Can Hearts and Minds Be Bought?

The Economics of Counterinsurgency in Iraq

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Abstract:

We develop and test an economic theory of insurgency motivated by the informal literature and military doctrine. We model a three-way contest between violent rebels, a government seeking to minimize violence by mixing service provision and coercion, and civilians deciding whether to share information about insurgents. We test the model using panel data from Iraq on violence against Coalition and Iraqi forces, reconstruction spending, and community characteristics (sectarian status, socio-economic grievances, and natural resource endowments). Our results support the theory's predictions: counterinsurgents direct services disproportionately to predictably violent locations, and improved service provision has reduced insurgent violence since January 2007.

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Introduction

> *"Successful guerrilla operations involve the people. It is the quality of their resistance to the enemy and support for the guerrillas which in the end will be the decisive factor…It fact, a guerrilla force will be unable to operate in an area where the people are hostile to its aims."*
>
> –Handbook for Volunteers of the Irish Republican Army[2]

> *"At the start of 2006, General Chiarelli took command of the Army's day-today operations in Iraq, and he was certain that no amount of killing or capturing could exhaust the ranks of unemployed and angry Iraqis willing to join the insurgency...Chiarelli became convinced that the way to win Baghdad was through civilian outreach, not skirmishes. When Chiarelli's men compared maps of insurgent activity with those showing access to electricity and drinkable water, they found a direct correlation between terrorist incidents and a lack of services."*
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> --Raffi Khatchadourian[3]

The twin tasks of rebuilding social and economic order in conflict and post-conflict areas will be critical for the United States and allied governments for the foreseeable future. Beyond Iraq and Afghanistan, unstable areas pose significant security threats from Gaza, to Somalia, to East Timor, to parts of South America. Huge flows of reconstruction aid have been directed to these areas on the theory that rebuilding economies can help rebuild societies --addressing donors' security concerns while improving the lives of those directly affected by the lack of order. Yet, little if any empirical research has evaluated these efforts to see where, when, and how efforts to improve material conditions in conflict zones actually enhance social and economic order.

Answering such questions is hardly a passing concern. A wide variety of structural factors—greater economic integration, a more unequal distribution of conventional military capabilities, the lethality and high capital costs of modern weaponry, and the like—imply that in the future conflict

[2] We thank Lindsay Heger for pointing this quote out to us.
[3] "The Kill Company," *The New Yorker* (July 6 & 13, 2009).

will continue shifting away from conventional force-on-force battles toward various forms of insurgency and irregular warfare currently engaging U.S. troops in Iraq, Afghanistan, and elsewhere.[4] The consensus among scholars and practitioners on how to most effectively conduct such conflicts is reflected in the United States Army's irregular warfare doctrine (FM 3-24). This doctrine places a heavy emphasis on influencing 'human factors', e.g. the population's tolerance for insurgent activities, by combining benign measures such as economic reconstruction with carefully targeted strikes against violent actors.

While this combined approach makes intuitive sense, existing discussions of it are not grounded in a coherent social scientific theory of insurgency that can generate clear predictions about how—and therefore where and when—benign measures work. Some argue that reconstruction addresses grievances, while others claim that reconstruction raises the opportunity cost of rebellion by improving the economy. Motivated by military doctrine and the literature on counterinsurgency, we develop a third approach, modeling insurgency as a three-way interaction between rebels seeking political change through violence, a government trying to minimize violence through some combination of service provision and hard counterinsurgency, and civilians deciding whether or not to share information about insurgents with government forces. The model generates testable hypotheses about the relationship between spending on benign measures and violence. We test these on a new dataset from Iraq that includes geo-spatial data on violence against US and Iraqi forces, reconstruction spending, and community characteristics, including social cohesion, sectarian status, and natural resource endowments.

Focusing on the impact of reconstruction spending on violence allows us to test the model while informing ongoing debates about the proper allocation of scarce reconstruction resources. From March 2003 through December 2007, the United States government spent at least $29 billion

[4] Irregular warfare is not new. Fearon and Laitin (2003) report that civil wars account for four times as many casualties as interstate wars in the second half of the twentieth century.

on various reconstruction programs in Iraq (CRS 2008). This money has had little obvious impact; the correlation between reconstruction spending and violence across Iraqi districts is generally positive. Problems of graft render the data on large-scale reconstruction projects deeply suspect (SIGIR 2007b), so we focus on the $2.9 billion in American reconstruction funds allocated through the Commander's Emergency Response Program (CERP) and related smaller programs.[5]

CERP has two major advantages for our study. First, CERP funds are allocated in small amounts without layers of subcontractors that make the relationship between dollars spent and work done tenuous for most American reconstruction spending. Second, CERP is explicitly designed to provide military commanders with resources to engage in small-scale projects that meet the needs of local communities with the aim of improving security and protecting forces. The idea is that these projects help Coalition and Iraqi Security Forces better combat insurgent activity and thereby enhance social order. So by assessing how the relationship between CERP spending and violence varies over time and space in Iraq, we test our theory and help answer practical questions about where, when, and how benign activities help build order in conflict and post-conflict settings.

The remainder of this paper proceeds as follows. Section 1 reviews existing arguments linking governance, service provision, and insurgency. Section 2 develops a model of insurgency that focuses on how the population's willingness to share information determines the success or counterinsurgent actions. Section 3 introduces new data on the provision of government services and conflict in Iraq. Section 4 tests several implications of the theory, finding that: (1) Coalition forces concentrate CERP spending where violence is predictably high: and (2) CERP spending is violence reducing after January 2007. Section 5 discusses future research and offers policy implications.

[5] As the results below indicate there is little evidence other types of reconstruction spending have reduced violence in Iraq or addressed the immediate problems of unemployment and poverty.

1 Literature

Prevailing theories of insurgency and counterinsurgency differ from conventional models of inter-state conflict in their emphasis on the decisive role of noncombatants. Mao Tse-Tung (1937) famously describes the people as "the sea in which rebels must swim," a perspective reinforced by a generation of 20th century counterinsurgency theorists (Trinquier 1961, Taber 1965, Galula 1966, Clutterbuck 1966, Thompson 1968, Kitson 1971). Twenty-first century scholarship by practitioners of counterinsurgency reinforces the enduring relevance of noncombattants (Sepp 2005, Petraeus 2006, Cassidy 2006, McMaster 2008). The most prevalent explanation for the importance of garnering popular support is that parties to insurgent conflicts use it to gain critical information and intelligence. Kalyvas (2006) demonstrates that this information increases the effectiveness of both defensive and offensive operations.

Prescriptions for gaining popular support vary considerably. Leties and Wolf (1971) suggest that efficient counterinsurgency can reduce the supply of insurgents, reduce demand for them, or both. Political scientists studying civil war and insurgency have debated the relative merits of employing attractive versus coercive measures. Proponents of "hearts and minds" theories advocate reducing the demand for rebellion. They believe that in as much as the government can secure the population and address popularly held grievances, the local beneficiaries of these efforts will reciprocate and reward it with their support (Gurr 1970, Horowitz 1985).

Skeptics point out the limitations of an over-reliance by counterinsurgents on winning "hearts and minds." Research on the supply of rebels suggests that popular support is largely irrelevant where states are weak and the government could not act on information if it had it. In such states, quasi-criminal rebels' profits from insurgency outweigh any reasonable government effort to buy off individual combatants (Collier and Hoeffler 2001, Sambanis 2002, Mueller 2003, Ross 2004). In contrast, Dube and Vargas (2008) find that increases in the prices of agricultural

exports reduce insurgency in rural Columbia, interpreting their finding as an opportunity cost mechanism like Becker's (1968) model of crime. Fearon and Laitin (2003) find the patterns of civil war are not well predicted by the nearly ubiquitous grievances that could, in principle, be addressed with economic growth and better governance. Instead, civil war correlates with difficult terrain and low GDP/capita (which they interpret as a symptom of weak state capacity).[6]

A broader assessment of the literature suggests that the division between coercive and attractive measures to combat insurgency may be misconceived. These could be viewed as strategic complements—the more security the greater the efficacy of benign activities and vice versa. Signaling both capacity and commitment to providing security is critical to increasing support, cooperation and information flow from the population. Economic aid and service provision by government could then contribute to the popular perception that the state is capable of maintaining order and enforcing security.[7]

Noncombatants are responsive and active actors in this competition for their support. Galula (1966) and Petersen (1997) show that support for government and rebels varies at the individual level and shifts across space and time in reaction to both rebel and the state activities. Popkin (1979) emphasizes that noncombatants make rational decisions regarding the direction and degree of their cooperation. Taken together these findings suggest that the interaction of insurgents,

[6] Most previous scholarly effort to model competition for popular support focuses on the interaction between governments and rebels. Gates (2002) examines competition between rebels and the government as it affects the ability of rebels to control their own fighters. Azzam (2006) argues that rebels sometimes loot to make joining relatively more attractive than staying in the normal economy. Kalyvas (2006) focuses on how the competition for information creates incentives for both sides to engage in or refrain from violence against civilians. Fearon (2007) models an endogenous size constraint on rebel bands, implicitly treating community preferences over sharing information as fixed. Shapiro (2007) explores how government efforts to elicit information influence the organizational forms that rebels choose. For a broad recent survey of the literature see Bueno de Mesquita (2008).

[7] This complementarity has long been explicit in the "community policing" anti-gang literature (Bayley 1994). Gangs and rebel groups have three strong similarities: both often enjoy community support; both are extremely vulnerable to leaks and defection if their control over territory is weak; and both often work hard to maintain the support of communities. Akerlof and Yellen (1994) interpret gangs' efforts to maintain the support of communities as self-interested, an insight we also apply to government in what follows.

counterinsurgents, and the populace whose cooperation they compete for is best understood by accounting for the preferences and incentives of all three.

2 A model of insurgency and counter-insurgency

> ``*Without good intelligence, counterinsurgents are like blind boxers wasting energy, flailing at unseen opponents and perhaps causing unintended harm. With good intelligence, counterinsurgents are like surgeons cutting out cancerous tissue while keeping other vital organs intact.*"
>
> –U.S. Army Counterinsurgency Field Manual 3-24 (2007), 1-23.

Unlike other forms of warfare, counterinsurgency is fundamentally a struggle over people, not territory. The key component in applying military pressure on insurgents, and thereby providing security for the population, is information. Information is even more central in insurgencies such as Iraq and Afghanistan where two conditions obtain. First at least some noncombatants know what insurgents are doing. In 2006 a Shi'ite sheik in Tal Afar irately described the situation in a city council meeting, declaring to his Sunni colleagues: "The people who are fighting—where do they come from? They don't pop up from the ground. Some of you know who they are." (quoted in Packer (2006)). Second, counterinsurgents can apply direct and indirect fire anywhere in the country at any time of day or night. That asymmetry of force makes this situation distinct from one in which counterinsurgents' capacity for violence is weaker (e.g. rural African insurgencies).

Taken together, these particular conditions in Iraq suggest that the silence of the population, or at least of a substantial portion thereof, is necessary (but not sufficient) for insurgent success. Conversely, the willingness of the population to share information with counterinsurgents is sufficient (though not necessary) for insurgents to fail. We see clear evidence of sufficiency in the much-heralded 'Anbar awakening.' For many years the residents of Anbar governorate knew who

the insurgents were but lacked either the will or the violent capacity to resist them. American and Iraqi security forces had the combat power, but not the required information. In late spring or early summer 2006, a number of local leaders in Anbar governorate decided to begin sharing information with counterinsurgents. After a short spike in June and July, violence in Anbar began a steady downward trend through December 2007.

If we acknowledge that counterinsurgency is fundamentally about information, then the critical question is: what makes information more or less forthcoming on the margins? We take as our starting point the notion that the level of information sharing, and consequently the level of violence, is the result of a three-way strategic interaction between rebels, the community, and the government.[8] Building on a model of criminal street gangs proposed by Akerlof and Yellen (1994), we study the following interaction: the government, G, seeks to limit or eliminate violence; a rebel group, R, seeks to conduct attacks which might include terrorism directed against civilians or other types of insurgency and rebellion;[9] and the community, C, can compromise rebels by sharing information with government.[10]

Play proceeds as follows: (1) G chooses a level of public goods to provide, *g*, and chooses a level of counterinsurgent effort, *m*; (2) R chooses a level of violence, *v*; (3) C then decides how much

[8] In treating the community and rebels as unitary actors our approach differs models of insurgency that study the strategic choices of individual rebels over participation or of community members over sharing information (Grossman 1991, Gates 2002, Weinstein 2005, Kalyvas 2006, Fearon 2008).

[9] We do not explore the benefit of violent attacks to rebels. Presumably, rebels aim to gain some political rents or concessions. What is critical is that violence occurs in equilibrium, rather than just the threat of it, since we observe violence in the data. Violence is inefficient in a Coasian sense; for it to occur there must be incomplete contracting ability between rebels and government (Fearon 2004; Powell 2006). This is not a restrictive assumption; governments and rebels often have trouble credibly committing to bargains.

[10] The model shares a main testable implication with the "club" model (Berman and Laitin, 2008): good governance—specifically public good provision—reduces the ability of rebels to do violence. Yet the club model has other implications for rebel groups not shared by all Iraqi rebels: strong clubs provide local public goods in a way that discriminates in favor of members and supporters; strong clubs can also choose high damage tactics that make them extremely vulnerable to information leaks by members, but are not vulnerable to leaks by nonmembers. Many rebel organizations cannot form strong clubs. This model seeks to explain such organizations. The distinction between models has important implications for tactic choice by insurgents and terrorists, a subject we plan to pursue in future work.

information, i, to share with G; and (4) either R or G gain effective control of the territory, with the probability of G winning control given by i. Two core observations motivate this approach. First, we assume violence by rebels inevitably reveals tactically useful (to government forces) information to the community. Setting a roadside bomb, ambushing a patrol, or attacking a police station requires activities that are visible to noncombatants who can share that information.[11] Second, following Popkin (1979) we assume that community members rationally decide whether or not to share information.

Community

The community chooses i to maximize expected utility,

$$(1) \qquad EU_C(i,l,e,g,s,v,r,n) = u(l+eg)i + u(l+s)(1-i) - v(1-i) - ri - ni - m \,,$$

$$u'>0,\ u''<0.$$

Here $g \geq 0$ is the level of government-provided local public goods, such as public safety, education, health care, welfare services, water, electricity or garbage collection. G's effectiveness at providing public goods is parameterized by $e \in (0,1]$. The better G's forces understand the community's needs, the more effectively they will be able to offer public goods.

Government-provided public goods are available to community members only to the extent that the government controls territory. Since the probability of control is proportional to information shared, public good provision and information are complements. Symmetrically, the rebels can provide services, $s \geq 0$, which will provide utility to residents if they win control, which occurs with probability $(1-i)$.

[11] Some tactics reveal less information than others. Berman and Laitin (2008) explore the implications for suicide attacks.

The community can also produce its own public goods, $l \geq 0$. These do not depend on outside funding or assistance as they are provided by the kinds of informal networks that form in most communities. In contrast to g and s, l is available with certainty, regardless of the community information-sharing choice, and for that reason appears in both subutility functions $u(.)$. Because the subutility function is concave, g and s weigh less heavily in C's decision to the extent that C can provide public goods for itself.

Community members suffer from rebel violence, $v \geq 0$, to the extent that they withhold information and thereby make it possible for rebels to operate within their community. The violence is not necessarily directed against the community, but nonetheless endangers them. Violence by the government also hurts the community and so $m \geq 0$ captures damage the government does in the course of counterterrorism and counterinsurgency operations, including apprehension, interdiction, incarceration, punishment, and the like.

Community members also suffer from rebel retaliation, $r \geq 0$, to the extent that they share information. Finally, community members may form norms, n, about sharing information with government, which may be influenced by whether the government is likely to torture or harshly punish captured rebels. We assume $n \geq 0$ as that makes it harder for G to influence violence and treat s, r and n as fixed constants in the analysis that follows for the sake of simplicity. When s, r and/or n are high we will call the rebels entrenched.

We call this a "rational peasant" model, in the tradition of Popkin's (1979) description of Vietnamese peasants; noncombatants make a decision based on a rational calculation of self-interest, rather than due to an overwhelming ideological commitment to one side or another. This is not to say that such an ideological commitment is irrational or unusual, just that on the margin both

governments and rebels can influence the decisions of noncombatants through concrete action: provision of services and threats of retaliation.[12]

[Insert Figure I about here.]

Figure 1 graphs the expected utility of community members against information revelation. Equation (1) implies that the utility of the representative community member is a monotonic function of i. The upper line illustrates the case where that slope is positive, and all information is optimally shared with government. The lower line shows the case where the slope is negative, and no information is shared.

C's best response, i^*, is to fully share information when Uc is increasing in i, and not to share any information otherwise. The boundary between these regimes determines what Akerlof and Yellen term the noncooperation constraint, the set of conditions under which the community is indifferent between sharing information with the government or staying quiet.[13] Stated as a formula for the maximal acceptable level of violence, v, C's best response function is

$$i^* = \begin{cases} 0 & \text{if } v \le u(l+s) - u(l+eg) + r + n \\ 1 & \text{otherwise} \end{cases}. \qquad (2)$$

Rebels

Rebels weigh the benefit of violence against the cost, taking into account the effect of violence on information-sharing by the community with government. Formally, rebels choose a level of violence, v, to maximize

$$U_R(v,m,i) = b_r v - a_r mvi \qquad (3)$$

[12] Retaliation by government is assumed away, but could be added without changing our results substantively. Gates (2002) and Kalyvas (2006) present models with government retaliation.

[13] This model generalizes easily from a representative community member to a community with heterogeneous members, some of whom have a higher propensity to share information than others, since information need only be shared once in order to obtain the results below.

where government enforcement, m, harms rebels to the extent that the community shares information, i, allowing the government to target rebels. Here b_r and a_r are positive constants, reflecting the value of violence for rebels and their disutility from successful enforcement respectively.

R's best response clearly depends on whether it's utility function is increasing in violence even when all information is shared. When $dU_R(v,m,i)/dv = b_r - a_r m > 0$, then U_R monotonically increases in v regardless of the community's actions and so rebels are unconstrained and optimally choose infinite violence. This amounts to rebel victory in the context of the model. Rebels are constrained when $b_r - a_r m \leq 0$, so their utility increases in v when communities keep mum and decreases in v when C shares information. Constrained rebels optimally choose a level of violence, v^*, that makes C indifferent between sharing information and remaining silent. Figure II illustrates the utility of constrained rebels as a function of violence. Importantly, rebel violence is a function of rebel characteristics (s,r), community capacity (l,n), and government choices of m and g.

[Insert Figure II about here.]

If rebels cannot induce noncooperation (by forcing the slope dU_C/di in Figure I to be negative) then they choose $v^* = 0$, and information is shared. Anticipating a full solution, that would be a peaceful equilibrium, which occurs when government services (which would be undermined by rebel activity) and the absence of violence are more valuable to community members than the combined effect of services provided by rebels, the threat of retaliation, and norms of information sharing.

To summarize, R's best response function is

$$v^* = \begin{cases} \infty & \text{if } b_r - a_r m > 0 \\ \max(u(l+s) - u(l+eg) + r + n, 0) & \text{if } b_r - a_r m \leq 0 \end{cases}. \quad (4)$$

Government

The government seeks to minimize violence by a cost-effective mix of counterinsurgent enforcement, *m*, and government services, *g*. It is not a social welfare maximizer. This is not a normative criticism. We make an extreme assumption about the objectives of government in order to focus on the optimal behavior of a government whose first priority is repressing violence. This assumption may fit particularly well for an ally or occupying power more concerned about externalities of violence than it is about the welfare of residents.

The government chooses *m* and *g* to minimize $C_G(v,m,g)$ which is simply a weighted average of the costs of violence, $A_G(v)$, and the costs of governing, $B_G(m)$ and $D_G(g)$. The subutility functions are all convex, monotonically increasing functions with increasing marginal costs of violence, enforcement, and service provision. $A_G(0) = B_G(0) = D_G(0) = 0$, and $A_G'(0) = D_G'(0) = 0$ so that low levels of violence and service provision are not very costly. We will call the government active if $m>0$ since the government may be passive in equilibrium when facing rebels with a low capacity for violence. Formally, G's best response function is

$$(5) \qquad \arg\min_{m,g} A_G(v)+B_G(m)+D_G(g)\Big|_{v^*,\ i^*} \ .$$

Equilibrium

We solve for the sub-game perfect Nash equilibrium via backwards induction, assuming for simplicity that rebels can produce infinite violence if government is passive.

C's decision is clear cut, remain quiet so long as $v \le u(l+s)-u(l+eg)+r+n$, and set $i=1$ otherwise. Constrained rebels' best response is then to set *v* at the highest level that sustains noncooperation with government. C's decision therefore leads directly to our first result on the effect of benign counterinsurgency (by which we mean government spending, *g*, designed to reduce violence).

Proposition 1 (Benign Counterinsurgency): If rebels are unconstrained, violence is unresponsive to government spending on local public goods. If rebels are constrained, rebel violence is weakly decreasing in *g*.

Proof: Unconstrained rebels choose infinite violence regardless of C's action, thus $\frac{\partial v^*}{\partial g} = 0$. For constrained rebels $\frac{\partial v^*}{\partial g} = -eu'(l+eg) < 0$ when v*>0.

■

Constrained rebels competing for "hearts and minds" in the face of a generous government must limit (unpopular) violence. We have written this as a partial derivative to emphasize that community and rebel characteristics *l*, *s*, *r* and *n* are held constant. Equation (4) also implies that violence by constrained rebels increases with their ability to retaliate and with norms of noncooperation. Similarly, the more the community values rebel-provided services, $u(l+s)$, the more violence rebels can allow themselves. In short, entrenched rebels choose higher levels of violence.

If rebels are constrained, so that government-provided local public goods reduce violence, the size of that reduction depends on the effectiveness of government at providing public goods, e, so that we have the following cross-partial

$$\frac{\partial^2 v^*}{\partial g \partial e} = -egu''(l+eg) - u'(l+eg). \quad (6)$$

Although the cross-partial derivative of violence with respect to *e* and *g* in the model is ambiguously signed, it will generally be negative when the utility of the community in services is not too concave, a condition likely to exist in Iraq where basic public goods are sorely lacking. Equation (6) thus yields an important policy implication: the more those providing government forces and their allies know about the communities they are working in, the greater the violence-reducing effect of

government provided services, g. Intuitively, better knowledge of what communities value helps counterinsurgents buy more 'no-bang for the buck.'

The government's first consideration must be avoiding infinite violence (which implies infinite costs). A cost-minimizing government chooses the lowest m that rules out maximal violence when information is shared, $m^* = b_r / a_r$, (solving for $dU_R/dv = 0$ in (3), when i=1).[14] This ensures that rebels will be constrained by the threat of the community sharing information. The government's optimal enforcement level, m^*, increases in the utility of rebels from violence and declines in rebel disutility from capture.

The government's remaining choice is a level of services, g, that minimizes costs, C_G, subject to the rebel's choice of violence as dictated by the community's noncooperation constraint:

$$(7) \qquad C_G(m,v,g) = A_G(v^*) + B_G(b_r/a_r) + D_G(g),$$

$$\text{s.t. } v^* = \max(r + n + u(l+s) - u(l+eg) , 0) .$$

Figure III plots C_G against government services, illustrating this choice in the case of a violent equilibrium. Note that violence declines as we move from left to right, until the point where v^*=0. The point E on the upper curve marks the minimum cost to government, where marginal cost of an additional unit of services is equated to the marginal cost of averted violence. Formally, g^* solves

$$(8) \qquad \frac{\partial C_G}{\partial g^*} = -eu'(l + eg^*)A'_G(v^*) + D'_G(g^*) = 0 \quad .$$

Since government services and violence are both nonnegative, equilibrium service provision, g^*, lies between 0 and the value that implies zero violence (from (4)), leading to the following proposition.[15]

[14] Assuming that $B_G(m^*)$ is finite.

[15] We illustrate this with $\tilde{g}$ in Figure III which gives the value of g for which v^*=0.

Proposition 2 (Interior Solution for government services and violence): If rebel capacity is infinite then the equilibrium is violent and government provides at least some services; i.e., $g^*>0$, $v^*>0$.

Proof: Rebels optimally choose violence, $v^* = r + n + u(l+s) - u(l+eg)$ by (4). $D_G'(0)=0$ in equation (8) indicates that the government's cost curve is downward sloping at $g=0$, meaning increased spending on g is cost-reducing, so $g^*>0$. At $v^*=0$, G's cost curve is upwards sloping since $A_G'(0)=0$, thus $v^*>0$. So neither zero violence nor zero government services can characterize the optimal choice.

■

Proposition 2 therefore predicts that when rebels can produce infinite violence, government will be active, both in service provision and in monitoring.[16] This illustrates the idea of "hearts and minds" in the sense that government spending on services limits the level of violence rebels can inflict without tipping the community over to cooperation. In that interior solution, equation (8) implies that the lower the marginal cost of providing g, $D_G'(g)$, the higher will be g^*, and the less violence rebels will conduct in equilibrium, as the noncooperation constraint limits them. Less corrupt governments, for example, might be able to provide g at lower marginal cost. Similarly, the more sensitive the government is to violence (i.e., the greater is A_G'), the more public goods it will choose to provide and the less violence it will suffer.

Note the broad implication of this model: even disenfranchised noncombatants receive services. This finding is common to Popkin (1977), Akerlof and Yellen (1994), and U.S. Army (2007). It results from the optimal behavior of a government trying to motivate information sharing,

[16] Though this government suffers some violence, it is "legitimate" in the relational contract sense of Lake (2008); through a combination of service provision and monitoring it has achieved a stable equilibrium in which violence is contained.

even in the extreme case in which government is indifferent to community welfare and seeks only to suppress rebel violence.[17]

Benign Counterinsurgency and Violence

Turning to benign counterinsurgency, our simple model yields predictions about how violence and government services are related when both are chosen optimally. The first insight we've seen already; if infinite violence (i.e. the rebels winning) is avoided then Proposition 1 predicts that g will be violence-reducing when the optimal level of violence is non-zero, which it will be by Proposition 2. A second insight is that the observed correlation between violence and service provision will generally be positive.

Proposition 3 (Endogenous positive correlation of services and violence): Comparing communities with different levels of violence for exogenous reasons, the government will spend more on local public goods, g^*, when the rebel's optimal level of violence, v^*, is higher.

Proof: Solving the first order condition in (8) and applying the implicit function theorem yields

$$\frac{dg^*}{dv^*} = \frac{eu'A_G''}{D_G'' - e^2u''A_G'} > 0 \quad (9)$$

■

This result must be interpreted carefully. When other conditions leading to violence were held constant, we saw in Proposition 1 that an increase in government spending on services reduced violence. Yet when violence increases for exogenous reasons, the government will optimally respond by increasing spending in order to reduce violence. That optimal response generates a positive correlation between exogenous violence and government spending.

[17] A government that includes the welfare of residents in its objectives would provide even more services (it would have an additional incentive to increase g^* in an augmented version of (8)), and might therefore achieve zero rebel violence in equilibrium, in contrast to the prediction of Proposition 2.

To illustrate how violence and services could move together, consider the effects of an exogenous increase in the ability of rebels to retaliate or impose norms of noncooperation ($r+n$), which we will call a transition from "weak entrenchment" to "high entrenchment." Intuitively, an increase in rebel entrenchment will allow the rebels to conduct more violence, since they have more leverage over the community (in equation (4)). Government will react with an increase in the optimal level of government services, [18]

$$\frac{dg^*}{d(r+n)} = \frac{eu'A''_G}{-e^2u''A'_G + [eu']^2 A''_G + D''_G} > 0 \quad (10)$$

This comparative static is illustrated in Figure III by the two curves. The lower of the two reflects the case of weakly entrenched rebels. Government costs are low at the intercept (g=0) because v^* is low. The cost-minimizing choice at point E_W is achieved at $g=g_W^*$. The upper curve reflects more entrenched rebels, i.e., higher values of r, n, or s.

Comparing cost minimizing points E_W and E, more entrenched rebels invite more government spending; which partially dampens the higher level of violence. [19] Increases in rebel strength will thus create a positive correlation of government services and violence, as the government responds optimally to reduce violence. Thus, in comparative statics across communities with different rebel strength, corr(g^*,v^*) will be positive. To estimate the negative partial derivative of Proposition 1, rebel strength and other rebel and community characteristics must be held constant. We will estimate both the full and partial derivates below.

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[18] Substitute for v^* in (9) and apply the implicit function theorem.

[19] To see this note that $1 > \frac{dv^*}{d(r+n)} = \frac{-e^2u''A'_G + D''_g}{-e^2u''A'_G + [eu']^2 A''_G + D''} > 0$ since along the surface described by cost-minimization (8) we have $\frac{dv^*}{d(r+n)} = \frac{dv^*}{d(g^*)} \times \frac{dg^*}{d(r+n)}$.

Before turning to data and estimation, two comments about extensions. First, should the rebels be capable of only limited violence, the government may choose to engage in neither benign nor violent counterinsurgency. This idea is developed in Berman, Shapiro and Felter (2008) and used to explain the initial passive posture of U.S. forces in Iraq in terms of both m and g. Second, in the longer run a government could seek to reduce violence through other strategies, perhaps by reducing the entrenchment of rebel organizations (r and n). It might also consider reducing s, by shutting down schools, clinics and other public goods, or retaliating for noncooperation, but only at the risk of increasing norms of noncooperation. Alternatively, it could establish a reputation for prosecuting retaliators (reducing r), or improve norms of cooperating with government by treating detainees fairly. Governments which expect to remain in power for a long time would pursue these longer term strategies, while roving rebels and short term occupying forces might not bother to prosecute retaliators or improve norms of cooperation.

Overall, our "hearts and minds" model suggests three hypotheses that we can test with available data:

H_1: The same variables that predict the location of violence will also predict the location of reconstruction spending (Proposition 3).

H_2: The correlation between small-scale reconstruction spending and violence will be negative when controlling for rebel strength and community characteristics (Proposition 1).

H_3: The violence-reducing impact of small-scale reconstruction spending will be greater when government forces operate in ways that give them better knowledge of local community needs (Equation 6).

3. Data

One striking feature of the Iraqi conflict is a tremendous variation in levels of violence across the country's 104 districts. Figure IV shows the dramatic heterogeneity in monthly violence per capita from February 2004 through December 2008.

[Insert Figure IV about here.]

This section describes a new dataset on the provision of government services and conflict in Iraq. Our data include precise geo-located U.S. government data on violence against Coalition and Iraqi security forces, geo-located reconstruction spending at the project level, district-level community characteristics measured through surveys by the Iraqi Central Statistical Office (COSIT) and World Food Program (WFP), and district-level GIS data on oil reserves and infrastructure measures such as road density.[20]

Our key dependent variable is the intensity of insurgent activity measured as attacks per capita against Coalition and Iraqi government forces. The attack data are based on 193,264 'significant activity' (SIGACT) reports by Coalition forces that capture a wide variety of information about "…executed enemy attacks targeted against coalition, Iraqi Security Forces (ISF), civilians, Iraqi infrastructure and government organizations" occurring from February 2004 through December 2008. Unclassified data drawn from the MNF-I SIGACTS III Database were provided to the Empirical Studies of Conflict (ESOC) project.[21] These data provide the location, date, time, and type of attack incidents but do not include any information pertaining to the Coalition Force units involved, Coalition Force casualties or battle damage incurred. Moreover, they exclude coalition-initiated events where no one returned fire, such as indirect fire attacks not triggered by initiating

[20] Full replication data are available from the authors.
[21] ESOC is a joint project based at Princeton University and the Hoover Institution. It collects micro-data on a wide range of conflicts.

insurgent attacks. We filter the data to remove attacks we can positively identify as being directed at civilians or other insurgent groups, leaving us with a sample of 168,730 attack incidents.[22]

The SIGACT data have two relevant weaknesses. First, they capture violence against civilians and between non-state actors only when US forces are present and so dramatically undercount sectarian violence (GAO 2007, Fischer 2008, DOD 2007). As our theoretical and empirical focus is on attacks against Coalition and Iraqi forces, this does not bias our results but renders the SIGACT data less than ideal as a measure of overall violence. Second, these data almost certainly suffer from some measurement error in that units vary in their thresholds for reporting something as an incident. Fortunately, there is no evidence the error is non-random with respect to our key variables.[23]

The key independent variable in the following analysis is spending on reconstruction projects, with a focus on programs intended to provide local public goods. Data were compiled from the U.S. Army Corps of Engineers Gulf Region Division's Iraq Reconstruction Management System (IRMS). These data are unclassified and include the start date, end date, project description, funding source, type of project, and amount spent for 62,628 reconstruction projects active from March 2003 through December 2008. They cover over $25.3 billion in projects funded under a variety of programs, including DOD administered programs such as the CERP, the Iraq Relief and Reconstruction Fund (IRRF), and various State Department programs including USAID activities funded through the Economic Support Fund (ESF). Altogether, these IRMS data account for the

[22] We thank LTC Lee Ewing for suggesting the filters we applied.
[23] Kilcullen (2008) reports that attempts to reconcile the SIGACT data with unit leaders' recollections show the accuracy of the data varies widely by unit. One source of these discrepancies is that the element responsibile for making initial SIGACT reports varies across units and over time. We should expect, for example, different reporting biases from a company headquarters than from a battalion intelligence officer (S-2).

vast majority of reconstruction funds spent during the period for which we have high-resolution data on violence.[24]

To generate a measure of reconstruction spending directed towards providing local public goods, we combined spending under three programs: CERP; the Commanders Humanitarian Relief and Reconstruction Program (CHRRP); and the Overseas Humanitarian, Disaster and Civic Aid Appropriation (OHDACA). These three sources accounted for approximately $3.1 billion in spending on 29,975 individual projects. The vast majority of this spending occurred through the CERP program ($3B) and so we will use CERP to refer to spending on local public goods. For each project we averaged spending over time by dividing it evenly by the number of days between project start and project completion and then calculated a daily total for each district. These totals were then aggregated to generate district/month reconstruction spending totals. Table I provides summary statistics for reconstruction spending of different types: CERP spending; non-CERP spending; large projects; and spending by different sectors of the economy.[25] The obvious thing to note from this table is that there is a great deal of variation in the size and duration of projects.

[Insert Table I about here.]

[24] These are the most complete data available on reconstruction spending in Iraq. The difference between totals captured in IRMS and estimates of total reconstruction spending from other sources are largely due to the failure of the Coalition Provisional Authority (CPA) to keep detailed accounts of most of the reconstruction money it spent. The CPA, which ran the reconstruction effort from May 2003 until it was dissolved in June 2004, initially tracked roughly $20B in expenditures on an Excel spreadsheet (SIGIR 2008, 328). This means that errors in tracking spending are unlikely to affect our estimates, which are based on the period from 2004 onwards.

[25] Large projects include all non-CERP projects over $100,000 in total cost with a spending rate of greater than $5,000/day. Sectoral project figures include both CERP spending and spending across all other types of programs on those sectors.

4. Have US efforts to provide public goods helped?

This section seeks to answer a basic question: does the provision of public goods reduce insurgent activity? Our data also provide evidence on a specific question: have the billions of dollars the United States has spent on reconstruction in Iraq, some portion of which went to providing public goods, had any effect on violence as measured by attacks recorded by Coalition and Iraqi security forces? At first glance the answer to both questions appears to be 'no', the simple correlation between reconstruction spending and violence is positive. When, however, we control for local conditions and focus on spending intended to provide local public goods, the kind of spending our model suggests should matter, a different picture will emerge.

This section begins by examining several other predictors of violence in Iraq. We then estimate the effect on violence of spending on local public goods. Along the way, we will be able explicitly test $H_1 - H_3$, finding strong support for our 'hearts-and-minds' model.

Any analysis of the correlates of violence must normalize by population size, so we organize our data around the smallest geographic unit for which accurate population estimates are available, the district (qada).[26] The boundaries we use divide Iraq into 104 districts in 18 governorates. We use the World Food Program's well-documented population estimates generated in 2003, 2005, and 2007 as part of its food security and vulnerability analysis (WFP 2004, WFP 2005, WFP 2007).[27] Using repeated observations of the population helps minimize the probability that our results are sensitive to biases driven by the substantial population movements Iraq suffered during the war.

[26] District and governorate boundaries in Iraq have changed substantially since 2003, as has the number of districts. We calculate all district-level variables based on the most refined boundaries for which we could generate consistent population estimates. Many of these changes were politically driven and so analysts cannot assume consistent boundary definitions over time when using published district-level data.

[27] The 2003 WFP population estimates used Iraqi government birth and death rates to update figures from the 1997 census. The 2005 and 2007 estimates were adjusted based on earlier survey results. Due to massive conflict-driven population movements—between 12 and 23 percent of Iraqis have been displaced since March 2003—these estimates likely become less accurate over time (Brookings 2007; UNHCR 2008). They are, however, and improvement on using time-invariant population data which would cause us to even more severely understate the effects of conflict, as people flee areas of high violence.

Violence clearly varies along ethno-sectarian lines. Unfortunately, there are no systematic country-wide data on the ethno-sectarian mix of Iraq, so we instead use governorate-level returns in the December 2005 election. When at least 66% of the population in a governorate voted for a clearly Sunni, Shia or Kurd party, the Table classifies the districts in that governorate according to the majority group. Using that system, 61% of Iraqis lived in governorates dominated by one group in 2004, while 39% lived in the remaining (mixed) governorates, 64% of whom lived in Baghdad. Population movement since 2005 has increased geographic segregation, though we lack precise estimates.

Table II describes our variables for the estimation sample: 1040 district/half-years observations (104 districts x 10 half-years from January 2004 through December 2008). Weighted by population, we record 21% of Iraqis voting for clearly Sunni parties, 17% voting for clearly Kurdish parties and 47% voting for clearly Shia parties. The remaining votes were either cast for secular-nationalist parties (9%), for parties whose sectarian affiliation could not be identified by the Iraq experts we consulted (1%), or for parties that never received more than 1% of the vote share in any governorate (5%). "CERP" spending per resident per half-year (which includes other measures of local public good spending, as described above) averages $10.56. It varies widely across district/periods: in the second half of 2007, for example, 17 districts had no CERP spending, mostly in Shia and Kurdish regions.

[Insert Table II about here.]

Rates of attacks against Coalition or Iraqi forces also vary widely across districts and over time, averaging .59 attacks per 1000 residents per district/half-year. Most of Iraq is quiet, with incidents concentrated in a small number of districts. 193 district-halfs have no reported incidents over the sample period, spanning 44 districts. This pattern is illustrated in Figure IV, which demonstrates variation across regions in violence. Only five districts average more than three

incidents per 1000 residents: Al Daur, Hamdaniya, Mahmoudiya, Muqdadiya, and Tarmia. Among districts experiencing heavy violence there is great variation over time and high serial correlation.

Our model links characteristics of regions to levels of violence. So what characteristics of districts actually predict violence? Figure V breaks the trends in per capita violence down by sectarian mix, providing some strong intuition. Two factors stand out. First violence in Iraq is largely driven by two distinct conflicts, a sectarian conflict in mixed areas and a quasi-nationalist insurgency in Sunni areas. Second, the reduction in violence observed in 2007 was initially driven by a fundamental change in Sunni areas, one that predates any nationwide change in Coalition strategy or operational patterns.[28]

[Insert Figure V about here.]

Table III reports a first econometric investigation.[29] The most important district characteristic in predicting violence is Sunni vote share, which by itself accounts for 18% of the cross-sectional variation, as reported in column (1). A district that voted entirely Sunni is predicted to have 2.1 more incidents per 1000 than a district with no Sunni votes, which is predicted to have only 0.14 incidents, a fifteen-fold higher rate of violence. These estimates are likely biased toward zero due to measurement error, since the Sunni vote share is only a noisy measure of the true proportion Sunni in a district, especially since it is measured at the more aggregated level of a governorate.

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[28] According to some reports Coalition units in Anbar governorate anticipated many of the operational changes—dispersal of forces, more frequent dismounted patrols, and emphasis on political engagement with local leaders—that MNF-I implemented nationwide in early-2007.

[29] Standard errors in this table and in all tables that follow are robust to heteroskedasticity and clustered by district to allow errors to be correlated temporally. Since the number of districts is large there is no particular concern with temporal unit roots. Rebel and government strategies may be coordinated over areas larger than a district. For that and other reasons errors in this and other regression tables might be correlated across districts. A full treatment of spatial correlation is beyond the scope of this paper as the level of coordination across districts in Iraq varies widely given the heterogeneity of command and control structures across rebel groups and Coalition commands. As a robustness check we've also estimated this specification and those that follow with standard errors clustered at the governorate level to allow for cross-district correlation within governorates. All core results are robust to those alternatives.

[Insert Table III about here.]

Year effects are also significant, reflecting the course of the conflict. Violence increased by .19 incidents/1000 in 2005 over 2004, and further by .53 and .61 incidents/1000 in 2006 and 2007, before dropping precipitously in 2008 (all measured per half-year). Column (3) reports that most of that escalation is associated with districts that had a high Sunni vote share, as reported by the large and significant coefficients on year indicators interacted with Sunni vote share. Once these interactions are accounted for, there is no statistically significant pattern of increased violence in other Iraqi districts in 2005 and 2006, and an increase in 2007 of .23 incidents per 1000.[30] Column (4) includes the Shia vote share which picks up the slight differences in violence between Shia and Kurdish areas, both of which have low violence.[31]

The literature on civil wars suggests that competition for natural resource endowments and economic weakness are significant predictors of violence at the national level. At the local level though, it is unclear how these factors should affect violence.[32] In our model, for example, greater income might be associated with lower r—it is harder to retaliate against families that can afford guards—but higher s—rebels from economically successful areas may be able to afford higher levels of service provision. The grievance model predicts that communities disadvantaged by the war should experience more rebel violence while the opportunity cost model suggests more rebel violence where unemployment and poverty are high, at least if finding recruits is the critical constraint on rebel production of violence.

Columns (5)-(7) of Table III report the results of our efforts to assess the influence of natural resources endowments and economic grievances on violence in Iraq by adding additional

[30] This increase in 2007 likely reflects increasing efforts by Coalition forces to reduce sectarian violence.
[31] Dropping Shia vote share makes core results marginally stronger and so including it is more complete and introduces a conservative bias to the estimation.
[32] Subnational variation in resources and economic strength should predict increased violence only if they can be captured at the local level. See Fearon (2005), Dunning (2005), and Dube and Vargas (2008).

measures to the full specification of column (4). We measure natural resources two ways; price-weighted oil reserves accessible from district; and the price weighted volume of oil pipelines passing through district. The latter measure attempts to control for the availability of resource rents—either by tapping pipelines or by extorting payoffs from government officials with threats to attack pipelines. We measure economic grievances with movement between income quintiles, and measure the opportunity cost of rebellion using unemployment and the proportion of a district's population in the bottom two national income quintiles.[33] Neither resource nor economic grievance variables are significant predictors of violence when entered individually (not shown) and when included jointly they do not make a substantial contribution to model fit when compared to column (4).

Measures of opportunity costs yield significant coefficients in the opposite direction from that predicted by the opportunity cost model. We discuss these findings in depth in a separate paper, which reports the same negative correlation in an analysis of the Philippine insurgency (Berman, Felter and Shapiro 2009). For now we note that this finding is consistent with the core premise of our model—that non-combatants' propensity to share information is the key constraint on rebels—provided that coalition intelligence dollars buy more information where there is greater poverty and unemployment.[34] Importantly, this finding is inconsistent with the notion that recruiting fighters is the key constraint on rebels in Iraq, reinforcing our decision not to model a manpower constraint for rebels.[35]

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[33] Unemployment and poverty measures generated from WFP surveys in 2003, 2005, and 2007. Values for 2004 and 2006 are based on population-weighted interpolation.

[34] Note this is a separate mechanism from the one modeled in section II and tested in the remainder of this section, that coalition efforts to provide small-scale public goods can motivate the community to greater information sharing. The interaction of CERP spending and unemployment does have the negative sign we would expect if CERP spending helped buy information, but while unemployment and its interaction with CERP are jointly significant ($p < .06$), the coefficient estimates are not significant at the 10% level.

[35] This finding is consistent with Hanson, Iyengar, and Monten (2009) who argue that exogenous increases in CERP spending—which they posit create short-term improvements in local labor markets—lead to little change in overall levels of attacks but a clear substitution from labor-intensive to capital-intensive attacks.

The government in our model chooses public goods provision, g^*, based on rebel strength ($s+r+n$) to the extent that rebel strength can be predicted. The strongest predictor of rebel strength is, quite naturally, the district's history of violence against Coalition and Iraqi forces. Table IV reports that lagged incidents in the previous half-year are an excellent predictor of current incidents. The first column shows that lagged incidents predict 72% of the variance in incidents by themselves. As in the previous table, the proportion Sunni predicts more incidents, and year effects and interactions provide extra predictive power. Variables measuring natural resources, economic grievances, and unemployment add no explanatory power.

[Insert Table IV about here.]

The first testable implication of our model was that optimal government (in this case U.S. government) spending on local public services increases with rebel strength. We can test H_1 by seeing if variables that predict violent incidents also predict CERP spending (i.e., spending on local public goods). Table V reports the result of that test, using the same variables that predict violent incidents in Table IV to predict CERP spending per capita. In the first column of results we see that a (hypothetical) entirely Sunni district would receive $16.01 in CERP spending per resident per half year, more than twice the average in other areas. That difference is statistically significant. Year indicators show increases in spending over time (not reported), by $8.44 per capita in 2005 over 2004, dropping slightly in 2006, jumping $6.07 in 2007, and then dropping by $2.95 in 2008. The only major difference between these results and the predictors of violence in Table IV is that voting for Shia parties predicts spending (but not violence), which might have to do with the Shia-dominated government rewarding governorates that strongly support it. As in the equation predicting violence, unemployment is an insignificant predictor. Overall, this is consistent with the idea that CERP spending is aimed at districts where the potential for violence is high.

[Insert Table V about here.]

Consistent with the results in Table IV, the strongest predictor of CERP spending is lagged violent incidents, which is highly significant and increases the predictive power of the model to 22% (column (4)). Each incident /1000 predicts an additional $5.00 in CERP spending in the subsequent half year (controlling for vote shares, year effects and their interaction). As we should expect, little spending goes to areas with no violence. In the second half of 2007 fifteen districts had no violent incidents recorded; nine of these received no CERP spending. These results should not be surprising, the program is built to serve the needs of coalition forces. We interpret this as supportive evidence for the idea that CERP spending behaves like g^* in the model, it increases in the equilibrium level of violence, the v^* chosen by rebels and does not seem to be motivated by economic needs—as conventional development assistance would be.

This empirical finding reflects the combination of several implications of the model illustrated in Figure III: the contrast between g in nonviolent and violent equilibria (g^{**} and g^*) and the extent to which the optimal g increases in rebel strength ($s+r+n$).

Evaluating the Effect of CERP Spending

We turn now to testing the main implication of the model, that conditional on rebel strength, CERP spending reduces violence (H_2). Our empirical challenge is to find a way to carry out the conditioning --a standard selection bias issue in evaluating treatment effects. Table VI reports the result of analyzing the effect of CERP spending on incidents by estimating the coefficient β in

$$(8) \qquad v_{it} = \alpha_i + \beta g_{it} + \gamma' \mathbf{z}_{it} + \varepsilon_{it} \ .$$

Here v is violence, as measured by incidents, g is CERP spending, $\mathbf{z}$ is a vector of control variables, including year indicators and their interaction with the Sunni vote share, the subscript i represents one of 104 Iraqi districts (qada) and t counts half-years from 2004 through 2008.

[Insert Table VI about here.]

The first column reports the coefficient of a simple regression of incidents on CERP spending, which is positive. We interpret this as reflecting the selection effect that we saw in Table V: districts with predictable violence received high CERP spending, so that the positive correlation should probably be understood as predicted violence (i.e., high α_i districts) attracting high spending. Consistent with that interpretation, the coefficient on CERP spending declines by about a third in the second column, where we condition on the predictors of violence from Table III: proportion Sunni, proportion Shia, year indicators and interactions. This is again consistent with the idea that these other predictors proxy for the omitted variable – rebel entrenchment – reducing positive selection bias in the CERP coefficient. Column (3) adds time x ethnicity controls, which further reduce the size of the estimated coefficient.

To account more fully for possible selection of CERP into predictably violent areas we estimate a first-differenced version of equation (8), augmented with controls for pre-existing trends,

$$(9) \qquad \Delta v_{it} = \delta_i + \beta \Delta g_{it} + \gamma' \Delta \mathbf{z}_{it} + \phi \Delta v_{it-1} + \Delta \varepsilon_{it} ,$$

where the Δ operator indicates a half-year difference within districts ($\Delta x_{it} = x_{it} - x_{it-1}$). Column (4) reports the result of the first differences regression which eliminates possible selection bias in levels by differencing out district fixed effects (α_i). The resulting coefficient on CERP becomes negative and statistically significant, at -.0095. That negative estimate is consistent with H_2 the prediction of Proposition 1; *conditional on district characteristics, government spending on public goods reduces violence*.

Another source of potential selection bias comes from the predictable trends in violence, that could potentially affect CERP spending. To control for these we take two approaches, including both lagged changes in violence (Δv_{it-1}) in column (5), and district-specific trends (δ_i) in column (6). While lagged changes in violence do have some predictive power, their inclusion has little effect on the estimated coefficient on CERP spending, which becomes only slightly more negative, at -.0111.

Including district-specific trends has little effect on the CERP coefficient. Overall, that estimate is negative and robust to the inclusion of trend terms, which is to say that CERP is violence reducing.

Figure VI provides a graphic intuition for these results. Each figure plots insurgent violence not predicted by the control variables on the y-axis and reconstruction spending not predicted by the control variables on the x-axis.[36] The left panel replicates column 3 from table VI, the center panel replicates the first-differences estimate from column 4 of table VI, and the right panel shows the first differences estimate for 2007 through 2008, which we will see in table VII. Three patterns stand out in figure VI. First, in accordance with H_1 (Proposition 3), there is a positive relationship between CERP spending and violence when we do not control the strategic allocation of aid based on rebel strength and community characteristics. Second, in accordance with H_2 (Proposition 1), when we aggressively control for selection using first differences, government spending on public goods appears to be violence reducing. Third, the violence-reducing effect of CERP becomes stronger from January 2007 on. So what changed?

In early 2007 U.S. forces in Iraq began to implement both an increase in troop strength (the "surge") and a set of operational changes including increased dispersal of forces, more dismounted patrols, and a greater emphasis on engaging with local political leaders. In Baghdad, for instance, US combat forces moved from large bases outside the city in January 2007 to occupying over 60 "combat outposts" spread throughout the city in May 2007. While the extra troops were disproportionately deployed in Baghdad and the immediate vicinity, the operational changes were implemented throughout the country. In the spirit of our model, those operational changes should help officials allocating CERP develop better information about community needs, amounting to an

[36] Observations more than four standard deviations from the conditional mean have been dropped for visual clarity. This does not affect the substantive results but dropping outliers does slightly alter the coefficient estimates for the models used in the figures relative to those in tables VI and VII.

improvement in the effectiveness of public goods provision, e in our model.[37] In accordance with H_3 (Equation 6), it appears that the violence-reducing impact of small-scale reconstruction spending is greater from January 2007 on.

To flesh out this result table VII repeats our analysis for the pre- and post-"surge" phases of the sample period, 2004-2006 and 2007-2008, respectively. In the first subperiod the coefficient on CERP spending is weakly positive in a differenced specification but becomes statistically zero when pre-existing trends are allowed for, indicating possible selection bias in CERP spending but also suggesting that CERP was not violence reducing for three years between 2004 and 2006. In contrast, in the period from 2007 on the coefficient on CERP is strongly negative (-.0176 in column (4)) and remains strongly negative when pre-existing trends and district specific trends are adjusted for. The rightmost column reports a formal test of the difference in coefficients across periods, comparing those with the full set of controls (in columns (3) and (6)): the increased effectiveness in CERP associated with the surge period is -0.0199, and statistically significant. The table indicates that (even if some selection bias were to remain) CERP spending became much more effective in reducing violence in the latter period, implying that the conditions under which development aid is delivered are critical to its' effectiveness.

[Insert Table VII about here.]

To quantify the estimated effect of CERP in column (6), it implies that an additional dollar of per capita CERP spending causes 1.59 less violent incidents per 100,000 residents, both over the span of half a year. To put that coefficient in context, average incidents per capita are 58.6 per 100,000 residents during the entire period, or about $37 (=58.6/1.59) per capita of CERP, at the effectiveness rate in the later period.

[37] Recall that the cross-partial derivative of violence with respect to e and g in the model is ambiguously signed but will generally be negative when the utility of the community in services is not too concave, a condition likely to exist in Iraq where basic public goods are sorely lacking.

Compared to an estimated effect which is statistically zero in the initial period, the post 2007 coefficient represents a major improvement. We interpret this change as reflecting the negative partial derivative of violence on CERP that our model predicted from an increase in government effectiveness at providing public goods as government forces began operating in ways that gave them better knowledge of community needs.

Alternative Explanations

An alternative explanation for the increased estimated effectiveness of CERP spending is that CERP merely proxies for coercive violence-reducing activity in a region, especially since the summer of 2007. If that were true, then non-CERP projects should just as plausibly serve as proxies. Table VIII reports a test of that implication.

[Insert Table VIII about here.]

Column (1) repeats the main first difference result for CERP spending, from tables VI and VII, in both the full and the post surge period. Column (2) reports the results of the same first-differenced regression for non-CERP reconstruction spending (as described in Table I). Unlike CERP, non-CERP spending shows a small and insignificant coefficient in the 2007-2008 period. The same is true of large non-CERP projects, reported in column (3). Columns (4) through (8) study five different categories of non-CERP reconstruction spending. Only one of these categories yields a negative and statistically significant in panel B (water and sanitation projects with $p = .085$). If CERP were merely proxying for coercive activity, then these seven non-CERP coefficients should have been as large and negative as that for CERP, leading us to reject that conjecture.

A second alternative hypothesis is that our CERP results reflect a force-level effect, i.e., that the increase in U.S. forces from January 2007 on, rather than the change in tactics, made CERP spending more productive. Since most of the additional forces were deployed in and around

Baghdad we can test this possibility by repeating the analysis in Table VIII with the nine districts in Baghdad removed. Table IX reports those results. When we look at the rest of Iraq, where the increase in troop strength was relatively small and substantially less concentrated, we see essentially the same results: CERP spending has a significantly negative effect on violence; non-CERP spending and large projects do not; only one of the five subcategories of non-CERP spending show a significant coefficient (this time education). The same result obtains if we exclude all districts that received surge forces from the analysis (not reported). Surge forces, and forces in general, were concentrated in areas with large Sunni populations, yet the effectiveness of CERP spending in the post-surge period is unrelated to the proportion Sunni in a district (not reported). We conclude that the increased violence-reducing effect of CERP must be due more to a change in tactics associated with the "surge" than to increased force-levels. Taken together, the results in tables VIII and IX provide strong evidence that a true change in the effectiveness of CERP, e in our model, drives a CERP-associated decline in violence.

[INSERT TABLE IX ABOUT HERE.]

In interpreting our results it is important to keep in mind the measurement error inherent in the SIGACT data. Conversations with former battalion and brigade staff officers suggest that the proportion of true incidents recorded as SIGACTs drops as the intensity of violence rises. A battalion with elements in contact forty times over a three-day period might report only thirty incidents, while a battalion with elements in contact three times over the same period is likely to report every incident. Even if the rate of undercounting is constant this form of measurement error biases coefficient estimates downwards in levels, introducing a conservative bias to our estimation.

Another potential source of bias in these data is that SIGACTs capture criminal violence attracted by CERP spending.[38] To the extent that the provision of CERP incentivizes criminal violence, it will introduce measurement error whose magnitude is positively correlated with CERP, biasing against observing a violence-reducing effect of CERP. This conservative bias lends additional credence to our findings. With the data in hand these conditional estimates are as close as we have come to estimates of dv^*/dg^* and $\partial v^*/\partial g$ in the model, the full and partial effects of local public good spending on violence.

A final use of our model is its ability to account for the changes in violence that occurred in 2006 and 2007. Returning to Figure V, which summarizes monthly incidents per capita by sectarian affiliation across Iraq, note that the downward trend in violence in Sunni areas—which accounts for most of the downward trend through 2007—substantially predates any changes in nation-wide Coalition counterinsurgency practices. The changes in late-Summer 2006 do coincide with the well-documented decision by local leaders in Anbar governorate to turn against foreign militants and begin sharing information with coalition forces. In the context of our model, this amounts to an exogenous change in community norms about cooperation, n.

5. Conclusion

Since March 2003 at least 100,000 civilians have been killed during the conflict in Iraq, between two and four million people have been displaced, thousands of Coalition and Iraqi soldiers have died, and hundreds of billions of dollars have been spent to fight the war and try to rebuild the shattered Iraqi state. Against this tragic background our goal is not to judge whether the U.S. and its allies

[38] In central Baghdad in 2006, for example, a battalion used CERP funds to pay for garbage collection, exactly the kind of visible, small-scale public good the model suggests should reduce violence. The garbage trucks were soon attacked, and the attacks duly entered into the SIGACT data. After some investigation, the battalion commander learned that the attackers were not insurgents, but criminals directed by the owner of a competing garbage collection firm vying for a piece of the lucrative CERP contract! Private communication, COL Jeffrey Peterson, September 17, 2008.

could have better supported the development of political order in Iraq. Rather, given the prospect that rebuilding conflict and post-conflict states will remain a central policy objective, we seek to identify conditions under which providing local public goods will help rebuild social and economic order in future conflicts.

To do so we developed a model of insurgency as a three-party struggle over information. Government seeks to fight the insurgency through military means and by providing services, public goods, to motivate the community to share information, which in turn enhances the effectiveness of military counterinsurgency. Rebels seek to persuade the population to refrain from sharing information by providing competing services, retaliating against those who do share, and by restraining their violence to the level the community will tolerate. The community shares information if the benefits of doing so outweigh the costs.

This simple framework generates a number of testable predictions about service provision and violence. We tested that model using new data at the district level from the conflict in Iraq.

Several results stand out. First, the conflict in Iraq is concentrated in a very few areas. Second, the timing of violence varies greatly within these areas. While overall violence in Sunni governorates began dropping precipitously in October 2006, the decline in key areas such as Balad and Tikrit did not begin until mid-2007. Third, the dynamics of conflict are fundamentally different in Sunni areas, where the conflict looks like a quasi-nationalist insurgency, as opposed to the sectarian conflict driving violence in mixed areas.

Our results support the model in that regional spending on public goods is unconditionally correlated with greater violence. This makes sense from both military and theoretical points of view. From a military perspective, commanders invest more resources where their soldiers are frequently attacked. From a theoretical perspective, our model predicts higher investments in public goods where local conditions dictate that the community will tolerate higher levels of insurgent violence.

Importantly though, once we condition on community characteristics, we find that greater service provision leads to less violence.

This violence-reducing effect becomes substantially stronger from January 2007 onwards when operational changes meant that Coalition forces nation-wide had a better understanding of their communities' needs. In that period every additional dollar per capita of CERP spending predicted 1.59 less violent incidents per 100,000 population per half year. While this may seem to be a relatively small coefficient, three points should be kept in mind. First, it may underestimate of the effect of CERP because of biases in estimation that we cannot (yet) treat. Second, it represents an average across programs and regions, some of which were not very violent to start with. Third, if interpreted causally, mean violence in Iraq over the entire period (58.6 incidents per 100,000 per half year) is equivalent to about $37 per capita per half year of CERP spending.

The larger message for understanding insurgencies is this: the increased efficacy of government spending when accompanied by a more effective military strategy is evidence for a "rational peasant" model –of insurgents constrained by noncombatants--, as opposed to explanations based on individual grievances or on opportunity costs of rebellion.

Our analysis also carries an important caution for policy makers: an observed positive relationship between service provision and violence does not imply that service provision makes things worse. Optimal distribution of aid would dictate exactly that type of selection, delivering it to where it is most violence-reducing. Efforts to understand the effects of nonviolent measures on conflict outcomes must explicitly take into account that selection bias.

Finally, these results have at least two important implications for future research. First, more attention needs to be paid, analytically and empirically, to factors that influence the returns to service provision. In a world where reconstruction and governance aid are severely lacking, governments and aid agencies require better guidance on where investments in service provision will yield the

highest returns in terms of social order and reduced violence. We are currently investigating that question with more detailed data on reconstruction spending. Second, the impact of economic activity on violence in Iraq is not consistent with a simple opportunity cost explanation for rebel violence. Understanding the observed negative correlations of both unemployment and poverty to violence requires a more nuanced understanding of the constraints on rebel organizations and the impact of economic activity on those constraints. Progress on these issues will go a long way towards addressing a central question in both development and counterinsurgency—how to effectively provide basic governance to residents of conflict areas.

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Tables and Figures

Table I: U.S.-Funded Reconstruction Projects

	Project Type			Project Sector				
	Non-CERP Projects	CERP Projects	Large Projects	Education	Electricity	Health	Transportation	Water & Sanitation
Mean cost *($,000)*	678	104	7,588	97	187	242	207	500
s.d. *($,000)*	5,435	425	18,379	390	544	973	646	502
Mean duration *(days)*	232	87	281	256	91	190	138	157
s.d.	237	103	279	342	100	304	180	193
N	32,653	29,975	2,469	4,825	1,814	1,487	2,580	5,526

Source: U.S. Army Corps of Engineers Gulf Region Division's Iraq Reconstruction Management System (IRMS) database, October 2, 2009. 860 projects dropped due to suspect coding in original data source. Statistics for all projects active between 1 January 2004 and 31 December 2008. Large projects are non-CERP projects over $100,000 in total cost with a spending rate of greater than $5,000/day. List of sectors is not exclusive.

Table II: Summary Statistics

	Variable	Observations	Weight	Mean	Std. Dev	Min	Max
	Incidents per 1000	1040	288,023,728	0.586	1.253	0	22.754
Ethnicity	Sunni vote share	18	28,104,187	0.210	0.252	0	0.917
	Shia vote share	18	28,104,187	0.466	0.351	0	0.902
	Kurdish vote share	18	28,104,187	0.171	0.326	0	0.993
Reconstruction Spending	CERP projects, $ per capita	1040	288,023,728	10.562	17.159	0	552.814
	Non-CERP projects, $ per capita	1040	288,023,728	68.856	124.632	0	10840.8
	Large projects, $ per capita	1040	288,023,728	57.750	115.165	0	10813.0
	Education projects, $ per capita	1040	288,023,728	0.461	2.127	0	33.107
	Electricity projects, $ per capita	1040	288,023,728	0.003	0.105	0	9.944
	Health projects, $ per capita	1040	288,023,728	0.872	2.450	0	45.795
	Transportation projects, $ per capita	1040	288,023,728	0.743	2.858	0	89.415
	Water & Sanitations projects, $ per capita	1040	288,023,728	6.981	68.294	0	10830.4
Economy	Unemployment rate	312	84,647,702	0.096	0.069	0	0.495
	Proportion of pop. In 1st or 2nd inc. quint.	304	84,181,884	39.686	14.555	5	80
	Inc. quintile change, 2002-04	100	26,637,385	-0.012	0.394	-1.6	1.925
Natural Resources	Oil and gas reserves, price weighted	1040	288,023,728	0.0012	0.002	0	0.017
	Pipeline volume, price weighted	1040	288,023,728	13.143	29.218	0	250.963

Note: Means weighted by World Food Program district population estimates. Vote shares are from December 2005 elections at the governorate level. Unit of observation for time-varying data is the district/half-year. Summary statistics for variables based on survey data are weighted by population during survey. Economy variables are based on surveys fielded in 2004:I, 2005:II, and 2007:I.

Table III: Predictors of Violent Incidents against Coalition and Iraqi Forces

Dependent variable: Incidents/1000	Baseline specifications				Natural Resources	Economic Grievance	Opportunity Costs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sunni share	2.123***	2.114***	0.915***	1.113***	1.141***	1.106***	1.495***
	(0.29)	(0.29)	(0.14)	(0.15)	(0.16)	(0.14)	(0.24)
2005		0.191***	-0.0745*	-0.0761*	-0.0660	-0.0739*	0.347*
		(0.064)	(0.043)	(0.042)	(0.045)	(0.042)	(0.20)
2006		0.531***	-0.0215	-0.0231	-0.00518	-0.0243	0.439*
		(0.15)	(0.12)	(0.12)	(0.13)	(0.12)	(0.22)
2007		0.608***	0.230**	0.229**	0.252**	0.225**	0.571***
		(0.12)	(0.10)	(0.10)	(0.11)	(0.10)	(0.18)
2008		0.0279	0.0246	0.0229	0.0632	0.0191	0.144**
		(0.040)	(0.034)	(0.034)	(0.041)	(0.035)	(0.064)
Sunni shr x 2005			1.321***	1.328***	1.344***	1.308***	1.154***
			(0.29)	(0.29)	(0.28)	(0.30)	(0.29)
Sunni shr x 2006			2.689***	2.696***	2.720***	2.729***	2.877***
			(0.78)	(0.78)	(0.77)	(0.80)	(0.78)
Sunni shr x 2007			1.857***	1.864***	1.895***	1.905***	2.111***
			(0.40)	(0.40)	(0.39)	(0.41)	(0.44)
Sunni shr x 2008			0.0713	0.0777	0.127	0.0818	0.202
			(0.25)	(0.26)	(0.29)	(0.26)	(0.32)
Shia share				0.251*	0.268*	0.324*	0.791***
				(0.14)	(0.14)	(0.18)	(0.28)
Oil and gas reserves, price weighted					-6.382		
					(21.1)		
Pipeline volume, price weighted					-0.00323*		
					(0.0017)		
Inc. quint. change, 02-04						-0.204	
						(0.20)	
Unemployment rate							-3.778**
							(1.76)
Prop. of pop. in 1st or 2nd inc. quint.							-0.0125**
							(0.0048)
Constant	0.144**	-0.129**	0.110***	-0.0479	-0.0356	-0.0809	0.396**
	(0.067)	(0.059)	(0.035)	(0.069)	(0.066)	(0.090)	(0.16)
Observations	1040	1040	1040	1040	1040	1000	1008
R-squared	0.18	0.22	0.26	0.27	0.27	0.27	0.32
MSPE, 10-fold CV	3.19	3.08	2.96	2.96	2.94	2.99	2.84

Robust standard errors in parentheses, clustered by district. Results are robust to clustering by governorate instead. Regressions weighted by estimated population. Coefficients on accessible oil, pipeline volume and income quintile are statistically insignificant when entered one at a time.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table IV: Serial Correlation in Violent Incidents

Incidents per 1000	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
Incidents/1000 Lagged ½ year	0.848***	0.855***	0.819***	0.832***	0.824***
	(0.0187)	(0.0186)	(0.0266)	(0.0235)	(0.0244)
2005		-0.0812**	-0.0770*	-0.0860**	-0.000995
		(0.0396)	(0.0411)	(0.0374)	(0.0532)
2006		0.108*	0.118**	0.0266	0.0853
		(0.0551)	(0.0588)	(0.0570)	(0.0696)
2007		-0.196**	-0.169**	0.0998	0.136*
		(0.0777)	(0.0722)	(0.0696)	(0.0741)
2008		-0.379***	-0.369***	-0.105*	-0.0884*
		(0.0724)	(0.0718)	(0.0549)	(0.0532)
Shia vote share			0.0214	0.0172	0.0827*
			(0.0275)	(0.0260)	(0.0498)
Sunni vote share			0.426***	0.924***	0.966***
			(0.0811)	(0.135)	(0.141)
Sunni x 2005				0.00385	-0.0259
				(0.243)	(0.244)
Sunni x 2006				0.388	0.426
				(0.419)	(0.430)
Sunni x 2007				-1.358***	-1.311***
				(0.495)	(0.490)
Sunni x 2008				-1.308***	-1.267***
				(0.238)	(0.253)
Oil and gas reserves, price weighted					-0.611
					(3.640)
Pipeline volume, price weighted					-0.000142
					(0.000245)
Inc. quint. change, 02-04					-0.0275
					(0.0396)
Unemployment rate					-0.778*
					(0.452)
Constant	0.0923***	0.214***	0.126***	0.0261	0.0264
	(0.0193)	(0.0418)	(0.0343)	(0.0233)	(0.0273)
Observations	936	936	936	936	900
R-squared	0.72	0.74	0.74	0.76	0.77

Robust standard errors in parentheses, clustered by district. Results are robust to clustering by governorate instead. Regressions weighted by estimated population. Coefficients on oil and gas reserves, pipeline volume, income change, and unemployment are jointly insignificant in column (5), $F_{4,99} = 1.41$.
*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table V: Spending on Local Public Goods – Ethnicity, lagged violence, and alternative explanations

CERP per capita	Baseline specifications				Natural Resources	Economic Grievance	Opportunity Costs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Year Fixed Effects	N	Y	Y	Y	Y	Y	Y
Year * Sect FE	N	N	Y	Y	Y	Y	Y
Sunni vote share	16.01***	15.76***	11.41***	11.59***	12.18***	9.311***	11.97***
	(4.207)	(4.301)	(3.077)	(3.686)	(3.583)	(2.770)	(3.575)
Incidents/1000 6 mo. Lag				5.001***	4.970***	4.763***	4.177***
				(1.430)	(1.434)	(1.359)	(1.162)
2005		8.436***	11.41***	11.59***	12.18***	9.311***	11.97***
		(1.810)	(3.077)	(3.686)	(3.583)	(2.770)	(3.575)
2006		7.801***	6.050***	4.991***	4.901***	5.300***	5.850***
		(0.892)	(1.879)	(1.549)	(1.631)	(1.510)	(2.228)
2007		13.87***	5.788***	5.088***	4.898***	5.303***	5.778***
		(2.595)	(1.119)	(1.228)	(1.159)	(1.209)	(1.372)
2008		10.92***	10.39***	8.619***	8.372***	8.491***	9.010***
		(2.211)	(2.786)	(2.235)	(2.222)	(2.210)	(2.501)
Sunni x 2005			7.846***	7.184***	7.273***	6.010*	7.366***
			(2.807)	(2.537)	(2.371)	(3.040)	(2.746)
Sunni x 2006			11.85***	3.180	3.424	1.462	1.634
			(3.969)	(3.011)	(2.984)	(2.197)	(2.067)
Sunni x 2007			10.06**	-4.521	-4.055	-5.636	-5.061
			(4.304)	(5.370)	(5.358)	(5.089)	(4.958)
Sunni x 2008			17.05	-3.030	-2.401	-0.183	0.873
			(11.37)	(11.37)	(11.34)	(10.94)	(10.81)
Accessible oil, price weighted					564.9		
					(447.3)		
Pipeline volume, price weighted					-0.0278		
					(0.0237)		
Inc. quint. change, 02-04						1.986	
						(2.591)	
Unemployment rate							-4.031
							(12.46)
Prop. of pop. in 1st or 2nd inc. quint.							-0.155*
							(0.0796)
Constant	7.232***	-1.100	-3.945**	-2.975*	-3.328**	-2.068	3.113
	(1.478)	(0.895)	(1.782)	(1.629)	(1.370)	(1.647)	(2.990)
Observations	1040	1040	1040	936	936	900	908
R-squared	0.05	0.13	0.15	0.22	0.22	0.26	0.29

Robust standard errors in parentheses, clustered by district. Results are robust to clustering by governorate instead. Regressions are weighted by estimated population. Regressions with sect/year interactions include Shia vote share.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table VI: Violent Incidents and Spending on Local Public Goods

Incidents per 1000	------ *2004-2008* ------					
	(1)	(2)	(3)	(4)	(5)	(6)
Basic controls		Y	Y			
Time controls			Y	Y	Y	Y
First differences				Y	Y	Y
Pre-existing trend (Δv_{t-1})					Y	Y
District specific trends						Y
CERP per Capita	0.0213*** (0.004)	0.0147*** (0.0038)	0.0115*** (0.0040)	-0.00945** (0.0043)	-0.0111** (0.0043)	-0.0110** (0.0046)
Pre-existing trend (Δv_{t-1})					0.195** (0.080)	0.192** (0.087)
Constant	0.361*** (0.085)	0.306** (0.13)	0.262** (0.10)	0.217*** (0.046)	-0.124*** (0.041)	0.0890** (0.042)
Observations	1040	1000	1000	936	832	832
R-squared	0.08	0.25	0.33	0.17	0.21	0.21
MSPE (10-fold CV)	3.52	3.05	2.81	4.77	4.95	5.25

Robust standard errors in parentheses, clustered by district. Results are robust to clustering by governorate instead. Regressions weighted by estimated population. Basic controls include sect, unemployment, and income variables (as in Table V). Time controls include year indicators and their interaction with Sunni vote share (as in Table V). District specific trends are district effects in a differenced specification. Basic controls are dropped from first-differenced specifications as they do not vary on a semi-annual basis.
*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table VII: Violent Incidents and Spending on Local Public Goods, by Period

	------ 2004-2006 ------			*------ 2007-2008 ------*			*-2004-2008-*
Incidents per 1000	(1)	(2)	(3)	(4)	(5)	(6)	(7) Diff-in-Diff
Time controls	Y	Y	Y	Y	Y	Y	Y
First differences	Y	Y	Y	Y	Y	Y	Y
Pre-existing trend (Δv_{t-1})		Y	Y		Y	Y	Y
District specific trends			Y			Y	Y
CERP Per Capita	0.00724* (0.0040)	0.00348 (0.0035)	0.00400 (0.0026)	-0.0176*** (0.0059)	-0.0181*** (0.0059)	-0.0159*** (0.0057)	0.00400 (0.0026)
Pre-existing trend (Δv_{t-1})		0.429** (0.18)	0.0258 (0.21)		0.127* (0.072)	0.0182 (0.066)	0.0258 (0.21)
CERP per Capita, post-2006							-0.0199*** (0.0069)
Pre-existing trend (Δv_{t-1}) post-2006							-0.008 (0.196)
Constant	0.161*** (0.038)	0.0625 (0.038)	0.231*** (0.034)	-0.0639 (0.059)	-0.0887 (0.059)	-0.0748 (0.048)	-0.139 (0.035)
Observations	520	416	416	416	416	416	832
R-squared	0.13	0.24	0.53	0.13	0.14	0.38	0.45
MSPE (10-fold CV)	4.28	4.25	4.78	5.18	5.42	5.47	5.06

Robust standard errors in parentheses, clustered by district. Results are robust to clustering by governorate instead. Regressions are weighted by estimated population. All regressions include year indicators and their interaction with Sunni vote share (as in Table V). District specific trends are district effects in a differenced specification, as in equation (9). The differences in differences specification in column 7 allows separate district specific trends in each period.
*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table VIII: Additional spending categories – first differences

	CERP	Non-CERP	Large	Education	Electricity	Health	Transportation	Water and Sanitation
A: 2004 - 2008								
Spending per capita	-0.0095**	0.0002	0.0002	-0.0214	-0.1345	0.0082	-0.0034	-0.000023
	(0.0043)	(0.0002)	(0.0002)	(0.0181)	(0.0094)	0.0114	(0.0041)	(0.000032)
R-squared	0.17	0.15	0.15	0.15	0.15	0.15	0.15	0.14
Observations	936	936	936	936	936	936	936	936
B: 2007 – 2008								
Spending per capita	-0.0176***	-0.0006	-0.0005	-0.0266	-0.0339	0.0363	-0.0090	-0.0094*
	(0.0059)	(0.0006)	(0.0005)	(0.0266)	(0.0213)	(0.0396)	(0.077)	(0.0054)
R-squared	0.13	0.03	0.03	0.03	0.04	0.03	0.03	0.03
Observations	416	416	416	416	416	416	416	416

Panel A specifications include year indicators and their interactions with Sunni vote share. Panel B includes an indicator for 2008 and its interaction with Sunni vote share. Robust standard errors in parentheses, clustered by district. Regressions are weighted by estimated population. *** significant at 1% level; ** significant at 5% level; * significant at 10% level

Table IX: Additional spending categories, Baghdad omitted – first differences

	CERP	Unconditional	Large	Education	Electricity	Health	Transportation	Water & Sanitation
A: 2004 - 2008								
Spending per capita	-0.0094	0.0002	0.0002	-0.0122	-0.0159	0.0063	-0.0053	-0.000021
	(0.0057)	(0.0002)	(0.0002)	(0.0171)	(0.0117)	(0.0110)	(0.0031)	(0.000029)
R-squared	0.19	0.17	0.17	0.17	0.17	0.17	0.17	0.17
Observations	855	855	855	855	855	855	855	855
B: 2007 – 2008								
Spending per capita	-0.0172**	-0.0005	-0.0004	-0.0479*	-0.0366	0.0561	-0.0079	-0.0057
	(0.0084)	(0.0006)	(0.0005)	(0.0259)	(0.0276)	(0.0443)	(0.0073)	(0.0056)
R-squared	0.13	0.04	0.04	0.05	0.06	0.05	0.04	0.04
Observations	380	380	380	380	380	380	380	380

Panel A specifications include year indicators and their interaction with Sunni vote share. Panel B includes an indicator for 2008 and its interaction with Sunni vote share. Robust standard errors in parentheses, clustered by district. Regressions are weighted by estimated population. Five additional combat brigades were ordered to Iraq beginning in January 2007, including approximately 20,000 additional troops. One brigade deployed each month from January through May with all in place by late June 2007. Two of five brigades deployed to Baghdad and the remaining three deployed within 30 miles of the capital, across five provinces.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level

Figure I: The utility of a noncombatant community from sharing information

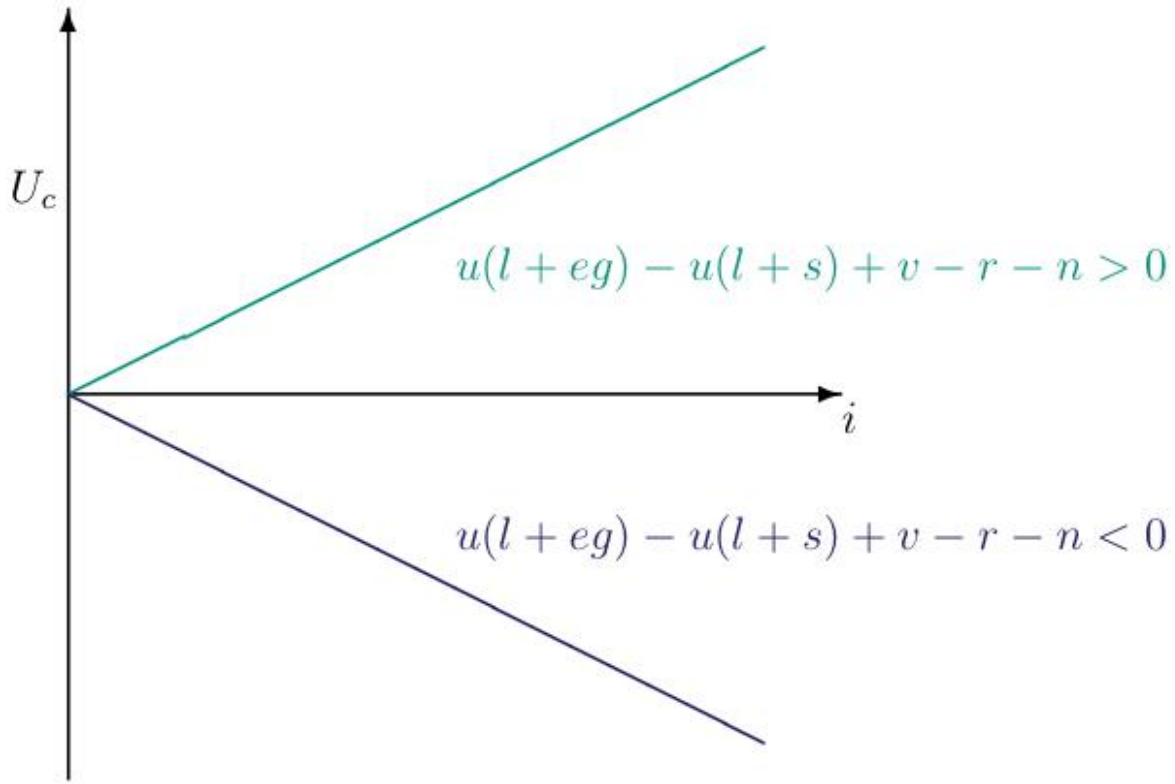

Figure II: The utility of rebels from violence

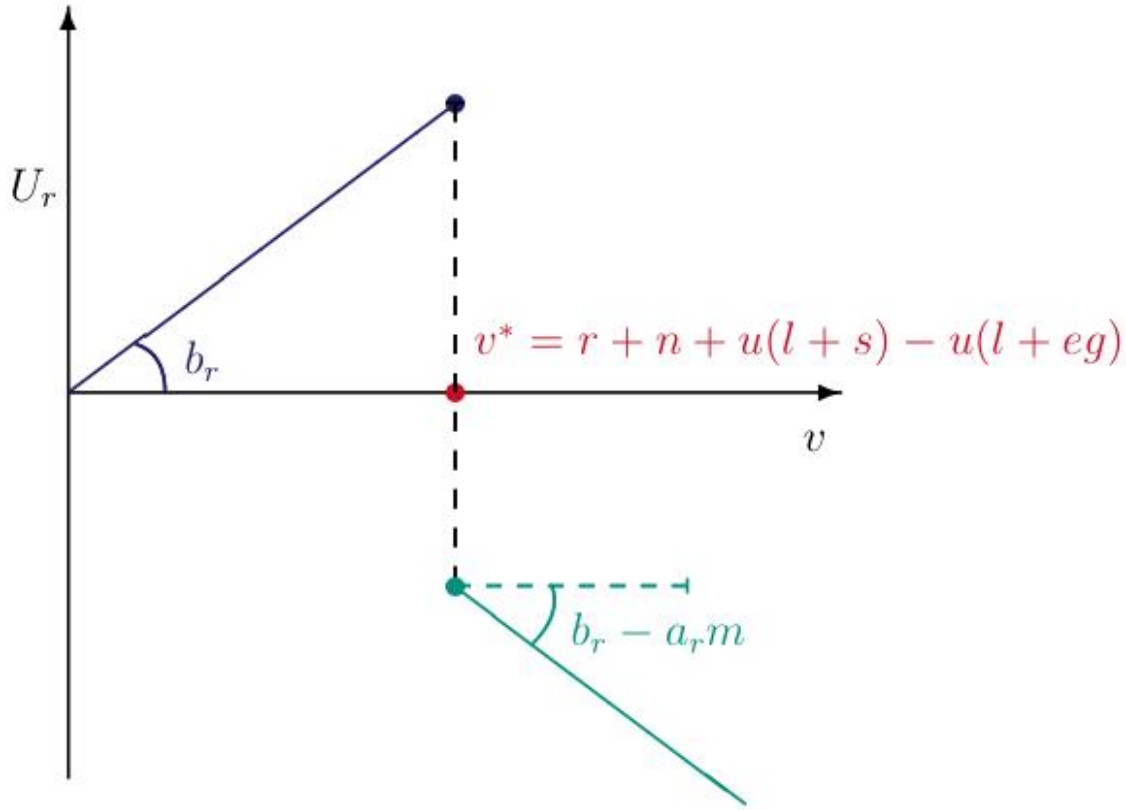

Figure III: Government spending increases with rebel entrenchment.

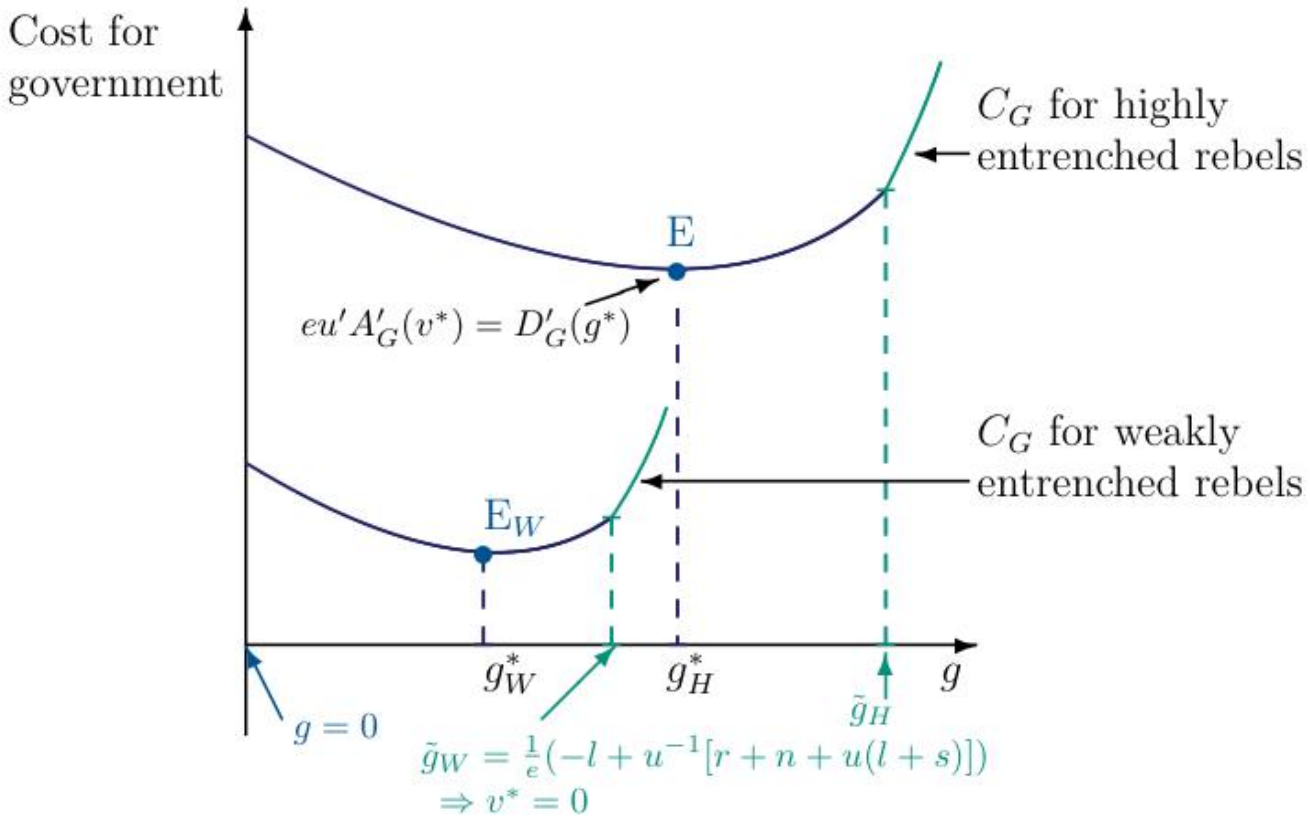

Figure IV. SIGACT incidents per 1,000 population by district/month

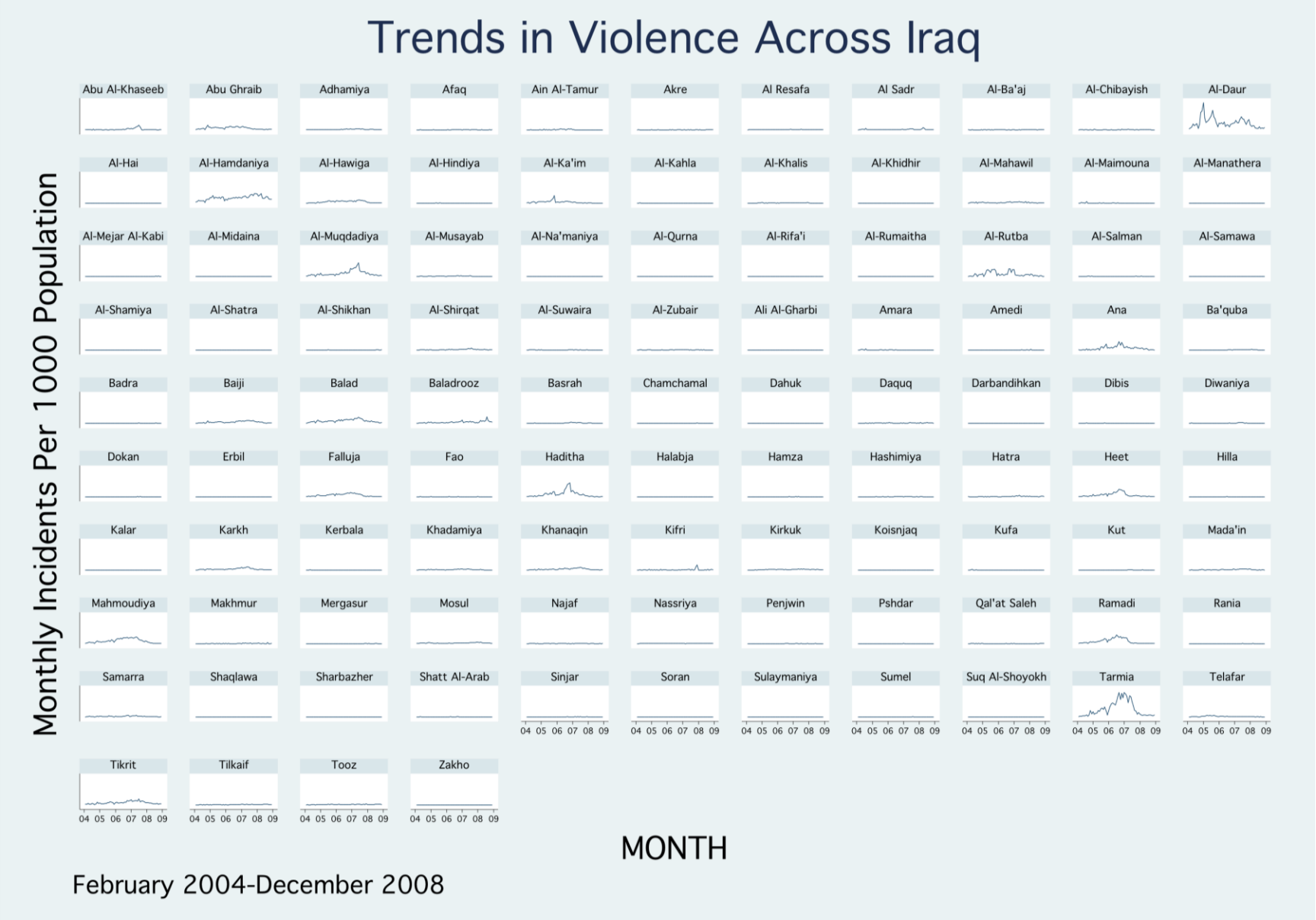

Figure V. SIGACT incidents per 1,000 population by sect/month

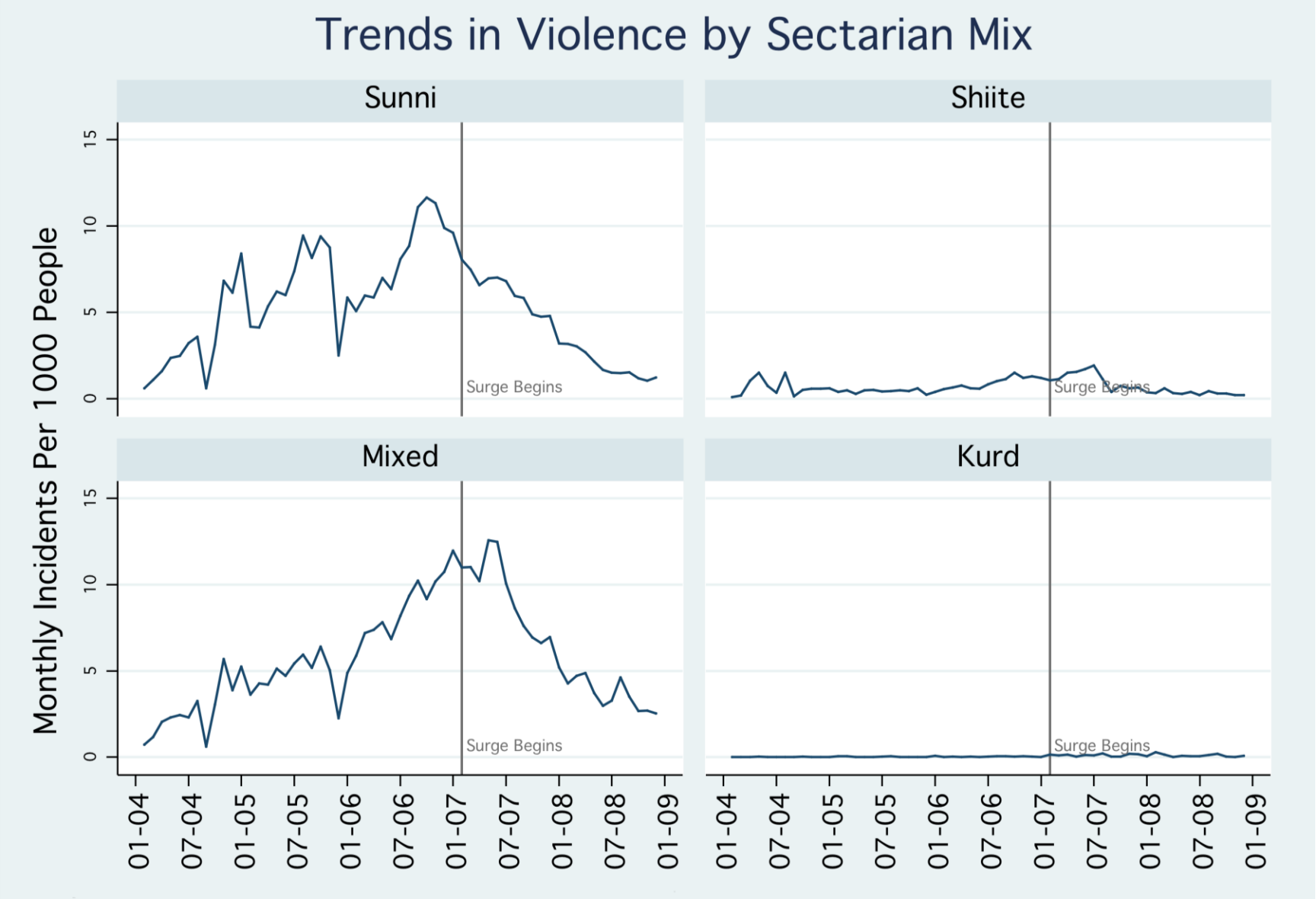

Figure VI. Comparing CERP