Proposition 3 characterizes the optimal benchmarking regime.

Proposition 3: Under the optimal benchmarking regime:

(3a) The TPI chooses $\alpha_g > 0$.

(3b) The TPI provides more resources than it does in either the input–based or outcome-based commitment cases.

(3c) The government provides more resources than it does in either the input–based or outcome-based commitment cases.

(3d) The insurgents provide zero resources.

(3e) The TPI and government are better off than in either the input–based or outcome-based commitment cases. The insurgents are worse-off than in the outcome–based commitment case, but may do better than in the input–based case.

Proposition 3 shows that the optimal benchmark policy for the TPI takes the following form. The TPI commits to match increases by the insurgents one-for-one. This effectively shuts them down. At the same time, the TPI promises to match efforts by the government as well, although not necessarily one-for-one. Adopting this posture with the insurgents effectively leverages the TPI's commitment, increasing its value. The government knows that for every unit of resources it commits to security, the TPI will commit α_g units. This effectively raises the marginal value of expenditures to the government. As a result, they are willing to spend more. From the TPI's point of view, they are willing to spend only x_t^{**} on security in the input-setting model. However, using the benchmark scheme, committing α_g to benchmarking effectively buys 1 unit of resources from the government and still contributes α_g dollars to security. Because the additional security purchased from the government is valuable to the TPI, it is willing to expend more than x_t^{**} total dollars overall on producing security. Thus, this system differs significantly from on in which the U.S. spends the α_g dollars but in a non-productive way. It is the fact that the α_g dollars pull

"double duty" that increases their value.

Although stated as a reward for increasing its efforts, the optimal benchmark for the government also entails a punishment for falling short. For each unit of resource that the government fails to provide, it loses α_g units of resources provided by the TPI. This is in contrast to the type of response implicit in the outcome-setting regime, where $\alpha_g = -1$. There, if the government falls short of its commitment, the TPI makes it up, with obvious undesirable incentive properties. The optimal benchmark, on the other hand, rewards commitment by the government by increasing aid from the TPI.

While benchmarking strategies outperform either input-based or outcome-based commitments, they are not without their drawbacks. In particular, benchmarking strategies involve tying the TPI's resource expenditures to specific activities of the government and insurgents. Before the conflict, it may be difficult to anticipate what the relevant activities to benchmark are. That is, should the U.S. respond to the Iraqi's creating a constitution, or security forces, or establishing electric service, etc.? Once the conflict has begun, it may be difficult to verify whether the specified actions have taken place, especially on the part of the insurgents. Thus, while they have superior incentive properties, benchmarking strategies also entail additional complexity and administrative costs. In practical circumstances, these costs must be weighed against the potential benefits.

2.5 Incomplete Commitment

The strategic effects of outcome commitments depend on their credibility. The government and insurgents will only respond to the government's outcome target if they believe the TPI can/will follow through on its promise to increase or decrease its resources in response to their actions. This section briefly discusses the impact on the outcome-setting regime if the government and insurgents do not fully believe the TPI's commitment to the outcome target.

To illustrate, let $p_i \in [0, 1]$ be party i's belief about the likelihood that the TPI will stick to its outcome target. In the event that the TPI does not behave as an outcome setter, party i believes that the TPI will behave as an input setter, holding its resources at s regardless of the other parties' behavior.

The government's payoff is now given by:

$$\begin{aligned} V_g &= p_g\left(x_g + t\left(x_g, x_n, s\right) - x_n - c_g\left(x_g\right)\right) + \left(1 - p_g\right)\left(x_g + s - x_n - c_g\left(x_g\right)\right), \\ &= \left(1 - p_g\right)\left(x_g - x_n\right) + s - c_g\left(x_g\right). \end{aligned}$$

In this case, the government's optimal choice of x_g is given by:

$$\left(1 - p_g\right) = c_g'\left(x_g^*\right).$$

If $p_g = 1$, as in the basic model, then the government chooses x_g^* where $c_g'\left(x_g^*\right) = 0$, or $x_g^* = 0$. On the other hand, if the government ascribes zero probability to the TPI maintaining its outcome target, it will choose x_g^* where $c_g'\left(x_g^*\right) = 1$, or $x_g^* = x_g^{**}$, as in the input-setting case. For intermediate values of p_g, the government chooses a positive resource commitment, but less than it does in the income-setting case. Thus, while adopting an outcome-setting posture still makes the government less aggressive, the magnitude of the effect is dampened by the TPI's lack of credibility.

A similar exercise shows that the insurgents will choose x_n^* where $c_n'\left(x_n^*\right) = \left(1 - p_n\right)$. Thus, the insurgents also become less aggressive, but once again the magnitude of this effect is lessened by incomplete commitment.

3 Extensions

The basic model considered in the previous section is quite simple, and it ignores a number of real-world considerations that should inform the TPI's choice among alternative approaches to the conflict. In this section, we extend the model in various directions in order to show how these factors affect the relative merits of the different postures. The first two extensions incorporate uncertainty into the basic model. First, we do so in the context of the one-period model studied above, allowing for uncertainty in the relationship between resource expenditures and security outcomes. Second, we consider a two-period model that incorporates both uncertainty and the dynamic aspects of competition. The final two extensions relax the assumptions about the form of the success functions. In Section 3.3, we relax the assumption that security is additively separable

in the three parties' resource levels, allowing for "cross effects." Finally, we consider a case where the insurgents have a different objective function than the one posited above.

In brief, while including additional complications in the model introduces other effects, the primary strategic considerations that emerge from the basic model continue to be important in the various extensions. As in the basic model, in each of the extensions the benchmarking regime continues to outperform the others due to the fact that the set of feasible benchmarking regimes includes both input and outcome setting as special cases. Because of this, we will conserve space by limiting discussion of the extensions to the input- and outcome-setting cases.

3.1 Uncertainty I: One-Period Model

We begin by considering the role of uncertainty in driving the TPI's choice. In the basic model, security is a non-stochastic function of the three parties' resource allocations. However, in reality, a variety of factors beyond the parties' control also affect the level of realized security. Letting ε represent a random shock capturing these factors, write realized security as $S_i = x_g + x_t - x_n + \varepsilon$, for $i = g, t$, and $S_n = -(x_g + x_t - x_n + \varepsilon)$, where $E(\varepsilon) = 0$. In addition, we will assume that $\varepsilon \in (-\infty, m)$ for some $m > 0$, and that the upper bound on the shock, m, is small relative to the TPI's optimal outcome target in the outcome-setting case.[18] The effect of this assumption is to rule out intuitively implausible cases where the TPI gets such a good shock that it is able to achieve its optimal goal (or over-achieve it) without spending any resources ex post. We do not, however, rule out large, adverse shocks. That is, we put no upper limit on the amount of resources that must be spent ex post in order to achieve a particular goal.[19]

[18] To be precise, we assume that $m << s^*$, where s^* is defined as in 5.

[19] This assumption greatly simplifies the analysis, but the qualitative results change only slightly. In particular, if under outcome setting the TPI with positive probability achieves its optimal goal while spending nothing, then the government will anticipate this when choosing its strategy. Since there is now a positive probability that the TPI will not be able to reduce its resources following an increase in effort by the government, the government believes that it can affect realized security, and it will choose a positive resource commitment in equilibrium. Since strategic effect on the insurgents involves responding by increasing expenditure, the non-negativity constraint on the TPI does not affect the insurgents' behavior. The full analysis of this case is available from the author upon request.

3.1.1 Input-based strategies

Under input-setting, the parties' incentives are unchanged, since $E(V_i) = E(S_i) - c_i(x_i) = S_i - c_i(x_i)$. To illustrate, consider the government's problem, which is to maximize:

$$E[x_g + x_t - x_n + \varepsilon] - c_g(x_g).$$

Since $E[x_g + x_t - x_n + \varepsilon] = x_g + x_t - x_n$, the government's objective is the same as in the non-stochastic case. Hence the optimality conditions governing its choice is the same, and given by (1). Similarly, the optimality conditions for the other two parties are (2), and (3). The equilibrium input choices are thus x_g^{**}, x_t^{**}, and x_n^{**}.

3.1.2 Outcome-based strategies

In the case of outcome-based commitments, the TPI once again commits to supply resources sufficient to maintain some target security level s. However, the required resources now depend on x_g, x_n, and the realization of the shock, ε. Since, net of the TPI's response, the government and insurgents once again believe that their resource allocation will not affect realized security, the analysis of their behavior is very similar to the non-stochastic case. Let $t(x_g, x_n, s, \varepsilon)$ be the TPI's resource allocation necessary to achieve security s:

$$x_t = t(x_g, x_n, s, \varepsilon) = s - x_g + x_n - \varepsilon.$$

The assumption above that $\varepsilon \in (-\infty, m)$ ensures that $t(x_g, x_n, s, \varepsilon) > 0$ in the relevant case.

Given the TPI's outcome commitment, payoffs to the other two parties are:

$$\begin{aligned} V_g &= x_g + t(x_g, x_n, s, \varepsilon) - x_n + \varepsilon - c_g(x_g) = s - c_g(x_g), \\ V_n &= x_n - x_g - t(x_g, x_n, s, \varepsilon) - \varepsilon - c_n(x_n) = -s - c_n(x_n). \end{aligned}$$

Hence outcome-based commitments once again induce $x_g^* = x_n^* = 0$, regardless of s and ε.

The computation of the optimal security target for the TPI is affected by uncertainty, since if

the TPI declares outcome target s, taking into account the other parties' behavior, it must supply $x_t = s - \varepsilon$, hence it chooses s to maximize:

$$V_t = s - E\left(c_t\left(s - \varepsilon\right)\right),$$

The first-order necessary condition for the TPI's problem is:

$$1 = E\left(c_t'\left(s^* - \varepsilon\right)\right). \tag{5}$$

Recall that under input-based commitments, the TPI chooses x_t to maximize $V_t = x_t - c_t\left(x_t\right)$ and sets $1 = c_t'\left(x_t\right)$. Hence whether the optimal choice of s under outcome-setting is larger or smaller than the optimal choice of x_t under input-setting depends on the concavity/convexity of $c_t'\left(\right)$. If $c_t'\left(\right)$ is convex, then $E\left(c_t'\left(s - \varepsilon\right)\right) \geq c_t'\left(s\right)$ so the TPI chooses $s^* \geq x_t^{**}$. On the other hand, if $c_t'\left(\right)$ is concave, then the opposite holds: $s^* \leq x_t^{**}$.

What determines whether the TPI prefers input-based commitments or outcome-based commitments? Note that when adopting an input–based posture, the addition of uncertainty has no effect on the TPI. On the other hand, when adopting an outcome-setting posture, uncertainty makes the TPI worse off. To see why, note that since $c_t\left(\right)$ is convex, $c_t\left(s\right) \leq E\left(c_t\left(s - \varepsilon\right)\right)$ for any zero-mean shock ε, with strict inequality when $s - \varepsilon > 0$ with positive probability, which occurs under the assumption above. Thus, when setting a target security level, adding uncertainty effectively shifts the TPI's cost curve upward, which can only make it worse off. We will call this effect, which reduces the attractiveness of outcome-setting, the "Expected Cost Effect."

The potential strategic benefits of adopting an outcome-setting posture are the same as in the non-stochastic case. From a security perspective, outcome-setting is preferred to input-setting if and only if $x_n^* > x_g^*$ in the input-setting case. However, uncertainty adds the Expected Cost Effect, which must also be considered. Thus, it may be that, from a strategic perspective, setting an outcome target is preferred to setting an input target, but the additional cost of doing so in the face of uncertainty outweighs the potential strategic benefit. In other words, **the introduction of uncertainty increases the relative attractiveness of adopting an input-setting**

posture.[20,21] Further, as the magnitude of the uncertainty grows, so will the relative attractiveness of input setting. To see why, note that if ν is a mean-preserving spread of ε, then $Ec_t(x-\nu) \geq Ec_t(x-\varepsilon) \geq c_t(x)$ with strict inequalities whenever $x > \varepsilon$ with positive probability. So, the magnitude of the Expected Cost Effect increases as the degree of uncertainty increases.

3.2 Uncertainty II: Two-Period Model

In this extension, we allow for the game between the TPI, government and insurgents to develop over time. In particular, we assume that competition takes place over two periods. Further, as in Section 3.1, we include a stochastic element in the security production function. Let x_{ij} denote party i's resource commitment in period $j = 1, 2$. Security is once again linear in resources: $S_i = \sum_{j=1}^{2} x_{tj} + x_{gj} - x_{nj} + \varepsilon_j$ for $i = t, g$, and $S_n = \sum_{j=1}^{2} x_{nj} - x_{tj} - x_{gj} - \varepsilon_j$, where ε_j are zero-mean, independently distributed, shocks to security. Let $\varepsilon = \varepsilon_1 + \varepsilon_2$. We once again assume that ε is small relative to the TPI's optimal outcome target. For simplicity, we assume that each party's cost function takes the following form: $C_i(x_{i1}, x_{i2}) = c_i(x_{i1}) + c_i(x_{i2})$, where $c_i'()$ is strictly increasing and strictly convex, with $c_i'(0) = 0$.[22] As in the previous section, we assume the shock is small relative to the TPI's resource expenditure, although this assumption can be relaxed without affecting the qualitative results. We assume players do not discount payoffs, although discounting would not affect the results. Player i's expected payoff in the entire game is $E(S_i - C_i(x_{i1}, x_{i2}))$.

The goal of this extension is not to build a fully dynamic version of the conflict, since doing so would be highly complex and tend to obscure the main intuition of the results. Rather, the intent is to show that the main intuition of the basic case continues to hold in a dynamic, stochastic model, and to illustrate that while adding additional complication would introduce other factors that must be considered in deciding whether input-based or outcome-based strategies are better,

[20] There is a connection to Weitzman's analysis (in a non-strategic setting) of price instruments vs. quantity instruments in regulation under uncertainty (Weitzman, 1974). Weitzman shows that quantity instruments are preferred when the marginal benefit function is linear. This paper analyzes the case of linear marginal benefit and shows that uncertainty increases the attractiveness of input-setting, which is similar to quantity-setting in Weitzman's model.

[21] The Obama campaign has emphasized the role of uncertainty, saying "I worr[y] about, 'an occupation of undetermined length, with undetermined costs, and undetermined consequences."' http://www.barackobama.com/issues/iraq/, accessed March 26, 2008.

[22] The analysis is robust to alternative specifications of the cost function. In particular, modeling cost as $C_i(x_{i1}, x_{i2}) = c_i(x_{i1} + x_{i2})$. While the latter specification imparts some indeterminacy to how players divide their resource expenditures across periods, the overall qualitative results are robust.

the basic strategic effects identified here would not cease to exist.[23]

3.2.1 Input-based strategies

If the TPI adopts an input-setting strategy, it competes by choosing x_{t1} and x_{t2}. In the first period, all three parties choose x_{i1}, which are then observed and become common knowledge. In the second period, players choose x_{i2}. We consider the subgame perfect equilibrium of the two-period game. Thus, a strategy for player i is an input x_{i1} in period 1 and a function $x_{i2}(x_{g1}, x_{t1}, x_{n1}, \varepsilon_1)$ specifying its second-period input commitment as a function of the three players' first-period decisions and the realization of the first-period shock. While the notation is formally necessary, firms' decisions are greatly simplified by the separable structure of the problem.

Begin with the second period. Conditional on x_{i1} and ε_1, the government chooses x_{g2} to maximize:

$$E\left[(x_{g1} + x_{t1} - x_{n1} + \varepsilon_1) + (x_{g2} + x_{t2} - x_{n2} + \varepsilon_2)\right] - c_g(x_{g1}) - c_g(x_{g2}),$$

which is maximized at $c_g'(\bar{x}_{g2}) = 1$. Similarly, the insurgents choose x_{n2} such that $c_n'(\bar{x}_{n2}) = 1$, and the TPI chooses x_{t2} where $c_t'(\bar{x}_{t2}) = 1$. Thus, $\bar{x}_{i2} = x_i^{**}$. Note that as in Section 3.1, since uncertainty figures linearly into the players' objectives, it does not affect their optimal choices.

Although formally player i's best responses in period 2 is a function of the three players' first period choices and the other two players' second-round choices (e.g., $\bar{x}_{g2} = \bar{x}_{g2}(x_{g1}, x_{t1}, x_{n1}, x_{t2}, x_{n2}) \equiv x_i^{**}$), additive separability here implies that these functions are, in fact, constants. And, since the players' continuation play in the second round is not affected by players' first round choices, it is straightforward to show that player i chooses x_i^{**} in the first period as well. Thus, the equilibrium path of play has the players repeating the equilibrium of the static model twice. Realized security is $S_t = S_g = 2\left(x_g^{**} + x_t^{**} - x_n^{**}\right) = -S_n$, and payoffs in the two-period game are given by $V_g = 2\left(x_g^{**} + x_t^{**} - x_n^{**} - c_g\left(x_g^{**}\right)\right)$, $V_t = 2\left(x_g^{**} + x_t^{**} - x_n^{**} - c_t\left(x_t^{**}\right)\right)$, and $V_n = 2\left(x_n^{**} - x_g^{**} - x_t^{**} - c_t\left(x_t^{**}\right)\right)$, or twice the payoffs in the input-setting version of the basic game.

[23] In particular, the results continue to hold if the within-period success function takes the general form studied in 3.3. We study the linear form here for explanatory ease.

3.2.2 Outcome-based strategies

Next, assume that the TPI adopts an outcome-setting approach to the problem. Specifically, we assume that the TPI specifies security target s and commits to adjust its input in order to bring about $S_t = s$, given the parties' choices of resources in the first and second periods as well as the realization of the shocks. With multiple periods, it becomes necessary to make assumptions about how the TPI's commitment plays out over time. We will assume that in round 1, the TPI chooses s and x_{t1}, while the government and insurgents simultaneously choose x_{g1} and x_{n1}, respectively. The results are robust to variations on the timing of the TPI's choice of s and x_{t1}. At the end of the first period, s, x_{t1}, x_{g1}, x_{n1} and ε_1 become common knowledge. In the second period, the three players once again simultaneously choose resource commitments (although at this point the TPI's expenditure choice is constrained by its outcome commitment).

If the TPI chooses output target s and x_{t1} in the first period, then, given the other players' choices and the realization of the shocks, its second-period resource commitment is determined:

$$\bar{x}_{t2} = s - \sum_{j=1}^{2} (x_{gj} - x_{nj}) - \varepsilon - x_{t1}. \tag{6}$$

If there are negative shocks to security, then the TPI will need to expend more resources in the second period in order to reach its target, while positive shocks imply it will need to spend less.

As before, we begin by considering the second period. The key intuition of the basic case continues to hold with multiple periods: when the TPI commits to an outcome target, both the government and the insurgents believe that their resource expenditures will not affect realized security. As a result, they choose $\bar{x}_{g2} = \bar{x}_{n2} = 0$ in the second period, and they do this independent of the x_{i1} chosen in the first period, s, and ε_1.

Next, consider the first period, assuming equilibrium continuation play. Once again, the government and insurgents, knowing the TPI is adopting an outcome-setting approach, will choose

$\bar{x}_{g1} = \bar{x}_{n1} = 0$. The TPI chooses s and x_{t1} to maximize expected payoff:

$$\begin{aligned} EV_t &= E\left[(x_{t1} + x_{g1} - x_{n1}) + (\bar{x}_{t2} + \bar{x}_{g2} - \bar{x}_{n2}) - c_t(\bar{x}_{t2}) - c_t(x_{t1})\right]. \\ &= (x_{t1} + x_{g1} - x_{n1}) + E\bar{x}_{t2} - Ec_t(\bar{x}_{t2}) - c_t(x_{t1}), \\ &= (x_{t1} + x_{g1} - x_{n1}) + E\left[s - \sum_{j=1}^{2}(x_{gj} - x_{nj}) - \varepsilon - x_{t1}\right] - Ec_t(\bar{x}_{t2}) - c_t(x_{t1}), \\ &= s - Ec_t(\bar{x}_{t2}) - c_t(x_{t1}). \end{aligned}$$

where $\bar{x}_{t2}$ is a function of s (see (6)). Differentiating yields first-order conditions with respect to x_{t1} and s:

$$\begin{aligned} Ec_t'(\bar{x}_{t2}) &= c_t'(\bar{x}_{t1}), \text{ and} \\ Ec_t'(\bar{x}_{t2}) &= 1. \end{aligned}$$

Finally, in any equilibrium, $\bar{x}_{g1} = \bar{x}_{n1} = 0$, and so the above conditions become:

$$\begin{aligned} Ec_t'(\bar{s} - \bar{x}_{t1} - \varepsilon) &= c_t'(\bar{x}_{t1}), \text{ and} \\ Ec_t'(\bar{s} - \bar{x}_{t1} - \varepsilon) &= 1. \end{aligned}$$

This implies that $\bar{x}_{t1} = x_t^{**}$. The TPI's second period resource commitment is $\bar{x}_{t2} = \bar{s} - \varepsilon - x_{t1}^{**}$, which will differ from x_t^{**} for two reasons. First, the value of the shock will affect $\bar{x}_{t2}$: when the shock is positive, the TPI will devote fewer resources to the conflict in the second period. Second, as in Section 3.1, since cost is convex, expected marginal cost for a zero mean shock will differ from marginal cost, and the distinction between $Ec_t'(x)$ and $c_t'(x)$ will also induce the TPI to adjust its strategy commitment. While the direction of this effect cannot be determined without making assumptions about the third derivative of the cost function, since $c()$ is convex, uncertainty will uniformly increase cost in the outcome-setting case, and thus reduce overall utility.

Thus, in the model with two periods and a stochastic shock, the relevant effects are the same as in the one-period model with a stochastic element. There are three effects that must be considered. The first two are the strategic effects identified in the basic model: adopting an output-setting

posture induces both the government and insurgents to be less aggressive, and an uncertainty effect. The third is the Expected Cost Effect: the stochastic shock effectively shifts the TPI's cost curve upward, which decreases the attractiveness of the outcome-based approach.[24]

Although the three effects that must be considered remain the same when a second period is added, the relative magnitude of the effects may change. The strategic effects scale linearly in the number of periods. The Expected Cost Effect also increases, although in a potentially non-linear manner. To see why, note that the aggregate shock in the two-period model is $\varepsilon = \varepsilon_1 + \varepsilon_2$. If ε_1 and ε_2 are independently and identically distributed, then the distribution of ε is a mean-preserving spread of ε_j. Consequently, $Ec_t(s-\varepsilon) > Ec_t(s-\varepsilon_j) > c_t(s)$. Thus, the longer the conflict, the more uncertainty increases the TPI's expected cost of meeting its goal in the final period under outcome-setting, and the greater the magnitude of the Expected Cost Effect. Whether adding a second period increases the Expected Cost Effect by more or less than 100 percent will depend on the actual form of the cost function.

3.3 General Success Functions

The basic model assumes that the effort by one party does not affect the productivity of the other parties' efforts. However, in reality this is not likely to be the case. For example, if the U.S. provides additional resources to train and equip Iraqi defense forces, this will tend to increase the effectiveness of Iraqi resources. In this case, the U.S. resource is complementary to the Iraqi resource. On the other hand, if the U.S. resources are perfect substitutes, as might be the case if there are a number of security functions that can be fulfilled equally well by U.S. or Iraqi troops, then increased U.S. involvement might decrease the productivity of additional Iraqi resource expenditures. Similarly, we might expect an interaction between the efforts of the TPI and the insurgents. In particular, increasing the U.S. troop presence in Iraq might make it more difficult for the insurgents to achieve victories, lowering the marginal product of resource expenditure by the insurgents. This is the logic underlying the U.S.'s "surge" strategy of 2007. Increasing the

[24] In the absence of the stochastic shock, the TPI's payoff in the input-setting case and output-setting case is twice its payoff in the basic model, since the players' strategies in the two- period model just repeat their optimal actions in the one-period model. Thus, without uncertainty, Propositions 1 and 2 continue to hold without modification. The TPI prefers outcome-setting when the benefit from the reduction in insurgent activity it induces outweighs the harm from the government's reducing its activity, i.e., if $x_g^{**} < x_n^{**}$.

number of troops in Iraq decreased the insurgents' likelihood of success, reducing their incentive to engage in attacks on U.S. and government forces.[25]

In this section, we briefly discuss extending the basic model to the case that allows for these "cross effects." Specifically, we assume security is given by the general function $S(x_g, x_n, x_t)$. As before, we assume that the government-TPI and insurgents have opposing views of security. Hence $V_i = S(x_g, x_n, x_g) - c_i(x_i)$ for $i = g, t$, and $V_n = -S(x_g, x_n, x_t) - c_n(x_g)$. We assume that $S(x_g, x_n, x_t)$ is strictly increasing in x_g and x_t, and strictly decreasing in x_n, and that it is strictly concave in x_g and x_t and strictly convex in x_n. We assume $S(x_g, x_n, x_t)$ is twice continuously differentiable, and denote partial derivatives with subscripts, e.g., $\frac{\partial S}{\partial x_g} \equiv S_g$.

3.3.1 Input-based strategies

In the case of input-based commitments, each party chooses the quantity of resources it will devote to the conflict. We continue to assume that all three parties choose their strategies simultaneously. The first-order necessary conditions for an equilibrium are:

$$\begin{aligned} S_g\left(x_g^*, x_n^*, x_t^*\right) &= c_g'\left(x_g^*\right), \\ S_t\left(x_g^*, x_n^*, x_t^*\right) &= c_t'\left(x_t^*\right), \text{ and} \\ -S_n\left(x_g^*, x_n^*, x_t^*\right) &= c_n'\left(x_n^*\right). \end{aligned}$$

For simplicity, we assume that the equilibrium $\left(x_g^*, x_n^*, x_t^*\right)$ is unique. In the equilibrium, each player sets the marginal benefit to increasing its strategy equal to its marginal cost.

3.3.2 Outcome-based strategies

Outcome-based strategies still entail the TPI choosing to maintain a target security level. Thus, the TPI chooses $\bar{t}$ and commits to supply $t(x_g, x_n, \bar{t})$ such that $S(x_g, x_n, t(x_g, x_n, \bar{t})) \equiv \bar{t}$. Implicitly differentiating this identity with respect to x_g, we have $\partial t/\partial x_g = -S_g/S_t$ and $\partial t/\partial x_n = -S_n/S_t$.

[25] The case where increasing one party's effort increases the marginal product of another party's effort, and thus induces the second party to choose to put forth greater effort, is known as "strategic complementarity," in the industrial organization literature, while the case where increasing one's party's effort decreases the marginal product of another party's effort, and thus induces the second party to choose to put forth less effort, is known as "strategic substitutability." See Bulow, Geanakoplos and Klemperer (1985) and Fudenberg and Tirole (1984).

Next, consider the second-stage game in which players choose strategies x_g, x_n, and s. The government's payoff is:

$$V_g = S\left(x_g, x_n, t\left(x_g, x_n, s\right)\right) - c_g\left(x_g\right).$$

The first-order condition for this problem is:

$$S_g + S_t \frac{\partial t}{\partial x_g} = c_g'\left(\bar{x}_g\right).$$

Using the definition of $\partial t/\partial x_g$, the left-hand side becomes $S_g + S_t\left(-\frac{S_g}{S_t}\right) = 0$. Hence $c_g'\left(\bar{x}_g\right) = 0$, and, as in the basic case, regardless of x_n and s, it is optimal for the government to choose $x_g^* = 0$.

The related computations for the insurgents show that it is also optimal for the insurgents to choose $x_n^* = 0$, again for any choice of x_g and s.

Finally, consider the optimal choice of s. To facilitate the analysis, we make the following observation: conditional on x_g and x_n, $S\left(x_g, x_n, x_t\right)$ is an invertible function. Thus, the problem of the TPI choosing target security level s and provides input x_t, where $S\left(x_g, x_n, x_t\right) = s$ is equivalent to one where the TPI chooses x_t directly, with the implied output target being s. Thus, it is not critical whether the TPI actually chooses an input or an outcome. Rather, it is critical that the other players' assume the TPI will maintain the outcome target when choosing their own strategies, and this feature has already been incorporated into the above analysis.[26] In light of this change of variables, the TPI's payoff is:

$$V_t = S\left(x_g, x_n, x_t\right) - c_t\left(x_t\right),$$

which has first-order condition $S_t\left(x_g, x_n, \bar{x}_t\right) = c_t'\left(\bar{x}_t\right)$. Thus, given x_g and x_n, the implied outcome target is $s^* = S_t\left(x_g, x_n, \bar{x}_t\right)$. Incorporating the fact that $x_g^* = x_n^* = 0$, we have that x_t^* solves $S_t\left(0, 0, x_t^*\right) = c_t'\left(x_t^*\right)$.

As in the basic case, adopting an outcome-setting posture makes both the government and the insurgents less aggressive. And, whether input-setting our outcome-setting is preferable for the TPI depends on whether it benefits more from the reduction in insurgent activity than it is harmed

[26] See MP, which proves this result in the two player case, for further discussion.

by the reduction in government activity. Thus, the qualitative insights of the basic model extend to general success functions.[27]

3.4 Alternative Payoff Functions

The previous extension generalizes the success function, but maintains the assumption that a gain in security for the government or TPI is a loss in security for the insurgents. However, other objectives are possible. For example, it is plausible that in the Iraqi conflict the insurgents are not interested in reducing security, per se. Rather, they are interested in causing a nuisance for the government and TPI. In this case, a more plausible view of their objective might be to maximize the sum of efforts net of the resource cost: $\hat{V}_n = x_g + x_n + x_t - c_n(x_n)$.[28] As we will see below, the key distinction between the model with this objective for the insurgents and the basic case considered above is now $\partial V_t/\partial x_n < 0$, but $\partial \hat{V}_n/\partial x_t > 0$, i.e., the effect of the government's strategy on the TPI and the effect of the TPI's strategy on the insurgents have opposite signs.[29] This fundamentally alters the nature of the strategic interaction in the outcome-based case.

In this extension, we briefly consider the impact on the model's predictions if the insurgents have this objective function, holding the objectives of the government and TPI constant. We show that in this case, input-based strategies unambiguously dominate outcome-based ones. Benchmarking strategies still dominate the other two options, but the nature of the optimal benchmarking strategy changes.

3.4.1 Input-based strategies

The change in the insurgents' objective does not impact the incentives of the other two parties, and since the insurgents' objective is still additively separable, neither does changing the objective function affect the insurgents' optimal choice. Hence the equilibrium under input-setting is the same as in the basic model. The players choose x_t^*, x_g^* and x_n^*, as defined in (1) - (3).

[27] Benchmarking strategies continue to be superior in this model, although, due to the non-linearity of the success function, non-linear benchmarking strategies are required.

[28] As in the basic case, the linear benefit function simplifies the presentation. However, the basic results extend to general success functions as in the previous subsection.

[29] In the case of two-player games, MP calls this case, where the effect of player A's effort on player B's outcome is opposite in sign to the effect of player B's effort on player A's outcome, the case of 'dissimilar' players.

3.4.2 Outcome-based strategies

While the interaction between the TPI's choice of strategic approach and the government remains the same, under outcome-based strategies the nature of the interaction between the TPI and the insurgents changes in a fundamental way. In the basic case, an increase in the insurgents' effort harms the TPI. If the TPI is committed to an outcome target, then it responds by increasing its own effort to compensate. This increase, in turn, harms the insurgents. The result is that the TPI's outcome-based strategy dampens the insurgents' incentives to increase effort and the insurgents become less aggressive. Here, however, when the outcome-setting TPI increases its effort to compensate for the insurgents' increase in effort, this actually *benefits* the insurgents. Thus, unlike in the basic case, adopting an outcome-based approach makes the insurgents *more* aggressive rather than less.

Despite this change, it is straightforward to compute the equilibrium resource commitments in this case. However, doing so is not necessary to answer the fundamental question of this paper: is it better for the TPI to adopt an input-based or outcome-based approach to the conflict? Outcome-based strategies make the government less aggressive and the insurgents more aggressive, both of which are undesirable for the TPI. Hence, unambiguously, input-based strategies dominate outcome-based ones in this environment.

3.4.3 A Taxonomy of Strategic Interactions

As argued above, whether adopting an outcome-setting posture makes the other parties more or less aggressive depends on the signs of $\partial V_t/\partial x_i$ and $\partial V_i/\partial x_t$. When these have the same sign, as in our basic model, adopting an outcome target makes party i less aggressive. On the other hand, when they have opposite signs, adopting an outcome target makes party i more aggressive. In light of this, we can identify four possible cases (maintaining the natural assumption that $\partial V_t/\partial x_n < 0$ and $\partial V_t/\partial x_g > 0$), as depicted in Table 1.

	$\partial V_g/\partial x_t$	$\partial V_n/\partial x_t$	Input vs. Outcome	Optimal α_g	Optimal α_n
Case I	+	-	?	+	+
Case II	+	+	Input	+	-
Case III	-	+	?	-	-
Case IV	-	-	Outcome	-	+

Table 1: A Taxonomy of Strategic Interactions

Case I is the basic case studied in this paper, where $\partial V_g/\partial x_t > 0$ and $\partial V_n/\partial x_t < 0$. Here, outcome-setting makes both the government and insurgents less aggressive, and as discussed, whether it is better to adopt an input- or outcome-setting strategy depends on the relative magnitude of the strategic effects. The optimal benchmarking regime positively matches an increase in activity by either party.

Case II is the one discussed in this section, where the both the government and insurgents benefit from greater TPI activity. Outcome setting makes both the government and TPI less aggressive, so input-setting is clearly preferred. However, an optimal regime would encourage the government by positively matching its effort while discouraging the TPI by negatively matching insurgent activity.

Case III is one where the government is harmed by TPI activity and the insurgents benefit. Thus, this might correspond to a case where, in the court of public opinion, greater involvement by the intervenor causes the government to lose legitimacy, which harms the government and benefits the insurgents. In this case, outcome setting makes the government more aggressive but the insurgents more aggressive as well, and thus whether input- or outcome-setting is preferred will depend on the relative magnitude of these effects. The optimal regime would negatively match both government and insurgent effort. As the government does more, the TPI rewards them by decreasing involvement, and as the insurgents do more, the government punishes them by reducing its involvement.

Finally, Case IV is where both the government and insurgents are harmed by TPI involvement. This might be the case if, for example, the public blames both parties for necessitating the involvement of an outside party to mediate their dispute. Outcome setting makes the government more

aggressive and the insurgents less aggressive. Thus, outcome setting is clearly preferred. The optimal policy features a positive match for the insurgents since responding to increases in insurgent activity with greater TPI activity discourages them, but a negative match for government activity, rewarding the government for taking charge of its own security by reducing the TPI's presence.

Although the discussion in this section considers the case where the TPI benefits from government activity and is harmed by TPI activity, the analysis can clearly be extended to other cases as well.

4 Internal Incentive Issues

The analysis in this paper has focused on issues of external strategy. However, whether the leadership of the TPI chooses an input-based, outcome-based, or benchmarking strategy can also have important effects within the TPI. If the TPI is a nation where significant stakeholder buy in is necessary before undertaking a substantial project, e.g., a democracy, then the external conflict is just one part of the game being played. There is also an internal game aimed at building acceptance and enthusiasm for the leadership's desired policy.[30] Although a full discussion of internal incentive issues is beyond the scope of this paper, a brief discussion here is warranted if only to remind the reader of the importance of these issues.

For many years, political leaders have adopted outcome-based commitments to usher in particularly bold policy initiatives. These include John F. Kennedy's declaration that the U.S. would put a man on the moon by the end of the 1960s, various proposals for universal health care ("every person will have access to affordable health care"), the "No Child Left Behind" program aimed at improving school performance, and the Bush administration's approach to the conflict in Iraq. Outcome-based commitments are bold and rhetorically very effective. Indeed, in the case of Kennedy's commitment to go to the moon, that commitment survived his death by many years.[31] By declaring a clear goal that the TPI will reach at any (reasonable) cost, this may reassure internal constituencies (as well as external allies) that the TPI has clear goals that agree with their own

[30] The notion of simultaneously playing an internal game, aimed at gaining political support, and external game, competing with other nations, is related to Putnam's (1988) concept of "two-level games."

[31] See MP for an extended discussion of U.S. strategy in the race to the moon.

priorities. While tactics may need to be adjusted over time, fundamental agreement on the goal to be achieved can go a long way toward building support.

In situations where the leadership of the TPI has better information about future prospects than internal stakeholders or allies, outcome-based commitments may also be used to convey favorable expectations about the likelihood of success. By declaring the U.S. would do what needed to be done to reach the moon by the end of the 1960s, Kennedy was implicitly saying that it was possible to do so, and conveyed this with a credibility that would not have been possible merely by stating that it was possible to get to the moon by the end of the decade. This confidence and credibility certainly went a long way toward building consensus supporting the moon program.

The example of Kennedy's approach to the moon program suggests an additional feature of outcome-based strategies: they may bind the country to taking certain actions in ways that outlast the particular administration that made the commitment. In the case of the moon program, the commitment to reach the moon survived Kennedy's death. In Iraq, the fact that George Bush has adopted an outcome-based approach, achieving a peaceful democratic society in Iraq, will make it harder for his successor to withdraw from Iraq without achieving this goal than it would have been if Bush had adopted an input-based posture, since by doing so the U.S. will lose prestige and credibility. This ability to bind future administrations may be a benefit of outcome-based strategies, since credible long-term commitments are more effective in encouraging the government/dissuading the insurgents, or, as explained in the next paragraph, be a drawback.

The down side to outcome-based commitments is, of course, that commitment to an outcome leaves the particular tactics unspecified, and in an uncertain world events may develop in such a way that, even though there is agreement on the goal among stakeholders ex ante, their objectives may diverge as time passes. Such has been the case in the Iraqi conflict. While there was substantial agreement on invading Iraq in order to eliminate Iraqi WMDs and on the value of expending significant resources to do so, the fact that there were no WMDs has led to a divergence in attitudes, with some believing the potential benefits to a "peaceful, democratic Iraq" are worth continuing to spend on the war, while others do not. The continuing difficulties in establishing security in Iraq have led many to worry about costs, in terms of dollars, lives, and national stature, spiraling out of control. In situations where allies and internal stakeholders focus on concerns such

as these, input-based strategies may go a long way toward quelling their fears.

In the case of external strategy, benchmarking represented the best of both worlds, simultaneously discouraging the insurgents and encouraging the government. They also are able to strike a balance between the concerns of those who want to know that the TPI is "in it to win it," and those who want to be reassured that the conflict will not continue to consume money and lives indefinitely, and they are not tying themselves to throw good resources after bad, even if it becomes clear that doing so is no longer worth it. Indeed, striking a balance between achieving the goal of establishing a peaceful democratic Iraq and establishing that the U.S. commitment to Iraq is not open-ended appears to be the motivating force underlying the language concerning benchmarks in the "U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007." The drawback to benchmarking vis-a-vis internal strategy is the same as with external strategy. Benchmarking strategies are very specific, and involve tying the TPI's commitments to observable actions by the government and insurgents. Ex ante, it may be difficult to anticipate what these actions should be (e.g., how could we anticipate the structure of a post-Saddam Iraqi government?), and even during the conflict it may be difficult to observe whether the actions have taken place. Thus, while they have beneficial incentive properties, benchmarking strategies are more complex and difficult to create and administer than either of the other alternatives.

5 Discussion

This paper has developed a simple model of third-party intervention in a conflict such as the war in Iraq and considered the question of whether it is better for the intervenor to adopt an input- or outcome-setting approach to the conflict. Through the basic model and a series of extensions, the paper characterizes the factors that combine to determine which approach is superior. The basic model shows that outcome-setting makes both the government and insurgents less aggressive. If the benefit from facing a less aggressive insurgency outweigh the cost of less aggressive government, outcome-setting will dominate input-setting. The extensions show that the fundamental strategic effects identified here are robust to the inclusion of uncertainty, cross effects and the possibility of different objective functions (although in the final case the sign of one of the effects changes).

While including each of these adds complication to the model, the basic strategic effects identified here remain. Similarly, the motivating example for this paper has been the US's involvement in the Iraqi conflict. However, the insights developed here are applicable to other conflicts, both historical (e.g., U.N. intervention in Korea, U.S. involvement in Viet Nam, NATO involvement in Bosnia and Herzegovina) and hypothetical. The extensions, and especially the taxonomy presented in Section 3.4.3, lay out a framework for assessing the likely direction of the strategic impact of adopting an input-setting our outcome-setting approach to a particular conflict, as well as guidance regarding the nature of optimal benchmarking policies.

One of the key issues that has not yet been discussed is whether or not the intervenor can credibly commit to an outcome–based commitment. Such commitments involve responding to poor performance by the government by reducing the TPI's involvement. However, such a withdrawal may be difficult to implement, especially if leaving the country will harm civilians and possibly open the door to insurgent forces. On the other hand, commitments to match government or insurgent efforts in kind also face credibility problems. If the government, indeed, takes effort to provide for its own security, the need for TPI effort will be lessened. Ex post, then, the TPI may find that it has an incentive to free-ride off of the government's effort. However, if the government anticipates that its efforts will not be matched, the whole situation may unravel. Although we have assumed that outcome commitments are credible, making them credible will involve appeal to reputation or some other mechanism. However, such mechanisms are well understood, and so we do not focus on them here. In the case where the TPI cannot credibly commit to an outcome–based posture, it will de facto be adopting an input–based strategy. Thus, difficulty in credibly committing will reduce the effectiveness of outcome-based commitments.

The motivating example for this paper has be the U.S.'s involvement in Iraq. In the debate over which policy should be adopted, advocates of one or the other approach focus on the subset of these factors that support their position and ignore the others. For example, supporters of input-based commitments frequently criticize outcome–based approaches as giving insufficient incentive to the Iraqi government to provide for its own security. The analysis here suggests that the criticism is correct: outcome–based approaches fail to give the Iraqi government strong incentives to provide for their own security. According to Hillary Clinton, "The only way to spur the Iraqis

to take responsibility for their own future and to ensure that we don't bear that responsibility indefinitely."[32,33] On the other hand, advocates of outcome–based approaches frequently criticize input-based commitments as "cut and run" strategies that will only embolden the enemy. For example, in April 2007, John McCain stated "The Democrats want to set a date for withdrawal, which should be named a date certain for surrender."[34] This criticism is also correct. Relative to outcome–based commitments, which promise to match increases in insurgent activity with increases in U.S. activities, input-based commitments do less to discourage insurgents. Thus, while each of these criticisms is valid up to a point, they fail to fully consider the whole strategic situation. Both approaches have strengths and weaknesses. Ultimately, which approach is better will depend on the details of the situation. One of the contributions of this paper, however, is to point out that complete arguments in favor of one or the other approach must address the strategic implications of the approach for both the government and the insurgents.

Figure 1 summarizes the interaction between various issues discussed in this paper and advocating input- or outcome-based commitments. Across the issues in the left-most column, an advocate of input-based commitments should embrace many, if not all, of the positions in the middle column, while an advocate of outcome–based commitments should embrace the positions in the right-most column.

The paper also examines a third alternative, that of benchmarking. This approach ties U.S. commitment to the efforts of the government and insurgents, but in a more general way than an outcome–based commitment. Like outcome–based commitments, the optimal benchmarking policy involves matches increases in insurgent activity with increases in U.S. efforts. However, the optimal benchmarking policy differs from an outcome–based commitment by also matching (although perhaps not 1-for-1) increases in government effort by *increasing* U.S. effort. In this way, the U.S. rewards government efforts instead of punishing them, as in outcome–based commitments,

[32] IRAQ: Hillary's Remarks at The George Washingon University, March 17, 2008. http://www.hillaryclinton.com/news/speech/view/?id=6553. accessed May 26, 2008.

[33] Similarly, Clinton explicitly rejects the president's approach in a column in the New York Daily News. "The administration has this mantra: 'We'll stand down when they stand up.' ... The appropriate formula is, 'We will stand down anyway, and you will fight to defend Iraq.' Because they are basically able to just allow us to take the brunt of the impact." Hillary Clinton, "Where I Stand on Iraq," New York Daily October 12, 2006.

[34] "G.O.P. Candidates Lay Into Democrats, Not One Another," *The New York Times,* April 15, 2007, Section 1, p. 22.

Issue	Advocate Input-based Commitment if:	Advocate Outcome-based Commitment if:
Relative Size of Strategic Effects	• Outcome-based commitments discourage government more than they discourage insurgents.	• Outcome-based commitments discourage insurgents more than they discourage government.
Uncertainty	• Level of uncertainty is high	• Level of uncertainty is low
Risk aversion	• Risk aversion is high / cost is highly convex.	• Risk aversion is low / cost is not highly convex.
Credibility / commitment cost	• Credible long-run commitments are difficult or costly.	• Credible long-run commitments are possible and feasible.
Internal strategy	• May allow for greater flexibility	• May provide greater motivation

Figure 1: Comparison of Input-based and Outcome-based Strategies.

and the U.S. is able to leverage its commitment to increase government efforts beyond what they are in either of the other regimes. The result is that the U.S. does better in the optimal benchmarking regime than when using either of the other approaches. And, as we argue in the example, employing a benchmarking scheme may make the overall benefits to intervention positive, even if they would be negative under either input- or outcome-based commitments. Of course, benchmarking has drawbacks of its own. In particular, benchmarking strategies are complex to specify and administer. In practical circumstances, the strategic benefits of benchmarking must be weighed against this additional cost.

Interestingly, the benchmarking regime resembles the strategy arising out of the new Iraq strategy proposed by the president in early 2007 and codified in the "U.S. Troop Readiness, Veterans' Care, Katrina Recovery, and Iraq Accountability Appropriations Act, 2007." However, as mentioned earlier the consequences of failures to achieve the benchmarks set out in the law are left somewhat vague. Although the U.S. promises to make its Iraq strategy contingent on the governments performance with respect to the benchmarks, it is unclear whether the promised adjustment by the U.S. is to reduce aid if the government does not help itself, or to provide additional aid in order to make the benchmarks feasible. The analysis in this paper suggests that the proper direction for this adjustment is to match Iraqi efforts with U.S. commitments: the more resources they provide, the more aid the U.S. will provide. Thus, this commitment is opposite of that implied by "we'll stand down when they stand up." As a further note, while U.S. policy explicitly benchmarks U.S. commitments to performance of the Iraqi government, promised responses to increased

insurgent activity are vague at best. In this case, the analysis of the paper suggests that a formal policy promising swift response to insurgent activity, such as that which is embodied in Article 5 of the North Atlantic Treaty governing NATO, may also be beneficial.[35,36]

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[35] Article 5 reads "The Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all and consequently they agree that, if such an armed attack occurs, each of them, in exercise of the right of individual or collective self-defence recognised by Article 51 of the Charter of the United Nations, will assist the Party or Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area." http://www.nato.int/docu/basictxt/treaty.htm, accessed March 31, 2008.

[36] The commitment in Article 5 can be interpreted as part of an open-ended commitment or benchmarking strategy. Arguably, this commitment was credible to forestall numerous military conflicts during the Cold War.

Appendix A: Proofs

Proof of Lemma 1: Consider the optimal choice of α_g. Substituting $\alpha_n = 1$ and $\bar{x}_n(\alpha_n) = 0$ into the TPI payoff function yields:

$$V_t = \bar{x}_g(\alpha_g) + \bar{t} + \alpha_g \bar{x}_g(\alpha_g) - c_t(\bar{t} + \alpha_g \bar{x}_g(\alpha_g))$$

Consider the possibility that $\bar{t} + \alpha_g \bar{x}_g(\alpha_g) < x_t^{**}$. In this case, $\bar{t} = x_t^{**} - \alpha_g \bar{x}_g(\alpha_g)$, and the TPI's problem becomes:

$$\begin{aligned} V_t &= \bar{x}_g(\alpha_g) + x_t^{**} - \alpha_g \bar{x}_g(\alpha_g) + \alpha_g \bar{x}_g(\alpha_g) - c_t(x_t^{**}) \\ &= \bar{x}_g(\alpha_g) - c_t(x_t^{**}). \end{aligned}$$

However, this is maximized by making $\bar{x}_g(\alpha_g)$ as large as possible, which involves increasing α_g. Since $x_g(\alpha_g)$ is strictly increasing in α_g, eventually $\alpha_g \bar{x}_g(\alpha_g) \geq x_t^{**}$. Hence in the optimal solution it must be that $\alpha_g \bar{x}_g(\alpha_g) > x_t^{**}$. In this case, $t^* = 0$.■

Proof of Proposition 3: Parts a and b: Since $\alpha_g \bar{x}_g(\alpha_g) > x_t^{**} > 0$, $\alpha_g > 0$, and the TPI provides more resources than in either of the other two cases. Part c is clear from the government's first-order condition. Part d was explained above. That the TPI is better off in this case is clear since it could achieve the same outcome as in either of the other cases. Input-based commitments has $\alpha_g = \alpha_n = 0$, and outcome–based has $\alpha_g = -1$, $\alpha_n = 1$. These are feasible but not optimal. Similarly, the government must do better. Under the optimal benchmarking regime, the TPI provides more resources than under either other regime, and the insurgents provide zero resources. Since, under the optimal benchmarking regime, the government could choose $x_g = x_g^{**}$ or $x_g = 0$, but doesn't, it must be that the government does strictly better under the optimal benchmarking regime.■

Appendix B: Example

Consider the model as specified above. Cost functions for the parties are given by $c_t(x_t) = \frac{1}{2}x_t^2$, $c_g(x_g) = \frac{c_g}{2}x_g^2$, and $c_n(x_n) = \frac{c_n}{2}x_n^2$. Thus, the constants c_g and c_n allow for the government and insurgents to have different costs, and for them to be higher or lower than that of the TPI. In the input–based commitment case, the optimal resource expenditures are given by $x_t^{**} = 1$, $x_g^{**} = 1/c_g$, and $x_n^{**} = 1/c_n$. Thus the insurgents provide more resources than the government if and only if $c_n < c_g$, i.e., they have lower cost. Table A1 gives security, cost, and net payoffs for the three parties are.

Input-Based Payoffs	S_i	$c_i(x_i)$	V_i
Government	$1 + 1/c_g - 1/c_n$	$\frac{1}{2c_g}$	$1 + \frac{1}{2c_g} - \frac{1}{c_n}$
Insurgents	$1/c_n - 1 - 1/c_g$	$\frac{1}{2c_n}$	$\frac{1}{2c_n} - 1 - \frac{1}{c_g}$
TPI	$1 + 1/c_g - 1/c_n$	$\frac{1}{2}$	$\frac{1}{2} + \frac{1}{c_g} - \frac{1}{c_n}$

Table A1: Payoffs under input-setting.

Next, consider the outcome-based case. Here, the government and TPI choose $x_g^* = x_n^* = 0$. The TPI chooses t to maximize its own payoff: $t - c_g(t) = t - \frac{1}{2}t^2$, which is optimized at $t = 1$.

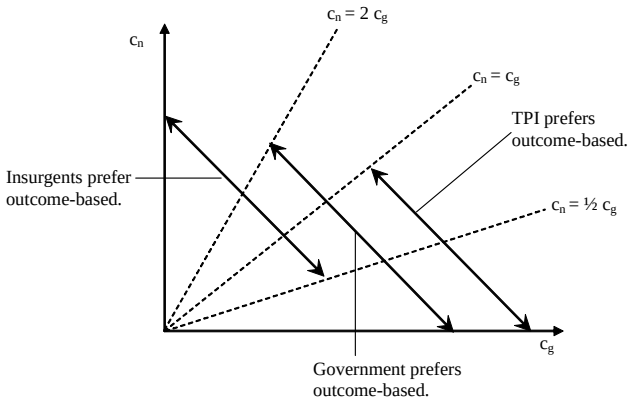

Figure 2: Comparison of Input- and Outcome-based strategies.

Security for the government and TPI is 1, so the TPI's payoff is $V_t = 1/2$, and the government's payoff is 1, while the insurgents' payoff is -1. Payoffs to the parties are given in Table A2. The government prefers an outcome-based approach to an input-based one whenever $c_n < 2$, while the insurgents prefer a outcome-based approach to an input-based one whenever $c_n > 1/2$.

	Input-based	Outcome-based
Government	$1 + \frac{1}{2c_g} - \frac{1}{c_n}$	1
Insurgents	$\frac{1}{2c_n} - 1 - \frac{1}{c_g}$	-1
TPI	$\frac{1}{2} + \frac{1}{c_g} - \frac{1}{c_n}$	0.5

Table A2: Payoffs In the three regimes.

Comparison of the payoffs in the two regimes is straightforward, and is depicted in Figure 2. The TPI prefers outcome–based commitments if $1/c_g < 1/c_n$, or $c_n > c_g$. That is, if, in the input-based commitment regime, the insurgents are more aggressive than the government (because they have lower costs), then the TPI benefits more from driving them from the conflict than they are harmed by discouraging the government. The insurgents prefer that the TPI adopt outcome–based commitments if they are relatively high cost: $c_n > \frac{1}{2}c_g$, and the government prefers that the TPI adopt outcome-based commitments if they are relatively high cost, $c_n < 2c_g$. In each case the reason is the same: when a party is high cost, then it does not provide many resources in the input-based commitment case. Thus, it loses relatively little in the way of security by cutting back, and, since it is high cost, gains a lot in terms of savings. As depicted in Figure 1, it is possible that the TPI chooses outcome-setting when only the TPI and government prefer it, or when all three parties prefer it. On the other hand, it is possible that both the government and insurgents prefer outcome-setting, but the TPI prefers an input-setting approach.

Next, consider the optimal benchmarking regime. As discussed above, the optimal benchmark for the insurgents is to match their efforts at least 1-for-1. In this case, the TPI forecloses the insurgents from the market and, in equilibrium expends no resources to do so. In light of this, we focus on the optimal benchmark for the government. Let the TPI's strategy be given by $t + \alpha_g x_g$. The government's payoff is $V_g = x_g + t + \alpha_g x_g - \frac{c_g}{2}x_g^2$. Differentiating with respect to x_g and

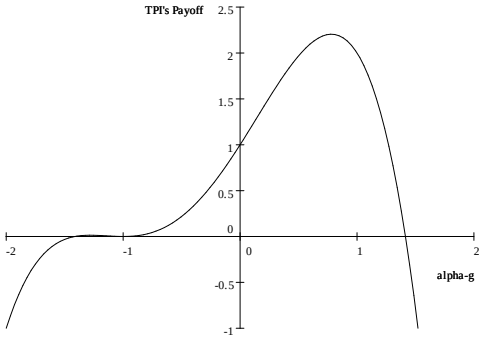

Figure 3: The TPI's payoff as a function of α_g.

setting the result equal to zero, the government's optimal resource allocation is $\bar{x}_g(\alpha_g) = \frac{1+\alpha_g}{c_g}$. Substituting this into the TPI's objective function and simplifying yields $V_t = \frac{(1+\alpha_g)^2(2c_g-\alpha^2)}{2c_g^2}$. The optimal α_t satisfies $V_t'(\alpha_g) = 0$, which occurs at

$$\alpha_g^* = \frac{1}{4}\left(-1 + \sqrt{1+16c_g}\right). \tag{7}$$

From (7), it is clear that $\alpha_g^* > 0$ whenever $c_g > 0$, that $\alpha_g^* = 0$ at $c_g = 0$, and that the optimal matching rate increases with c_g. The TPI's optimal resource commitment $x_t^* = \alpha_g \bar{x}(\alpha_g)$, viewed as a function of c_g, is $t(\alpha_g^*) = \frac{-1+8c_g+\sqrt{1+16c_g}}{8c_g}$, which decreases from 2 to 1 as c_g increases from 0 to infinity.

Finally, it is instructive to compare profit under the three regimes. For the purposes of illustration, let $c_g = 1$. The qualitative nature of the relationship is robust over a range of c_g. Figure 3 plots the TPI's optimal payoff as a function of α_g, $V_t = -(1+\alpha_g)^2\left(\alpha_g^2 - 2\right)/2$. Interestingly, choosing $\alpha_g = -1$, as in the outcome-setting regime, is a local minimum and does quite poorly.[37] Choosing $\alpha_g = 0$, as in the input-based case, is also suboptimal. The TPI's optimal choice of α_g is $\alpha_g^* \approx 0.78$. Thus, the TPI matches government expenditures 78% on the margin.

At $\alpha_g = 0.78$, $x_g = 1.78$ and $x_t = 1.39$. In this case, Table A3 depicts the parties' payoffs. Regardless of the level of c_n, both the TPI and the government prefer benchmarking to either of the other regimes, and benchmarking is always worst for the insurgents.

	Input-based	Outcome-based	Benchmark
Government	$\frac{3}{2} - \frac{1}{c_n}$	1	1.58
Insurgents	$\frac{1}{2c_n} - 2$	-1	-3.17
TPI	$\frac{3}{2} - \frac{1}{c_n}$	0.5	2.2

Table A3: Payoffs when $c_n = 1$.

Entry Costs

Now, consider the case where $c_n = 1$. Table 3 depicts the parties' payoffs for the three regimes. Here, the TPI is indifferent between the input-based commitment and outcome-based commitment

[37] This is true regardless of c_g.

cases, but does strictly and significantly better in the benchmarking case due to the ability to simultaneously drive out the insurgency and leverage its own commitment to get the government to provide greater resources than in either of the other two cases. Suppose that we introduce a first stage to the game where the TPI chooses whether or not to enter the conflict. The cost of entering is 1, and if the TPI stays out of the conflict it earns payoff 0.[38] In this case, it is not worth it for the TPI to enter the conflict under input-based or outcome-based commitments. In either case, the payoff is -0.5, and staying out dominates. On the other hand, if the TPI will adopt an effective benchmarking strategy after entry, then it will choose to do so, earning a net payoff of $2.2 - 1 = 1.2$. Here, entry also benefits the government and harms the insurgents. Thus, through its superior provision of incentives, adopting a benchmarking strategy may make it possible to effectively intervene on behalf of the government when it would not be possible otherwise.

[38] In assuming that $c_g(0) = 0$, the main part of the analysis assumes away this situation.